

# Atomic Form Factors, Incoherent Scattering Functions, and Photon Scattering Cross Sections

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Tabulations are presented of the atomic form factor,  $F(x,Z)$ , and the incoherent scattering function,  $S(x,Z)$ , for values of  $x$  ( $=\sin(\theta/2)/\lambda$ ) from  $0.005 \text{ \AA}^{-1}$  to  $10^9 \text{ \AA}^{-1}$ , for all elements  $Z=1$  to 100. These tables are constructed from available state-of-the-art theoretical data, including the Pirenne formulas for  $Z=1$ , configuration-interaction results by Brown using Brown-Fontana and Weiss correlated wavefunctions for  $Z=2$  to 6, non-relativistic Hartree-Fock results by Cromer for  $Z=7$  to 100, and a relativistic K-shell analytic expression for  $F(x,Z)$  by Bethe and Levinger for  $x > 10 \text{ \AA}^{-1}$  for all elements  $Z=2$  to 100. These tabulated values are graphically compared with available photon scattering angular distribution measurements. Tables of coherent (Rayleigh) and incoherent (Compton) total scattering cross sections, obtained by numerical integration over combinations of  $F^2(x,Z)$  with the Thomson formula and  $S(x,Z)$  with the Klein-Nishina formula, respectively, are presented for all elements  $Z=1$  to 100, for photon energies  $100 \text{ eV}$  ( $\lambda=124 \text{ \AA}$ ) to  $100 \text{ MeV}$  ( $0.000124 \text{ \AA}$ ). The incoherent scattering cross sections also include the radiative and double-Compton corrections as given by Mork. Similar tables are presented for the special cases of terminally-bonded hydrogen and for the  $H_2$  molecule, interpolated and extrapolated from values calculated by Stewart et al. and by Bentley and Stewart using Kolos-Roothaan wavefunctions.

**Key words:** Atomic form factor; Compton scattering; cross sections; gamma rays; incoherent scattering function; photons; Rayleigh scattering; tabulations; x-rays.

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## 1. Introduction and Notation

### 1.1. Introduction

A number of systematic calculations and tabulations of atomic form factor (see, e.g., [1]–[14]<sup>1</sup>) and incoherent scattering function (see, e.g., [9], [12], and [14]–[19]) values have been presented in the crystallographic and chemical physics literature. These tabulations, in some cases presented in the form of parameters for simple analytical formulas (see, e.g., [10], [13], and [19]) to facilitate their use in machine computations, are generally limited to momentum transfer arguments<sup>2</sup> ( $1/\lambda$ )  $\sin(\theta/2)$  (or  $(1/\lambda) \sin \phi$ , where  $\phi = \theta/2$  = the angle of incidence and reflection from a crystal lattice plane) below  $\sim 2.0 \text{ \AA}^{-1}$ . A few higher- $x$  exceptions include tabulations by Hanson et al. [7] extending to  $6.0 \text{ \AA}^{-1}$ , by Cromer and Mann [17], Cromer [18] and Tavard et al. [9] extending to  $8.0 \text{ \AA}^{-1}$ , and results by Cromer [20] published by Veigle et al. [12] extending to  $80.0 \text{ \AA}^{-1}$ .

Integral coherent and incoherent scattering cross sections for photon<sup>3</sup> energies up to 24.8, 99.2, and 992.0 keV can be calculated using the above atomic form factor and incoherent scattering function sets extending up to momentum transfer arguments 2, 8, and  $80 \text{ \AA}^{-1}$ , respectively, without extrapolation. For calculating these scattering cross sections for higher photon energies, various ad hoc extrapolation procedures have been employed (see, e.g., refs. [21], [22], [23], and [24]).

The incoherent scattering integrated cross section is relatively insensitive to variations in the high- $x$  extrapolated incoherent scattering function values, all of which approach the free-electron limiting case as  $x$  increases. The coherent scattering cross section, on the other hand, increases its sensitivity to the atomic form factor with increasing  $x$ . Although the asymptotic high- $x$  dependence<sup>4</sup> has recently been shown by Goscinski and Lindner [25] and by Smith [26] to be  $F(x, Z) \sim x^{-4}$ , the differing extrapolation procedures [21]–[24] have led to substantially differing integrated cross section values.

Although the integrated coherent scattering cross section is a small fraction of the total attenuation coefficient in the extrapolation region, it can still result in total attenuation coefficient variations of the order of 1%, or in one extreme case [21] 5–10%. For the present tabulations the atomic form factor was extrapolated to high- $x$  by means of a relativistic theoretical expression given by Bethe and Levinger [29].

Although the form-factor and scattering-function approach is an approximation valid primarily for small angles and neglects electron pre-collision motion effects, the more rigorous theoretical treatments (see, e.g., refs. [30]–[38]) are not sufficiently tractable for extensive systematic calculation and tabulation. Within these limitations, the tables presented in this report fill what the authors consider a present need for an extended-range, state-of-the-art set of evaluated theoretical scattering cross section differential and integral data for use in calculating radiation attenuation, transport and energy deposition in medical physics, reactor shielding, industrial radiography, weapons effects, and in a variety of other applications in addition to x-ray crystallography.

We caution, however, that in some regions of the tables there are large uncertainties, particularly in  $F(x, Z)$  for  $x > 10 \text{ \AA}^{-1}$  where use of the Bethe-Levinger formula forces a smooth  $Z$ -dependence from which the available measurements suggest departures of as much as a factor of two or more for some elements. For  $x > 100 \text{ \AA}^{-1}$ , where no measurements are available for comparison, the combination of the above and other uncertainties may result in departures of  $F(x, Z)$  values (in table I) from physical reality by one or more orders of magnitude.

We caution also that for energies above a few MeV and extending up into the asymptotic region, additional scattering processes such as Delbrück, nuclear resonance and proton Compton, not considered in this work, may become considerably more important than those derived from the  $F(x, Z)$  and  $S(x, Z)$  values described and tabulated in this work.

The specific sources of theoretical data (previous calculations, formulas, normalizations) used in constructing the present  $F(x, Z)$  and  $S(x, Z)$  tabulations (table I), and the  $x$ - and  $Z$ -region in which each is applied, are listed in section 3 of this work.

### 1.2. Physical Constants<sup>5</sup>: Units: Notation: Basic Photon Scattering Formulas

|       |                                                                                                                                                                                                                                      |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $c$   | velocity of light = $2.99792458 \cdot 10^8 \text{ m s}^{-1}$ ,                                                                                                                                                                       |
| $e$   | elementary charge = $1.6021892 \cdot 10^{-19}$ Coulomb<br><br>$= 4.803242 \cdot 10^{-10} \text{ cm}^{3/2} \text{ g}^{1/2} \text{ s}^{-1}$ (e.s.u.)<br>$= 1.5189186 \cdot 10^{-14} \text{ m}^{3/2} \text{ kg}^{1/2} \text{ s}^{-1}$ , |
| $m_e$ | electron rest-mass = $9.109534 \cdot 10^{-31} \text{ kg}$ ,                                                                                                                                                                          |

<sup>1</sup>Figures in brackets indicate literature references at the end of this paper. See also section 4, footnote 11, for an explanation of references of the form [70 Ba 01], listed separately in section 8 following the main bibliography.

<sup>2</sup>The momentum transfer argument, most frequently given as  $\sin(\theta/2)/\lambda(\text{\AA})$ , also appears in the literature as  $4\pi \sin(\theta/2)\lambda(\text{\AA})$ , and as applied in x-ray scattering problems is defined as  $q = (2k/\hbar) \sin(\theta/2) = (2/\hbar) \sin(\theta/2)/\lambda(\text{\AA})$ . To avoid confusion with these definitions, we use the momentum transfer parameter  $x = \sin(\theta/2)/\lambda(\text{\AA})$  throughout this work.

<sup>3</sup>The terms "photon," "x-ray" and "gamma-ray" are used interchangeably throughout this work.

<sup>4</sup>Y.-K. Kim [27] has pointed out to the authors that arguments by Lassettre [28] can be generalized to provide high- $x$  expansions for  $F(x, Z)$  and  $S(x, Z)$  which can be truncated and least-squares-fit to presently calculated intermediate- $x$  values, in order to extrapolate into the extreme asymptotic region.

<sup>5</sup>Numerical values given here are those recommended in 1973 by the Task Group on Fundamental Constants, Committee on Data for Science and Technology (CODATA) of the International Council of Scientific Unions (ICSU) [39], taken from an analysis by Cohen and Taylor [40]. An exception is the new higher-precision  $\text{\AA}^*/\text{\AA}$  value determined by Deslattes and Henins [41].

|                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $m_e c^2$                                                                                                                                                                                                                                                                                                                                                                                 | electron rest-mass energy<br>$= 5.110034 \cdot 10^{-5}$ eV,                                                                                         | $\phi$                      | Bragg angle in x-ray crystallography<br>$= \theta/2$ ,                                                                                                                                                                                                                                                                                     |
| $b$                                                                                                                                                                                                                                                                                                                                                                                       | barn $= 10^{-28}$ m <sup>2</sup> ,                                                                                                                  | $x$                         | $= \sin(\theta/2)/\lambda$ (Å)                                                                                                                                                                                                                                                                                                             |
| $r_e$                                                                                                                                                                                                                                                                                                                                                                                     | classical electron radius $= e^2/(m_e c^2)$<br>$= 2.8179380 \cdot 10^{-15}$ m,                                                                      | $\hbar q$                   | momentum transfer to an atom or electron<br>(or, in vector notation, $\hbar \mathbf{q} = \mathbf{k}_i - \mathbf{k}_f$ ,<br>where $k_i$ and $k_f$ are the initial and final<br>momenta of the photon). In units of $m_e c$ ,<br>$= 2 k \sin(\theta/2)$ (1)                                                                                  |
| $r_e^2$                                                                                                                                                                                                                                                                                                                                                                                   | $= 7.940775 \cdot 10^{-30}$ m <sup>2</sup> $= 0.07940775$ b,                                                                                        |                             | for coherent scattering, or                                                                                                                                                                                                                                                                                                                |
| $\sigma_T$                                                                                                                                                                                                                                                                                                                                                                                | cross section for classical Thomson scattering<br>from an electron<br>$= 8\pi r_e^2/3 = 6.652448 \cdot 10^{-29}$ m <sup>2</sup><br>$= 0.6652448$ b, |                             | $= 2 k \sin(\theta/2) \cdot \sqrt{1 + (k^2 + 2k) \sin^2(\theta/2)} /$<br>$[1 + 2k \sin^2(\theta/2)]$ (2)                                                                                                                                                                                                                                   |
| $\alpha$                                                                                                                                                                                                                                                                                                                                                                                  | fine structure constant<br>$= 7.2973506 \cdot 10^{-3} = 1/137.03604 \approx 1/137$ ,                                                                |                             | for incoherent scattering<br>$= 2 k \sin(\theta/2)$ (2a)                                                                                                                                                                                                                                                                                   |
| $a_0$                                                                                                                                                                                                                                                                                                                                                                                     | first Bohr radius $= r_e/\alpha^2$<br>$= 5.2917706 \cdot 10^{-11}$ m $= 0.52917706$ Å,                                                              |                             | when $q$ (or $x$ ) is small. Conversion of $q$ -<br>arguments in $m_e c$ units (equations (1)–<br>(2a)) to the $x$ -arguments [ $\lambda$ (Å) <sup>-1</sup> sin( $\theta/2$ )]<br>used in the present tables (tables I<br>and IV) is accomplished by multiplication<br>by the factor 20.60744<br>$= \frac{1}{2} \cdot 511003.4/12398.52$ , |
| $E$                                                                                                                                                                                                                                                                                                                                                                                       | photon energy in eV units (e.g., keV, MeV<br>or GeV),                                                                                               | $Z$                         | atomic number = electrons/atom,                                                                                                                                                                                                                                                                                                            |
| $k$                                                                                                                                                                                                                                                                                                                                                                                       | photon energy in units of the electron rest-<br>mass energy (i.e., $m_e c^2$ units)<br>$= E(\text{eV})/511003.4$ ,                                  | $d\Omega$                   | differential solid angle in steradians =<br>$2\pi \sin\theta d\theta$                                                                                                                                                                                                                                                                      |
| $\lambda$                                                                                                                                                                                                                                                                                                                                                                                 | photon wavelength in Compton units<br>$= 1/k = 511003.4/E(\text{eV})$ ,                                                                             | $d\sigma_T(\theta)/d\Omega$ | differential Thomson scattering cross<br>section per electron                                                                                                                                                                                                                                                                              |
| $\lambda$ (Å)                                                                                                                                                                                                                                                                                                                                                                             | photon wavelength in angstroms<br>(1 angstrom $= 10^{-10}$ m $= 0.1$ nm)<br>$= 12398.520/E(\text{eV})$ , <sup>6</sup>                               |                             | $= \frac{r_e^2}{2} (1 + \cos^2\theta)$ (3)                                                                                                                                                                                                                                                                                                 |
| $\theta$                                                                                                                                                                                                                                                                                                                                                                                  | angle between the photon directions of<br>travel prior to and following a scattering<br>interaction                                                 | $F(x, Z)$                   | atomic form factor (tables I and IV),                                                                                                                                                                                                                                                                                                      |
| <hr/>                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| <sup>6</sup> In addition to the angstrom, which is based on the meter, two photon wavelength units,<br>Å* and xu, are in use which are based on characteristic emission wavelengths. The Å*-unit<br>introduced by Bearden [42] is defined using the tungsten K $\alpha_1$ emission line as an x-ray wave-<br>length standard, such that<br>$\lambda(\text{W } K\alpha_1) = 0.2090100$ Å*. |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| By means of simultaneous x-ray and visible-region interferometry Deslattes and Henins<br>[41] have recently determined that                                                                                                                                                                                                                                                               |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $1 \text{ Å}^* = 1.0000256 \text{ Å}$ (1.8 ppm).                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| The x-unit (xu), used in much of the older literature and occasionally in the present literature,<br>was intended to be $10^{-3}$ Å but has taken on a variety of values because of errors and in-<br>consistencies in the various wavelength standards used. If the molybdenum K $\alpha_1$ emission<br>line is taken as a reference with a "defined" value [42]                         |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $\lambda(\text{Mo } K\alpha_1) = 707.831$ xu,                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| then from the recent Deslattes-Henins [41] measurement:                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $\lambda(\text{Mo } K\alpha_1) = 0.7093187 \text{ Å}$ (0.6 ppm),                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| we find                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $1 \text{ xu} = 1.0021017 \cdot 10^{-3}$ Å (0.6 ppm),                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| and                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $\lambda(\text{xu}) \approx 12.37/\text{MeV}$ .                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| <hr/>                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $\sigma_{coh}$                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| coherent (Rayleigh) scattering cross sec-<br>tion per atom (table II)                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $= \int_{\theta=0}^{\theta=\pi} d\sigma_T(\theta) [F(x, Z)]^2$ (4)                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $= \frac{3}{8} \sigma_T \int_{-1}^{+1} (1 + \cos^2\theta) [F(x, Z)]^2 d(\cos\theta)$ (4a)                                                                                                                                                                                                                                                                                                 |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $d\sigma_{KN}(\theta)/d\Omega$                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| differential Klein-Nishina (free-electron<br>Compton) collision cross section per<br>electron                                                                                                                                                                                                                                                                                             |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $= \frac{r_e^2}{2} [1 + k(1 - \cos\theta)]^{-2}$                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |
| $\times \left[ 1 + \cos^2\theta + \frac{k^2(1 - \cos\theta)^2}{1 + k(1 - \cos\theta)} \right]$ (5)                                                                                                                                                                                                                                                                                        |                                                                                                                                                     |                             |                                                                                                                                                                                                                                                                                                                                            |

|                                         |                                                                                                                                                                                 |                        |                                                                                                                                                                                                                                                   |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\sigma_{\text{KN}}$                    | total Compton collision cross section per electron as given by the Klein-Nishina formula (5)                                                                                    | $a\sigma_{\text{KN}}$  | total Compton energy-absorption cross section per electron, as given by the Klein-Nishina formula (11)                                                                                                                                            |
|                                         |                                                                                                                                                                                 |                        | $= \int_{\theta=0}^{\theta=\pi} d\sigma_{\text{KN}}(\theta) = 2\pi r_e^2 \left\{ \frac{1+k}{k^2} \left[ \frac{2(1+k)}{1+2k} - \frac{\ell n(1+2k)}{k} \right] + \frac{\ell n(1+2k)}{2k} - \frac{1+3k}{(1+2k)^2} \right\} \quad (7)$                |
|                                         |                                                                                                                                                                                 |                        | $= 2\pi r_e^2 \left\{ \frac{2(1+k)^2}{k^2(1+2k)} - \frac{1+3k}{(1+2k)^2} - \frac{(1+k)(2k^2-2k-1)}{k^2(1+2k)} - \frac{4k^2}{3(1+2k)^3} - \left( \frac{1+k}{k^3} - \frac{1}{2k} + \frac{1}{2k^3} \right) \cdot \ell n(1+2k) \right\} \quad (13)^s$ |
| $S(x, Z)$                               | incoherent scattering function<br>(tables I and IV)                                                                                                                             | $a\sigma_{\text{inc}}$ | total incoherent (bound-electron Compton) scattering cross section per atom                                                                                                                                                                       |
| $\sigma_{\text{inc}}$                   |                                                                                                                                                                                 |                        | $= \int_{\theta=0}^{\theta=\pi} d\sigma_{\text{KN}}(\theta) S(x, Z) \quad (8)$                                                                                                                                                                    |
| $\Delta\sigma_{\text{KN}}^M$            | radiative and double-Compton correction to the integrated Klein-Nishina formula (7) as given by Mork [44]. Values for $[1+\Delta\sigma_{\text{KN}}^M]$ are listed in table III, | $a\sigma_{\text{inc}}$ | total incoherent (bound-electron) scattering energy-absorption cross section per atom (ignoring fluorescence and bremsstrahlung escape losses)                                                                                                    |
| $\sigma_{\text{KN}}^M$                  | Klein-Nishina total cross section per electron including radiative and double-Compton corrections                                                                               |                        | $= \int_{\theta=0}^{\theta=\pi} d_a\sigma_{\text{KN}}(\theta) S(x, Z). \quad (14)$                                                                                                                                                                |
|                                         | $= \sigma_{\text{KN}} \cdot (1 + \Delta\sigma_{\text{KN}}^M) \quad (9)$                                                                                                         |                        |                                                                                                                                                                                                                                                   |
| $\sigma_{\text{inc}}^M$                 | total incoherent scattering cross section per atom including radiative and double-Compton corrections (table II)                                                                |                        |                                                                                                                                                                                                                                                   |
|                                         | $\approx \sigma_{\text{inc}} \cdot (1 + \Delta\sigma_{\text{KN}}^M) \quad (10)$                                                                                                 |                        |                                                                                                                                                                                                                                                   |
| $d_a\sigma_{\text{KN}}(\theta)/d\Omega$ | differential Klein-Nishina (free-electron) energy-absorption cross section per electron                                                                                         |                        |                                                                                                                                                                                                                                                   |
|                                         | $= \frac{r_e^2}{2} \frac{k(1-\cos\theta)}{[1+k(1-\cos\theta)]^3} \times \left[ 1 + \cos^2\theta + \frac{k^2(1-\cos\theta^2)}{1+k(1-\cos\theta)} \right] \quad (11)$             |                        |                                                                                                                                                                                                                                                   |

<sup>s</sup> Below 100 keV equation (7) becomes unsuitable for computation because of near-cancellation between the logarithmic and purely algebraic terms. In this energy region the expansion [43]

$$\sigma_{\text{KN}} = \frac{8}{3} \pi r_e^2 \frac{1}{(1+2k)^2} \left( 1 + 2k + \frac{6}{5} k^2 - \frac{1}{2} k^3 + \frac{2}{7} k^4 - \frac{6}{35} k^5 + \frac{8}{105} k^6 + \frac{4}{105} k^7 - \dots \right), \quad (7a)$$

may be used.

<sup>s</sup> Analogous to equations (7) and (7a) above, an expression more suitable than (13) for computation below 100 keV is [43].

$$\sigma_{\text{KN}} = \frac{8}{3} \pi r_e^2 \frac{1}{(1+2k)^3} \left( k + \frac{9}{5} k^2 + \frac{3}{2} k^3 - \frac{13}{35} k^4 + \frac{2}{35} k^5 + \frac{4}{35} k^6 - \frac{4}{15} k^7 + \dots \right). \quad (13a)$$

<sup>t</sup> Other names for  $F(x, Z)$  have included "atomic structure factor" (see, e.g., Hartree [48] or Compton [49]) and "atomic scattering factor" (see, e.g., James and Brindley [1]).

in which  $\rho(\mathbf{r})$ , the total electron density at  $\mathbf{r}$ , can in turn be written as the inverse Fourier transform of  $F(\mathbf{q}, Z)$

$$\rho(\mathbf{r}) = (2\pi)^{-3} \int F(\mathbf{q}, Z) \exp(i\mathbf{q} \cdot \mathbf{r}) d^3 q. \quad (17)$$

For a spherically symmetric atom the angular integrations in equation (16) can be performed, resulting in (see, e.g., Debye [46] and Pirenne [47])

$$F(q, Z) = 4\pi \int_0^\infty \rho(r) \frac{\sin(qr)}{qr} r^2 dr. \quad (18)$$

The incoherent scattering function  $S(x, Z)$  can be expressed in terms of a form factor generalized to include excited states (see, e.g., Grodstein [50], Brown [51] or Veigle [52])

$$F_\epsilon(\mathbf{q}, Z) = \langle \epsilon | \sum_{j=1}^Z \exp(i\mathbf{q} \cdot \mathbf{r}_j) | 0 \rangle, \quad (19)$$

where  $\epsilon$  indicates the energy of an excited (or ionized) stationary state as measured from the ground state. The incoherent scattering function is then

$$S(\mathbf{q}, Z) = \sum_{\epsilon > 0} |F_\epsilon(\mathbf{q}, Z)|^2, \quad (20)$$

where the sum is taken to mean a sum over the discrete states and an integral over the continuum states, excluding the ground state  $\epsilon = 0$ .

To remove the summation over excited states, equation (20) may be rewritten [51]

$$S(\mathbf{q}, Z) = \sum_{\epsilon > 0} \left\langle 0 | \sum_n \exp(-i\mathbf{q} \cdot \mathbf{r}_n) | \epsilon \right\rangle \\ \left\langle \epsilon | \sum_m \exp(i\mathbf{q} \cdot \mathbf{r}_m) | 0 \right\rangle - \left| \left\langle 0 | \sum_j \exp(i\mathbf{q} \cdot \mathbf{r}_j) | 0 \right\rangle \right|^2. \quad (21)$$

Employing the closure property (see, e.g., Schiff [53] or Messiah [54])

$$\sum_{\epsilon > 0} |\epsilon\rangle \langle \epsilon| = 1, \quad (22)$$

and identifying the last term in equation (21) with  $|F(\mathbf{q}, Z)|^2$  as given in equation (15) we have

$$S(\mathbf{q}, Z) = \sum_{m=1}^Z \sum_{n=1}^Z \left\langle \Psi_0 | \exp[i\mathbf{q}(\mathbf{r}_m - \mathbf{r}_n)] | \Psi_0 \right\rangle \\ - |F(\mathbf{q}, Z)|^2, \quad (23)$$

in terms of the ground state wave functions only.

We have omitted in equations (20), (21) and (23) the factor  $Z^{-1}$  appearing in the Kim and Inokuti [55] and Brown [56] expressions, to be consistent with equations

(8) and (14) and to correspond to the numerical values in table I (where  $S(0, Z) = 0$  and  $S(\infty, Z) = Z$ ) as they are customarily tabulated.

## 2. Theoretical Models and Approximations for $F(x, Z)$ and $S(x, Z)$

### 2.1. Atomic, Terminally-Bonded, and Molecular Hydrogen

For atomic hydrogen the Schrödinger equation yields a closed-form solution for the ground-state wave function

$$\Psi_0 = (\pi a_0^3)^{-1/2} \exp(-r/a_0), \quad (24)$$

where  $a_0$  is the first Bohr radius ( $0.52917706\text{\AA}$ ). Thus the electron density probability  $\rho(r)$  is

$$\rho(r) = |\Psi_0|^2 = \pi^{-1} a_0^{-3} \exp(-2r/a_0), \quad (25)$$

which when substituted into the integral in equation (18) yields the simple closed-form expression for the atomic-hydrogen atomic form factor (Pirenne [57])

$$F(q, H) = [1 + (\pi a_0 q)^2]^{-2}, \quad (26)$$

in which  $\hbar q = 2k \sin(\theta/2) = 2\lambda^{-1} \sin(\theta/2)$ . In terms of the momentum-transfer variable

$$x = [\sin(\theta/2)]/\lambda(\text{\AA}), \quad (27)$$

where  $\lambda(\text{\AA}) = 12.398520/E(\text{keV})$ , equation (26) becomes

$$F(x, H) = [1 + 4\pi^2 a_0^2 x^2]^{-2}, \quad (28)$$

shown in figure 1 as the solid curve.

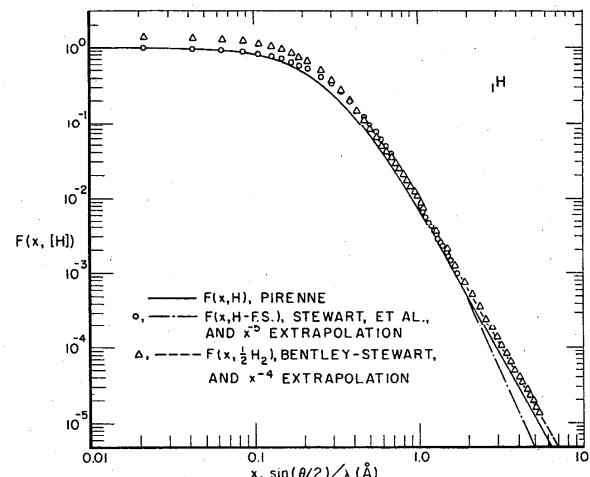


FIGURE 1. Comparison of the floated-sphere bonded-hydrogen Stewart et al. [58] (circles) and  $H_2$  Bentley-Stewart [61] (triangles) form factors with the atomic-hydrogen form factor (Pirenne).

For a one-electron atom the double-summation term in equation (23) reduces to unity, hence the atomic hydrogen incoherent scattering function can be expressed in terms of  $F(x, H)$  as given in equations (26) or (28) as

$$S(x, H) = 1 - [F(x, H)]^2. \quad (29)$$

The values of  $F(x, Z)$  and  $S(x, Z)$  for hydrogen ( $Z=1$ ) listed in table I were computed by using equations (28) and (29).

However, for practical applications, it should be remembered that the hydrogen atom is unique in that its single 1s electron serves as both core and valence shell, resulting in a substantial distortion (dilation) of the atom (electron density function) in the presence of molecular binding. The effect on  $F(x, Z)$  of this distortion has been quantitatively estimated by Stewart, Davidson and Simpson [58], with specific application to the  $H_2$  molecule by McWeeny [59], Iijima and Bonham [60], and by Bentley and Stewart [61].

For application to terminally-bonded hydrogen (for example H in C—H or N—H bonded situations), Stewart et al. [58] have calculated  $F(x, [H])$  over the range  $x=0$  to  $1.72 \text{ \AA}^{-1}$  using the Davidson-Jones [62] natural orbital expansion of the Kolos-Roothaan [63]  $H_2$  wavefunction to obtain a one-electron density function. In this calculation, Stewart et al. assume a spherical density for the bonded H-atom, but "float" this spherical distribution 0.07 Å off the proton into the bond. The resulting "floated-sphere" values of  $F(x, H\text{-F.S.})$  are shown as the circles of figure 1, as compared with the Pirenne isolated-atom values (solid curve), and the ratio is shown in figure 2 (circles). A nine-parameter analytic fit to the Stewart et al. [58]  $F(x, H\text{-F.S.})$  values, useful over the range  $0 \leq x \leq 1.72 \text{ \AA}^{-1}$ , is included in reference [14] (table 2.2B).

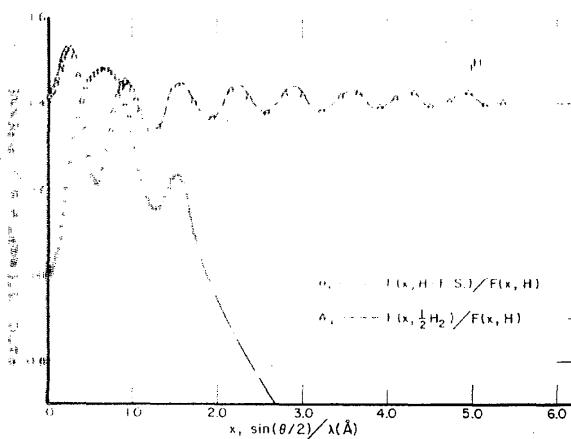


FIGURE 2. Ratios of the Stewart et al. [58] floated-sphere bonded-hydrogen  $F(x, H\text{-F.S.})$  form factor (circles) and Bentley-Stewart [61]  $H_2$   $F(x, \frac{1}{2}H_2)$  form factor (triangles), respectively, to the atomic-hydrogen form factor.

Since these "floated-sphere" results correspond to a charge density  $\partial\rho/\partial r_a=0$  at  $r_a=0$ , Stewart [64] conjectures that

$$\lim_{x \rightarrow \infty} F(x, H\text{-F.S.}) \propto x^{-5}, \quad (30)$$

which is the basis for the extrapolation curves (dash-dot) in figures 1 and 2, and for the  $F(x, H\text{-F.S.})$  values for  $x \geq 2.0 \text{ \AA}^{-1}$  listed in table IV. The remaining  $F(x, H\text{-F.S.})$  values in table IV, for  $0 \leq x \leq 1.5 \text{ \AA}^{-1}$  were interpolated from Stewart et al. (ref. [58], table II) by means of a least-squares cubic spline fit interpolation procedure derived by Berger and Seltzer [65] from an algorithm given by Powell [66].

For a consistent set of incoherent scattering function values for bonded hydrogen in the floated-sphere approximation, we have arbitrarily assumed the relation

$$S(x, H\text{-F.S.}) = 1 - [F(x, H\text{-F.S.})]^2, \quad (31)$$

analogous to equation (29), for purposes of providing a set of  $S(x, H\text{-F.S.})$  values in table IV. Using the values of  $F(x, H\text{-F.S.})$  described above and listed in table IV, values of  $S(x, H\text{-F.S.})$  in table IV were computed using equation (31) over the entire range  $0 \leq x \leq 10^9 \text{ \AA}^{-1}$ . The parentheses are to caution the reader that equation (31) does not necessarily reflect physical reality, particularly for key values of  $x$  where

$$F(x, H\text{-F.S.}) \approx 0.5.$$

In addition to the "best floated sphere" Stewart et al. results, there is a recent calculation by Bentley and Stewart [61] of the form factor (squared)  $|F(x, H_2)|^2$  for the  $H_2$  hydrogen molecule, over the range  $0 \leq x \leq 1.61 \text{ \AA}^{-1}$ . In this calculation, Bentley and Stewart represented the two-center scattering potential in prolate spheroidal coordinates, and used the Davidson-Jones [62] natural spin-orbital expansion of the Kolos-Roothaan [63] essentially exact ground-state wavefunction for  $H_2$ .

For purposes of the present tabulations, we have derived from the Bentley-Stewart (ref. [61], table V, also ref. [64])  $|F(x, H_2)|^2$  values the quantity

$$F(x, \frac{1}{2}H_2) = \{\frac{1}{2} |F(x, H_2)|\}^{1/2}, \quad (32)$$

shown as triangles in figure 1, to provide a direct comparison with the Pirenne isolated-atom result. The ratio of the Bentley-Stewart results to those of Pirenne, shown as triangles in figure 2, is similar in magnitude ( $\sim 1.4$ ) to that calculated by Cooper [67] for the photo-effect ratio  $\tau_{1/2} H_2 / \tau_H$ . Also, the Bentley-Stewart value  $|F(x, H_2)|^2 = 3.99985$  for  $x=0$  suggests that the  $H_2$  molecule resembles a helium atom in its coherent scattering properties. Stewart [64] has also supplied the

authors with additional high- $x$   $|F(x, H_2)|^2$  values out to  $x=5.37 \text{ \AA}^{-1}$  which show  $F(x, \frac{1}{2}H_2)$  falling off as  $x^{-3.98}$ , hence the  $x^{-4}$  extrapolation (dashed line)

$$\lim_{x \rightarrow \infty} F(x, \frac{1}{2}H_2) \propto x^{-4}, x > 5.37 \text{ \AA}^{-1}, \quad (33a)$$

similar to the Pirenne formula high- $x$  behavior, shown in figures 1 and 2.

In addition to the above-described  $F(x, \frac{1}{2}H_2)$  values, Stewart [64] has kindly calculated and supplied to the authors a consistent set of  $S(x, \frac{1}{2}H_2)$  values over the range  $0 \leq x \leq 1.07 \text{ \AA}^{-1}$ . An examination of the complement of these  $S(x, \frac{1}{2}H_2)$  values vs  $x$  on a log-log graph suggested an extrapolation function

$$1 - S(x, \frac{1}{2}H_2) \propto x^{-7.59}, x > 1.07 \text{ \AA}^{-1} \quad (33b)$$

which we have used in this work.

From the above Bentley-Stewart and Stewart  $F(x, \frac{1}{2}H_2)$  and  $S(x, \frac{1}{2}H_2)$  values we again used the Berger-Seltzer [65] least-squares cubic spline-fit interpolation procedure, also the extrapolation formulas in equations (33a) and (33b), respectively, to derive the standard-grid values of  $F(x, \frac{1}{2}H_2)$  and  $S(x, \frac{1}{2}H_2)$  listed in the last two columns of table IV.

## 2.2. Pauling and Sherman Method

For many-electron atoms, exact solutions for the atomic form factor and incoherent scattering function are not obtainable, so a variety of approximations have been used. Among these approaches is the treatment by Pauling [68] who has calculated approximate atomic wave functions by assuming each electron of the atom to move in a hydrogen-like field reduced from the nuclear Coulomb field by a screening constant, with the screening constant different for each electron group. Using this method, Pauling and Sherman [69] computed  $F(x, Z)$  tables for 66 atoms over the range  $Z=1$  to 92 and for 20 ions, over the range  $0 \leq x \leq 1.4 \text{ \AA}^{-1}$ . These values are realistic for small-angle scattering in all elements and for intermediate angles in low- $Z$  elements but otherwise exaggerate shell-structure effects and depart systematically from the more accurate self-consistent-field results.

## 2.3. Thomas-Fermi Statistical Model

In a method developed independently by Thomas [70] and Fermi [71], the atomic electrons are treated as a degenerate gas obeying Fermi-Dirac statistics and the Pauli principle, with the ground-state energy of the atom equal to the zero-point energy of this gas. The average charge-density  $\rho(r)$  then becomes the radial function

$$\rho(r) = \frac{8\pi e}{3h^3} [2 m e V(r)]^{3/2} \quad (34)$$

of the potential  $V(r)$  which in turn can be substituted in Poisson's equation  $\nabla^2 V(r) = 4\pi\rho(r)$ , to give

$$\frac{1}{r^2} \frac{d}{dr} \left( r^2 \frac{dV(r)}{dr} \right) = \frac{32\pi^2 e}{3h^3} [2 m e V(r)]^{3/2}, \quad (35)$$

which is to be solved for  $V(r)$  under the conditions that  $\lim_{r \rightarrow \infty} V(r) = 0$  and that  $\lim_{r \rightarrow 0} r V(r) = Ze$ . Thomas [70] solved equation (35) numerically for the case of cesium ( $Z=55$ ) and obtained  $V(r)$  from which, in turn,  $\rho(r)$  is obtained by using equation (34) and thence  $F(x, Z)$  by using equation (18), again with assumed spherical symmetry.

The Thomas-Fermi charge distributions for different atoms are related to each other such that, once  $F(x, Z_0)$  has been calculated for a "standard" atom  $Z_0$  (e.g., Cs:  $Z_0=55$ ),  $F(x, Z)$  for any other atom  $Z$  is given by

$$F(x, Z) = (Z/Z_0) F(x', Z_0), \quad (36)$$

where  $x$  is the desired argument  $[\sin(\theta/2)]/[\lambda(\text{\AA})]$  and, if  $x$  is the tabulated argument for  $Z_0$ ,

$$x' = x(Z/Z_0)^{1/3}. \quad (37)$$

Similarly for incoherent scattering, Heisenberg [72] has shown that in the Thomas-Fermi approximation the incoherent scattering function  $S(x, Z)$  can be written in terms of a "universal" function  $S(v)$  where (see, e.g., James [73] and Bewilogua [74])

$$v = 4\pi x a \cdot (6\pi Z)^{-1/3} \quad (38)$$

where  $x = [\sin(\theta/2)]/[\lambda(\text{\AA})]$  and

$$\begin{aligned} a &= [3/(32\pi^2)]^{2/3} \cdot [h^2/(2me^2)] \cdot Z^{-1/3} \\ &= a_0 \cdot [(6\pi)^{1/3}/3] \cdot Z^{-1/3} \\ &= 0.46944 Z^{-1/3} \text{\AA} \end{aligned} \quad (39)$$

using the recent value  $a_0=0.52917706 \text{ \AA}$  for the Bohr radius, from which

$$\begin{aligned} v &= 4\pi x \cdot (a_0/3) \cdot Z^{-2/3} \\ &= 2.2166 \cdot x \cdot Z^{-2/3} \end{aligned} \quad (40)$$

Numerical values of  $S(v)$  were calculated and tabulated by Bewilogua for  $v=0.05$  to 0.1 and this tabulation was extended to  $v=0.001$  by Grodstein using the low- $v$  extrapolation formula

$$S(v) = 13.8v - 55.4v^{3/2} \quad (41)$$

given by Wheeler and Lamb [75].

Extensive calculations of  $d\sigma_{coh}/dr$ ,  $\sigma_{coh}$ ,  $d\sigma_{inc}/dr$  and  $\sigma_{inc}$  with the Thomas-Fermi model were given by Veigle et al. [52], [76], and by Brown [45] and [51].

Also, exchange effects have been incorporated into the Thomas-Fermi model by Dirac [88], taking into account the fact that electrons are identical particles which must be described by a totally antisymmetric wavefunction. Extensive tables of the resulting Thomas-Fermi-Dirac(TFD) values of  $F(x, Z)$  are given by Ibers [6] for 103 atoms and ions from  $Z=20$  to 104 over the range  $0 \leq x \leq 1.50 \text{ \AA}^{-1}$ .

#### 2.4. Hartree-Fock Model

The most accurate extensive computations of wavefunctions of many-electron atoms are based on the self-consistent-field (SCF) method of Hartree [77]. This is an independent-particle model in which each electron is assumed to be in the field of the nucleus and in an average field due to the other electrons. Thus the charge distribution  $\rho(r)$  can be written

$$\rho(r) = \sum_{j=1}^Z \rho_j(r) = \sum_{j=1}^Z \psi_j^*(r) \psi_j(r), \quad (42)$$

where  $\rho_j(r)$  is the charge-density distribution of the  $j$ th electron and  $\psi_j(r)$  is its wave function. The Hartree scheme has been generalized by Fock [78], [79] to include the effects of exchange, and Slater [80] has shown that the Hartree and Hartree-Fock wave functions arise out of variational treatments in which the wave function of the many-electron atom is assumed to be a product of individual electron wave functions.

James and Brindley [1] used Hartree wave functions (without exchange) to calculate values of the atomic form factor  $F(x, Z)$  for 8 atoms from He ( $Z=2$ ) to Cl ( $Z=17$ ) and 15 ions from  $\text{Li}^+$  to  $\text{Rb}^+$  and, by an interpolation scheme, obtained  $F(x, Z)$  values for 23 additional atoms and ions, for  $x$  from 0 to  $1.1 \text{ \AA}^{-1}$ . Viervoll and Ogrim [2] extended the James and Brindley results to include 22 elements from Li ( $Z=3$ ) to Cu ( $Z=29$ ), for  $x$  values from 0 to  $2.4 \text{ \AA}^{-1}$ . Subsequent Hartree and Hartree-Fock calculations of  $F(x, Z)$  through 1961 including, among others, the extensive results of Berghuis et al. [5] and Freeman [81], are reviewed by Ibers [6] who includes tables of SCF  $F(x, Z)$  values for  $x$  from 0 to  $1.9 \text{ \AA}^{-1}$ , for 38 atoms from He ( $Z=2$ ) to Hg ( $Z=80$ ) and for 85 ions from  $\text{H}^{-1}$  to  $\text{U}^{+6}$ . Subsequent to the Ibers [6] review article, Hanson et al. [7] used the non-relativistic SCF Hartree-Fock-Slater wavefunctions of Herman and Skillman [82] to calculate  $F(x, Z)$  for all neutral atoms  $Z=2$  to 100 over the range  $x=0$  to  $6.0 \text{ \AA}^{-1}$ .

More recently, Cromer and Mann [10] have used non-relativistic Hartree-Fock wave functions (computed by Mann [83]) to compute  $F(x, Z)$  values for all atoms

from He ( $Z=2$ ) to Lr ( $Z=103$ ) for  $x$  from 0 to  $1.5 \text{ \AA}^{-1}$ . To enable Veigle et al. [84], [85] to compute coherent scattering cross sections for photons with energies up to 1 MeV ( $80.655 \text{ \AA}^{-1}$ ) without arbitrary extrapolation from available  $F(x, Z)$  values, Cromer [20] subsequently extended his calculations of these non-relativistic Hartree-Fock  $F(x, Z)$  values to cover the range  $x$  from 0 to  $80.0 \text{ \AA}^{-1}$ . The Tavard et al. [9] results for all elements from He ( $Z=2$ ) to Kr ( $Z=36$ ) for  $x$  from 0 to  $7.96 \text{ \AA}^{-1}$  (or  $4\pi[\sin(\theta/2)]/[\lambda(\text{\AA}^{-1})]$  from 0 to  $100.0 \text{ \AA}^{-1}$ ) were calculated from Clementi [86], [87] wave functions equivalent to those of Cromer and Mann [10].

In addition to the above non-relativistic results, Cromer and Waber [8] have used relativistic Dirac-Slater [88], [80] wavefunctions to compute  $F(x, Z)$  values for all elements He ( $Z=2$ ) to No ( $Z=102$ ) plus 105 ions from  $\text{H}^{-1}$  to  $\text{Am}^{+3}$  for  $x$  from 0 to  $2.0 \text{ \AA}^{-1}$ .

Finally, Cromer and Waber [14] have compiled a table of relativistic Hartree-Fock values of  $F(x, Z)$  for Vol. 4 of the *International Tables for X-Ray Crystallography* (table 2.2A) for the range  $x=0$  to  $2.0 \text{ \AA}^{-1}$  and for all free atoms from He ( $Z=2$ ) to Cf ( $Z=98$ ). This latter compilation, from which we give a sampling of values in table VI, is taken primarily from the relativistic Hartree-Fock  $F(x, Z)$  values calculated by Doyle and Turner [11] using wavefunctions of Coulthard [89] for 54 elements from He ( $Z=2$ ) to U ( $Z=92$ ) (plus 22 ions) for  $x$  from 0 to  $6.0 \text{ \AA}^{-1}$ . Values of  $F(x, Z)$  for the remaining elements in the above compilation were calculated by Cromer and Waber using relativistic Hartree-Fock wave functions of Mann [90] differing from those of Coulthard in that they assume a finite rather than a point nucleus for the potential.

In extending the Hartree method to calculation of the incoherent scattering function  $S(x, Z)$ , one again assumes the independent particle picture in which the excitation or ionization involves one electron only, leaving the other electrons undisturbed. Thus the incoherent scattering function for an element of atomic number  $Z$  represents an average of the incoherent scattering functions for its separate electrons and can be written

$$S(q, Z) = Z - \sum_{i=1}^Z |f_0^{(i)}(q)|^2, \quad (43)$$

where  $f_0^{(i)}$  indicates the probability that the  $i$ th electron gets neither excited nor detached even though it has received the recoil momentum  $q$ . The quantity  $f_0^{(i)}$  differs from the ordinary form factor  $f^{(i)}(q)$  in that the Pauli exclusion principle may forbid excitation of an electron from one orbit to another.

Since information on form factor data  $f^{(i)}(q)$  is considerably more extensive than on  $f_0^{(i)}$ , the incoherent scattering function  $S(q, Z)$  is usually cast in the form

$$S(q, Z) = Z - \left\{ \sum_{i=1}^Z |f_i^{(i)}(q)|^2 \right\} - \left\{ \sum_{i=1}^Z |f_0^{(i)}|^2 - \sum_{i=1}^Z |f_i^{(i)}|^2 \right\}, \quad (44)$$

in which the last term in brackets has been treated by Waller and Hartree [91] and indicated as a corrective term by Pirenne [57].

Cromer and Mann [17] and Cromer [18] have used Hartree-Fock self-consistent-field wave functions by Mann [83] and the complete Waller-Hartree theory with exchange terms to calculate non-relativistic values of  $S(x, Z)$  for all elements He ( $Z=2$ ) to No ( $Z=102$ ) for  $x$  from 0.005 to 8.0 Å<sup>-1</sup>. This set of  $S(x, Z)$  values was extended to  $x$  arguments up to 80.0 Å<sup>-1</sup> to enable Veigle et al. [84], [85] to calculate photon incoherent scattering cross sections up to 1 MeV (80.655 Å<sup>-1</sup>) without extrapolation.

### 2.5. Configuration-Interaction Calculations for $Z=2$ to 6

Electron correlation effects can produce substantial corrections to the Hartree independent-particle model, particularly for low- $Z$  elements. Configuration-interaction wave functions are given by Brown and Fontana [92] for  $Z=2$  and 3 and by Weiss [93] for  $Z=2-6$ . Using the  $Z=2$  correlated ground-state wave functions of Brown and Fontana and those for  $Z=3-6$  of Weiss, Brown [56], [94] has calculated both  $F(x, Z)$  and  $S(x, Z)$  for the five elements He ( $Z=2$ ) to C ( $Z=6$ ) over the following ranges of  $x$ : He: 0 to 2.0 Å<sup>-1</sup>; Li: 0 to 3.4 Å<sup>-1</sup>; Be: 0 to 4.4 Å<sup>-1</sup>  $F(x, Z)$  and 0 to 3.6 Å<sup>-1</sup>  $S(x, Z)$ ; B: 0 to 6.0 Å<sup>-1</sup>; and C: 0 to 6.0 Å<sup>-1</sup>  $F(x, Z)$  and 0 to 4.4 Å<sup>-1</sup>  $S(x, Z)$ . Kim and Inokuti [55] have obtained similar results for both  $F(x, Z)$  and  $S(x, Z)$  for He ( $Z=2$ ) for  $x$  from 0 to 1.5 Å<sup>-1</sup> using Hylleraas 2-, 3-, 6-, and 20-term correlated ground-state wave functions.<sup>10</sup>

For He this correction to the Hartree-Fock model is less than 1% for  $F(x, Z)$  and 5% for  $S(x, Z)$  at small momentum transfers. However, for Be and C this correction to  $S(x, Z)$  can be as much as 30% and 20%, respectively, producing corrections of similar magnitude in the photon incoherent scattering cross section at 1 keV.

### 2.6. Bethe-Levinger Relativistic K-Shell Formula for $F(x, Z)$

In all the above models  $S(x, Z)$  approaches the value  $Z$  as  $x$  becomes large, and in the above calculated results usually has nearly attained this value within the highest  $x$ -argument calculated, so that little or no extrapolation is required for application to photon incoherent scattering calculations up into the MeV region. However, the asymptotic behavior of  $F(x, Z)$

for high  $x$  is not as well defined, resulting in large differences between calculated coherent scattering cross sections depending on the choice of extrapolation procedure.

The extended-range (up to 80.0 Å<sup>-1</sup>)  $F(x, Z)$  values of Cromer [20] would eliminate most of the need for such extrapolation, except that these values have large roundoff oscillations in the region of  $x$  from 10 to 80 Å<sup>-1</sup>, particularly for  $Z=2$  to 56, leading to difficulties in interpolation and integration in computation of the coherent scattering cross section.

Since the contribution to  $F(x, Z)$  for  $x > 10$  Å<sup>-1</sup> is primarily from the two K-shell electrons, the relativistic Bethe-Levinger [29] (see also Smend and Schumacher [98], and Tseng et al. [99]) closed-form K-shell expression

$$F_{rel}(x, Z) = [\sin(2\gamma \tan^{-1} Q)] / [\gamma Q(1 + Q^2)^{\gamma}], \quad (45)$$

where  $Q = q/a$  ( $q$  in mc units),  $\gamma = (1 - a^2)^{1/2}$  and  $a = \alpha Z \approx Z/137$ , provides a well-behaved extension of  $F(x, Z)$  from 10 Å<sup>-1</sup> to arbitrarily high  $x$ -values as shown in figures 3-10.

Also, as was mentioned in section 1.1, Kim [27] has derived from the work of Goscinski and Lindner [25], Smith [26], and Lassetre [28] a power-series expression for  $F(x, Z)$  suitable for intermediate as well as high  $x$  values:

$$F(x, Z) = [1 + (x/\alpha)^2]^{-2}$$

$$\left\{ Z + \sum_{n=1}^{\infty} A_n (x/\alpha)^{2n} / [1 + (x/\alpha)^2]^n \right\}, \quad (45a)$$

in which  $\alpha = (E_{tot} - Z^2)^{1/2}$  and  $E_{tot}$  is the total energy of the atom in Rydbergs. Application of this formula requires least-squares fitting of the  $A_n$  power-series (appropriately truncated) coefficients to a selected inter-

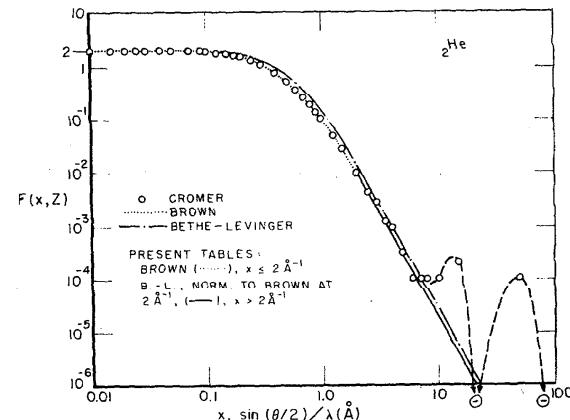


FIGURE 3. Comparison of the Cromer [10], [20]  $F(x, Z)$  values for He with the Bethe-Levinger [29] relativistic K-shell formula, also the Brown [56] configuration-interaction results. The dashed arrows indicate negative values in the Cromer-Veigle [12], [20] tables.

<sup>10</sup> Kim [27] has pointed out to the authors the further configuration-interaction results by Tanaka and Sasaki [95] for  $Z=4-11$  and by Naon and Cornille [96], [97] for  $Z=4-10, 17$ .

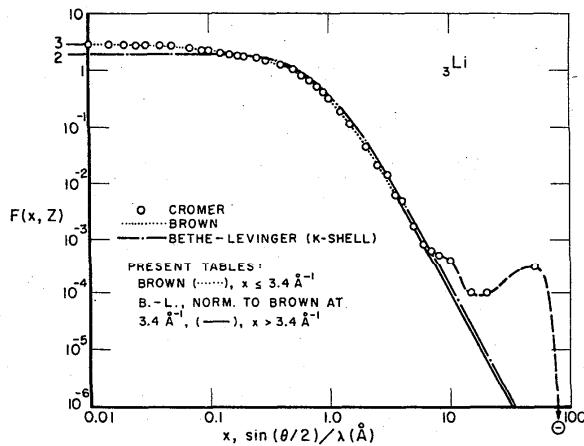


FIGURE 4. Comparison of the Cromer [10], [20]  $F(x, Z)$  values for Li with the Bethe-Levinger [29] relativistic K-shell formula, also the Brown [56] configuration-interaction results. The dashed arrow indicates a negative  $F(x, Z)$  value in the Cromer-Veigle [12], [20] tables at  $x=80.0 \text{\AA}^{-1}$

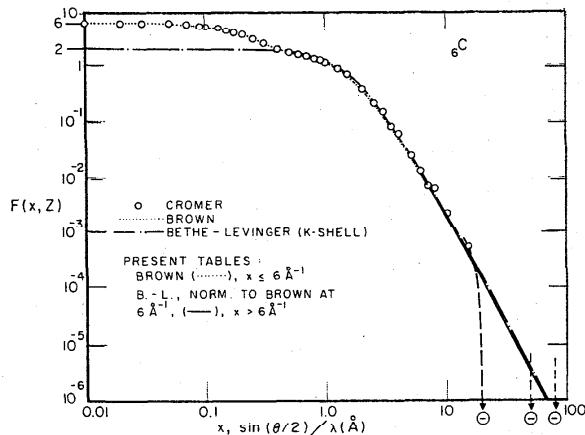


FIGURE 5. Comparison of Cromer [10], [20]  $F(x, Z)$  values for C with the Bethe-Levinger [29] relativistic K-shell formula, also the Brown [94] configuration-interaction results. The dashed arrows indicate negative values in the Cromer-Veigle [12], [20] tables.

mediate- $x$  range of  $F(x, Z)$  (from Cromer-Veigle or other available set) for each element  $Z$ . Both equations (45) (used in this work) and (45a) reduce to  $x^{-4}$  behavior in the high- $x$  limit.

### 3. Composition of the present $F(x, Z)$ and $S(x, Z)$ Tables

The atomic hydrogen  $F(x, Z)$  and  $S(x, Z)$  values in table I were computed from the Pirenne [57] formulas [equations (28) and (29)] and the bonded hydrogen values in table IV were interpolated and extrapolated from the Stewart et al. [58], Bentley and Stewart [61] and Stewart [64] numerical results as discussed in section 2.1.

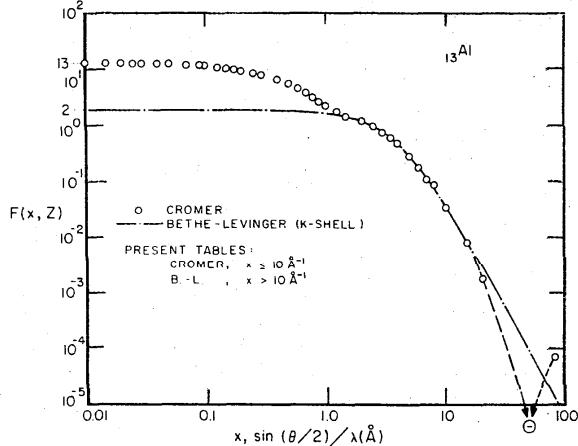


FIGURE 6. Comparison of Cromer [10], [20]  $F(x, Z)$  values for Al with the Bethe-Levinger [29] relativistic K-shell formula. The dashed arrows indicate a negative value in the Cromer-Veigle [12], [20] tables at  $x=80.0 \text{\AA}^{-1}$ .

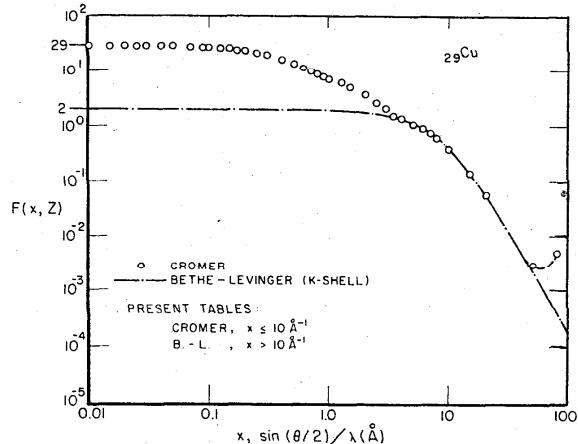


FIGURE 7. Comparison of Cromer [10], [20]  $F(x, Z)$  values for Cu with the Bethe-Levinger [29] relativistic K-shell formula.

For the remaining elements  $Z=2$  to 100 in table I a primary consideration in our selection of  $F(x, Z)$  and  $S(x, Z)$  values from the various available calculated tabulations, none of which covers the entire  $x$ - and/or  $Z$ -range of table I, was that both  $F(x, Z)$  and  $S(x, Z)$  should preferably be derived from the same theoretical model in order to provide an internally consistent data set. Hence in table I we have not used the Cromer-Waber [14] relativistic Hartree-Fock (RHF) values of  $F(x, Z)$  (see sample table VI) since a complementary RHF set of  $S(x, Z)$  is not presently available. Percent deviations of the present (table I)  $F(x, Z)$  values from Cromer-Waber [14] RHF values are listed in table VII.

For elements He ( $Z=2$ ) through C ( $Z=6$ ) Brown's [56], [94] configuration-interaction  $F(x, Z)$  and  $S(x, Z)$  values (see section 2.5) are used in table I. For each of these elements Brown's  $S(x, Z)$  values have effectively reached the asymptotic value ( $Z$ ) within his range of  $x$ -values. For these elements  $Z=2$  to 6 Brown's  $F(x, Z)$

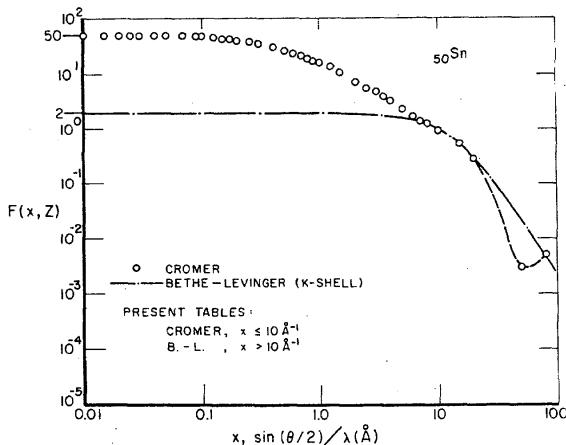


FIGURE 8. Comparison of Cromer [10], [20]  $F(x, Z)$  values for Sn with the Bethe-Levinger [29] relativistic K-shell formula.

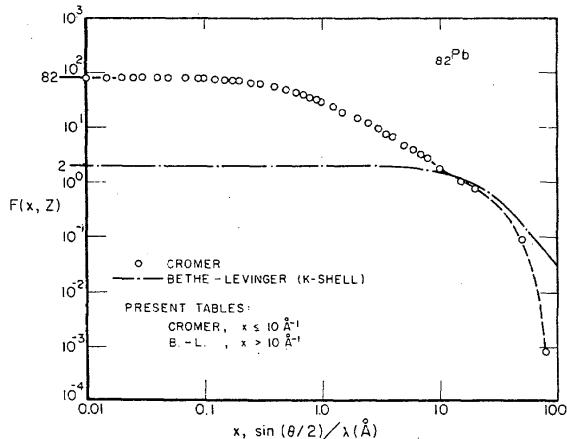


FIGURE 9. Comparison of Cromer [10], [20]  $F(x, Z)$  values for Pb with the Bethe-Levinger [29] relativistic K-shell formula.

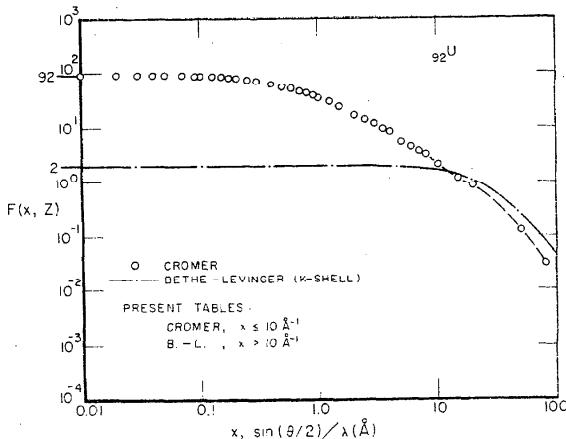


FIGURE 10. Comparison of Cromer [10], [20]  $F(x, Z)$  values for U with the Bethe-Levinger [29] relativistic K-shell formula.

values are used in table I up to his highest  $x$ -value (2.0, 3.4, 4.4, 6.0, and 6.0 Å<sup>-1</sup>, respectively), above which the Bethe-Levinger relativistic K-shell formula [equation (45)] is used, normalized to Brown's highest  $x$ -value for each element.

For elements  $Z=7$  to 100 the Cromer-Mann [10], [20] non-relativistic Hartree-Fock (HF)  $F(x, Z)$  values (see section 2.4) are used in table I up to  $x=10$  Å<sup>-1</sup>. Above 10 Å<sup>-1</sup>, where the Cromer [20]  $F(x, Z)$  values tend to oscillate from round-off in the calculations, the Bethe-Levinger formula [equation (45)] is used directly without normalization to complete the  $F(x, Z)$  tables out to 10<sup>9</sup> Å<sup>-1</sup>.

The corresponding Cromer-Mann [17] and Cromer [18], [20] non-relativistic Hartree-Fock (HF)  $S(x, Z)$  values, consistent with the above Cromer-Mann [10], [29] set of HF  $F(x, Z)$  values, are used in table I for all elements  $Z=7$  to 100 over the range  $x=0$  to 80 Å<sup>-1</sup>, above which  $S(x, Z)$  is effectively equal to the asymptotic value ( $Z$ ) over the balance of the range up to  $x=10^9$  Å<sup>-1</sup>.

#### 4. Comparison of Theoretical $F(x, Z)$ and $S(x, Z)$ Values with Available Experiments

In figures 11-41 we compare theoretical  $F(x, Z)$  values obtained from the various models with available experimental points obtained from photon coherent scattering angular distribution measurements for 31 elements from Be ( $Z=4$ ) to U ( $Z=92$ ). The experimental data do not as yet suggest any single theoretical model as clearly superior to the others.

Some of the high- $x$  measurements of  $F(x, Z)$ , particularly those of Basavaraju and Kane [70 Ba 01]<sup>11</sup> (1.12, 1.33 Mev;  $\theta=90^\circ$ , 124.5°; Cu, Zr, Mo, Ag, Ta, W, Hg, Pb) and of Eberhard et al. [59 Eb 01] (2.62 MeV;  $\theta=26^\circ$ -126°; Pb, Bi, U) suggest the onset of additional elastic scattering processes, such as Delbrück scattering, for  $x \geq 100$  Å<sup>-1</sup>.

Significant temperature effects on  $F(x, Z)$  have been observed in the range  $0.2$  Å<sup>-1</sup> ≤  $x$  ≤  $1.4$  Å<sup>-1</sup>, by Brill and Chopra [62 Br 01] for Mg and Ru (figures 13 and 26). Such temperature effects may account for similar discrepancies for Si and Ni (figures 15 and 19) in which a number of  $F(x, Z)$  measurement points are systematically lower than the present (table I)  $F(x, Z)$  values which ignore zero-point-energy and thermal-vibration effects (see, e.g., Lonsdale [100]).

In figures 42 and 43 we compare the Brown configuration-interaction and the Cromer non-relativistic Hartree-Fock  $S(x, Z)$  values with available measurements for Be and C. For carbon, at least, the Laval [42 La 01] data tend to favor the Brown results as used in table I for elements  $Z=2$  to 6. Comparisons of table I Cromer

<sup>11</sup> Reference symbols of the form [70 Ba 01] for measured data are composed of (a) the year, (b) the first two letters of the first-author's last name and (c) an additional number for uniqueness. These references, ordered by year and author, are listed separately in section 8 following the main bibliography.

$S(x, Z)$  values with available measurements for elements  $Z = 13, 26, 29$ , and  $82$  are given in figures 44 to 47. The agreement is within the experimental error-bars except for Al ( $Z=13$ ) and Pb ( $Z=82$ ) at low momentum transfers where the Cromer values are systematically higher.

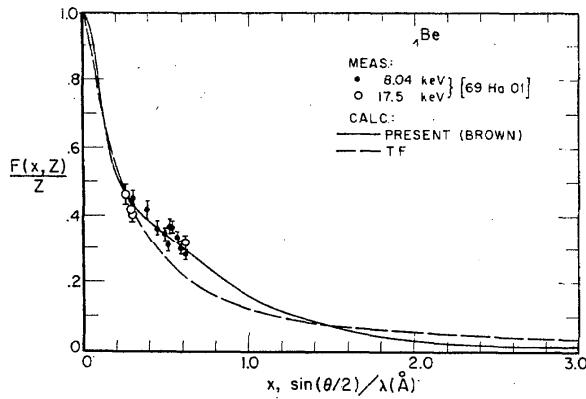


FIGURE 11. Comparison of Thomas-Fermi (TF) and present (Brown [56] in this  $x$ -range) tabulated  $F(x, Z)$  values for Be with available measurements.

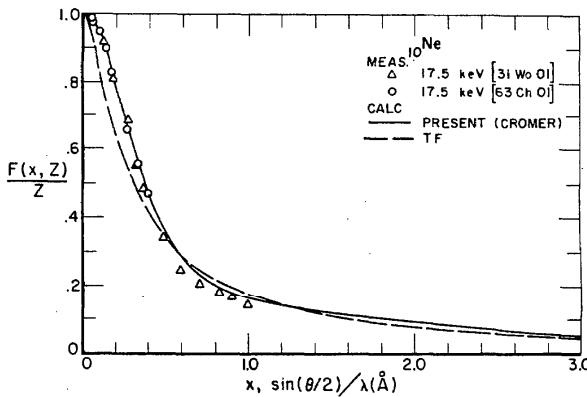


FIGURE 12. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] in this  $x$ -range) tabulated  $F(x, Z)$  values for Ne with available measurements.

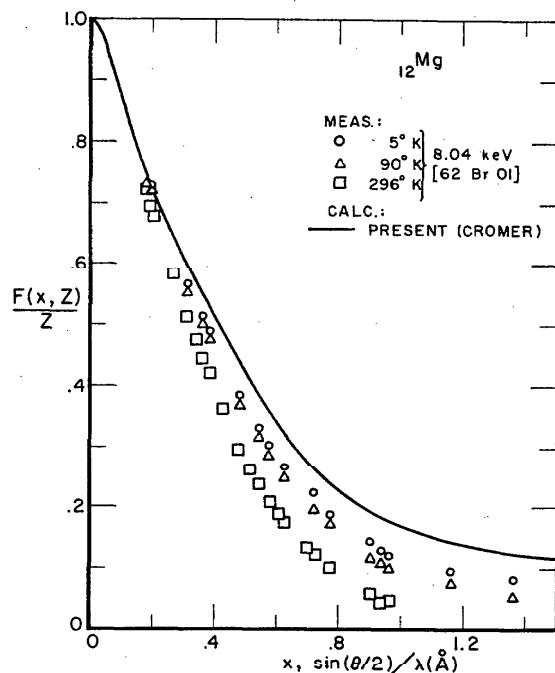


FIGURE 13. Comparison of present (Cromer [10], [20] in this  $x$ -range) values of  $F(x, Z)$  for Mg with the Brill and Chopra [62Br01] measurements of metallic Mg showing the effect of thermal motion on the scattering centers.

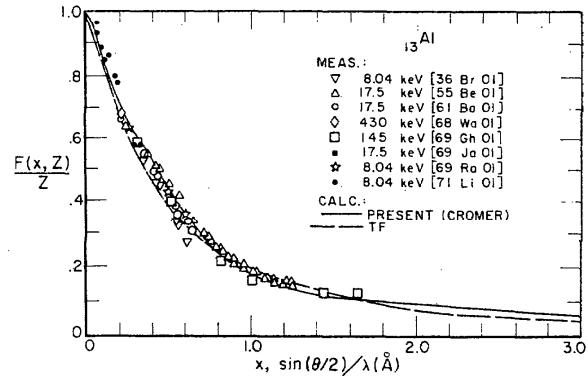


FIGURE 14. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] in this  $x$ -range) tabulated  $F(x, Z)$  values for Al with available measurements.

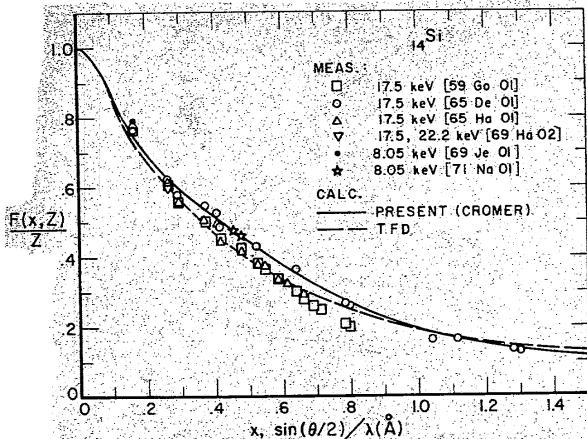


FIGURE 15. Comparison of Thomas-Fermi-Dirac (TFD) (from ref. [6], table 3.3.1B) and present (Cromer [10], [20] in this  $x$ -range) tabulated  $F(x, Z)$  values for Si with available measurements.

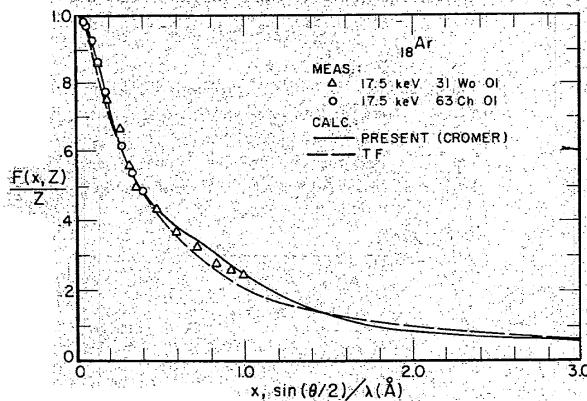


FIGURE 16. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] in this  $x$ -range) tabulated  $F(x, Z)$  values for Ar with available measurements.

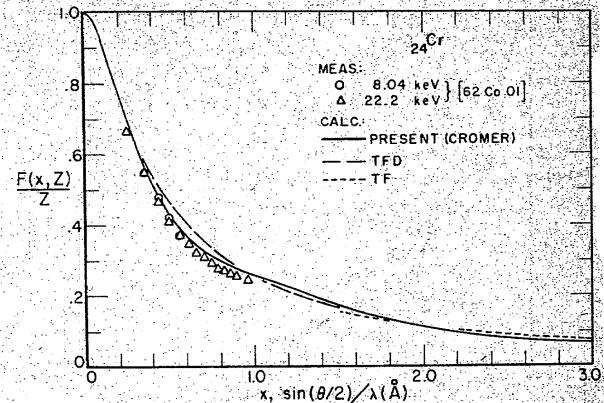


FIGURE 17. Comparison of Thomas-Fermi (TF), Thomas-Fermi-Dirac (TFD) (from ref. [6], table 3.3.1B) and present (Cromer [10], [20] in this  $x$ -range) tabulated  $F(x, Z)$  values for Cr with available measurements.

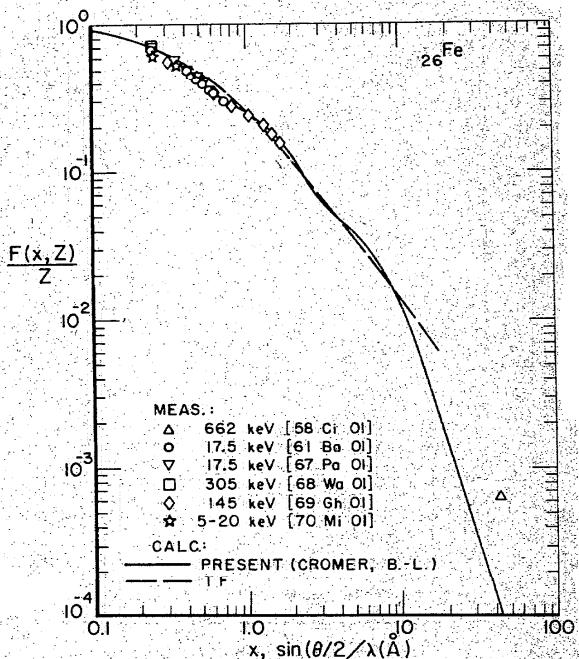


FIGURE 18. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10\text{\AA}^{-1}$  and Bethe-Levinger [29] for  $x > 10\text{\AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Fe with available measurements.

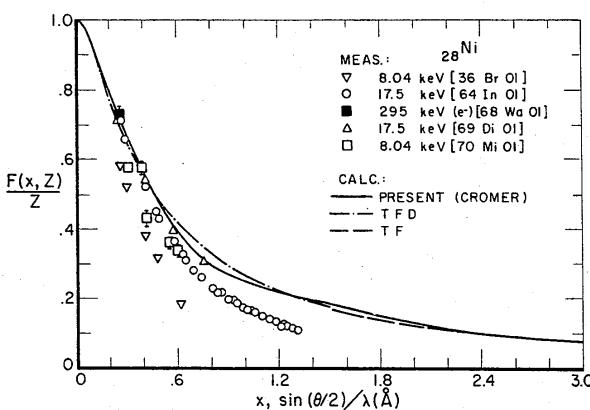


FIGURE 19. Comparison of Thomas-Fermi (TF), Thomas-Fermi-Dirac (TFD) (from ref. [6], table 3.3.1B) and present (Cromer [10], [20] in this  $x$ -range) tabulated  $F(x, Z)$  values for Ni with available measurements.

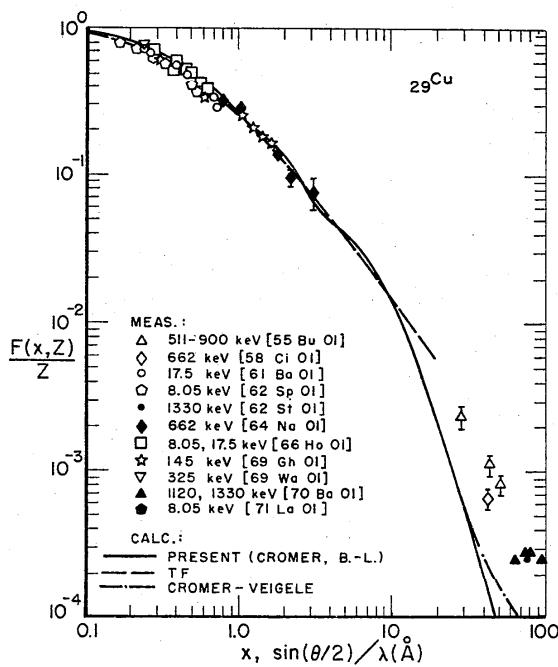


FIGURE 20. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Cu, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

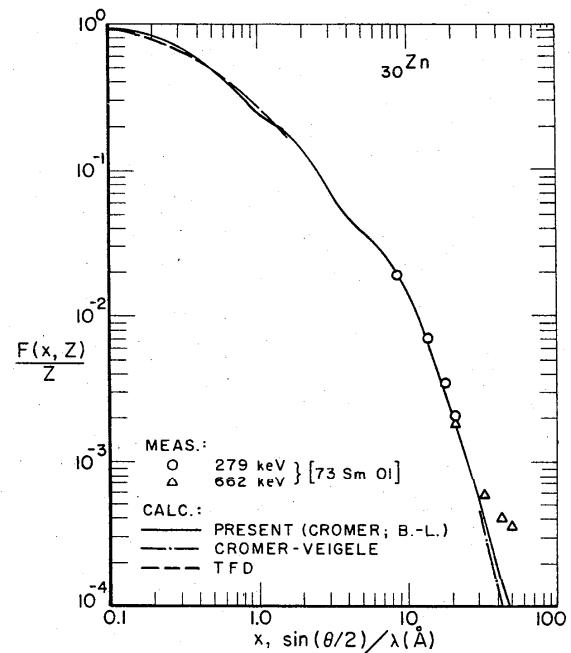


FIGURE 21. Comparison of Thomas-Fermi-Dirac (TFD) (from ref. [6], table 3.3.1B) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Zn, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

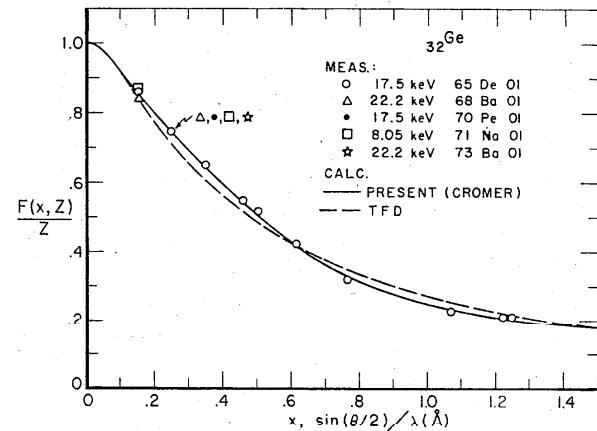


FIGURE 22. Comparison of Thomas-Fermi-Dirac (TFD) (from ref. [6], table 3.3.1B) and present (Cromer [10], [20] in this  $x$ -range) tabulated  $F(x, Z)$  values for Ge with available measurements.

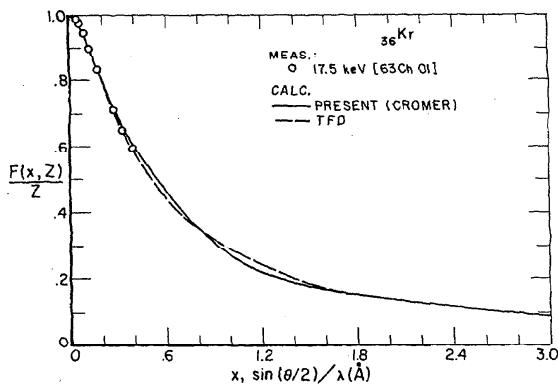


FIGURE 23. Comparison of Thomas-Fermi-Dirac (TFD) (from ref. [6], table 3.3.1B) and present (Cromer [10], [20] in this  $x$ -range) tabulated  $F(x, z)$  values for Kr with available measurements.

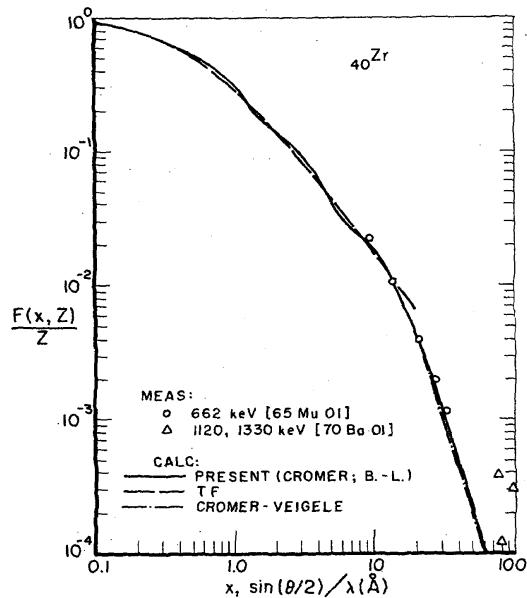


FIGURE 24. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Zr, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

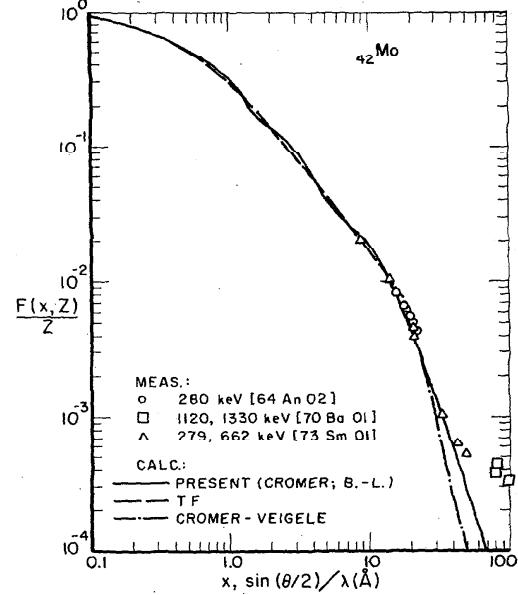


FIGURE 25. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Mo, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

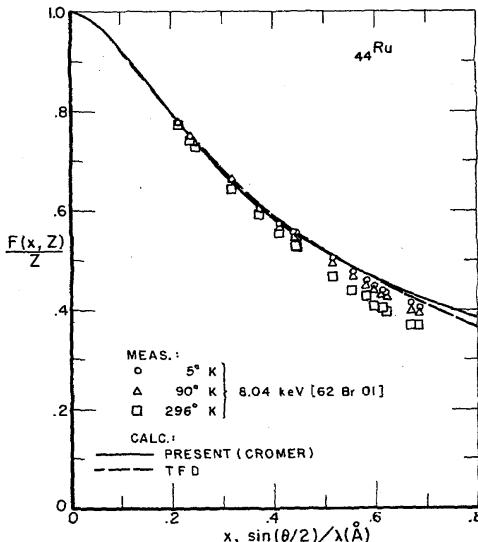


FIGURE 26. Comparison of Thomas-Fermi-Dirac (TFD) and present (Cromer [10], [20] in this  $x$ -range) tabulated  $F(x, Z)$  values for Ru with the Brill and Chopra [62 Br 01] measurements of Ru powder showing the effect of thermal motion on the scattering centers.

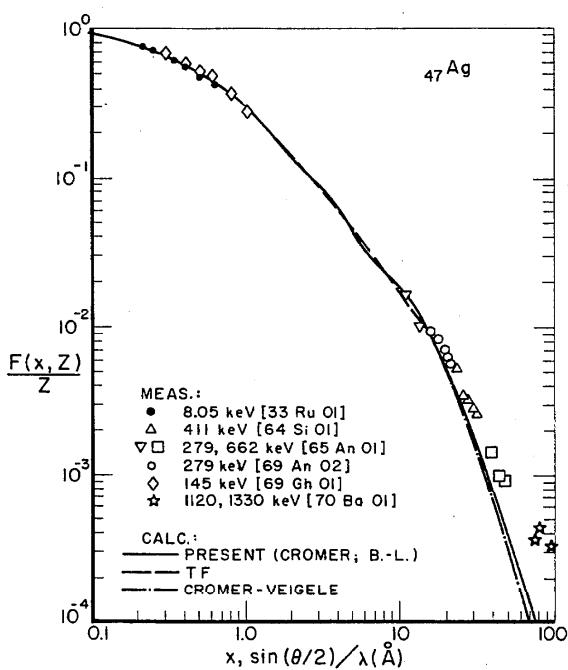


FIGURE 27. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Ag, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

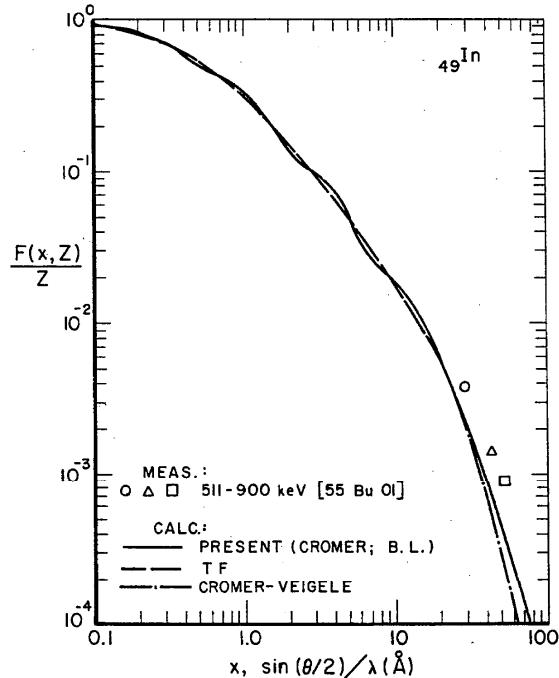


FIGURE 29. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for In, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

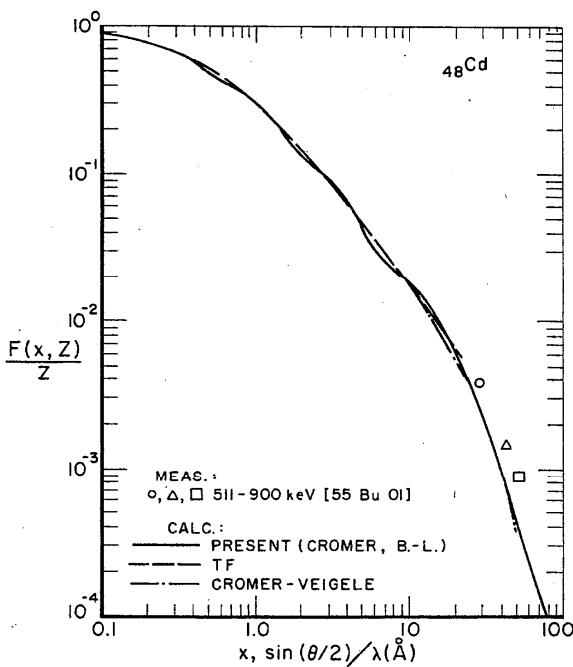


FIGURE 28. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Cd, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

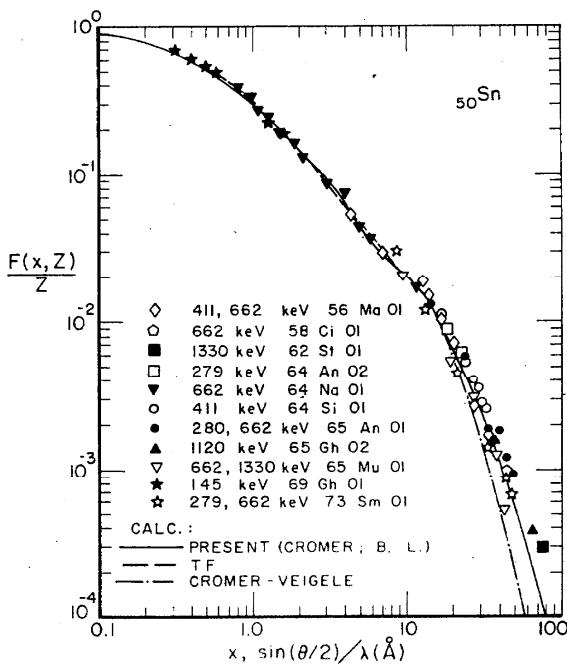


FIGURE 30. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Sn, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

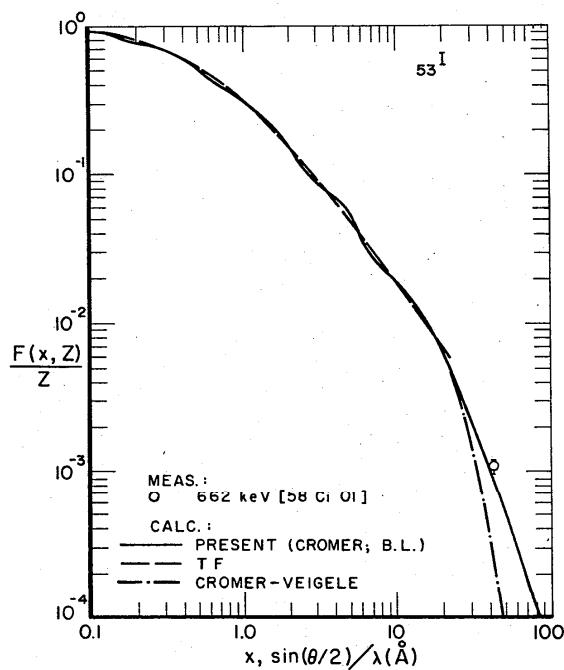


FIGURE 31. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for I, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

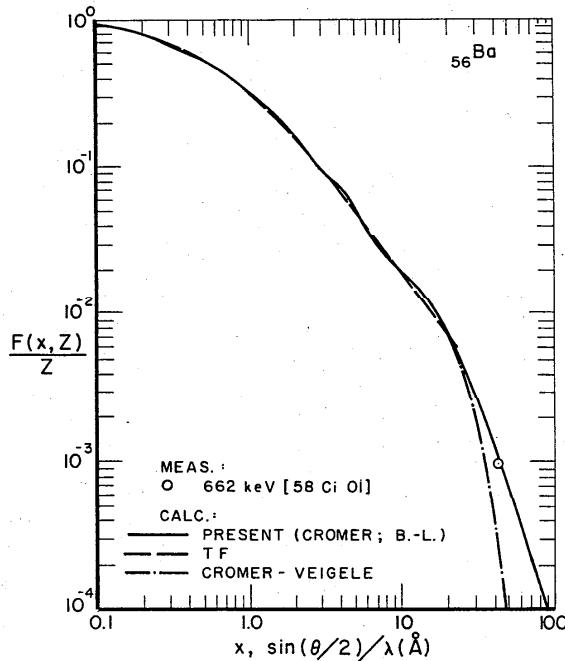
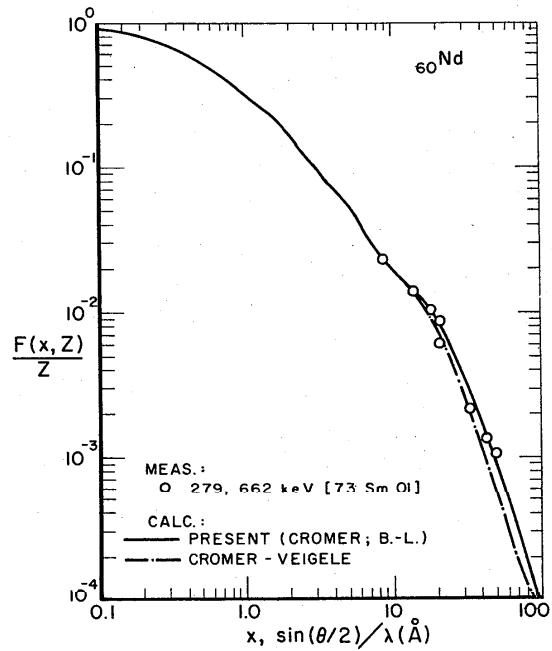


FIGURE 32. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Ba, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

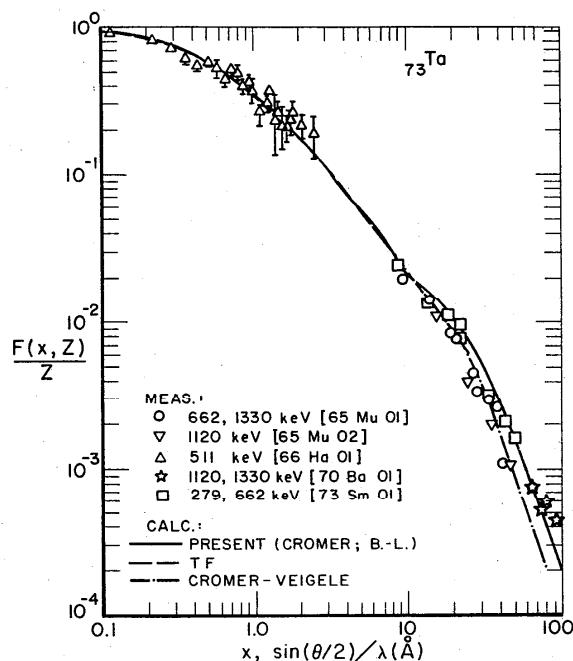
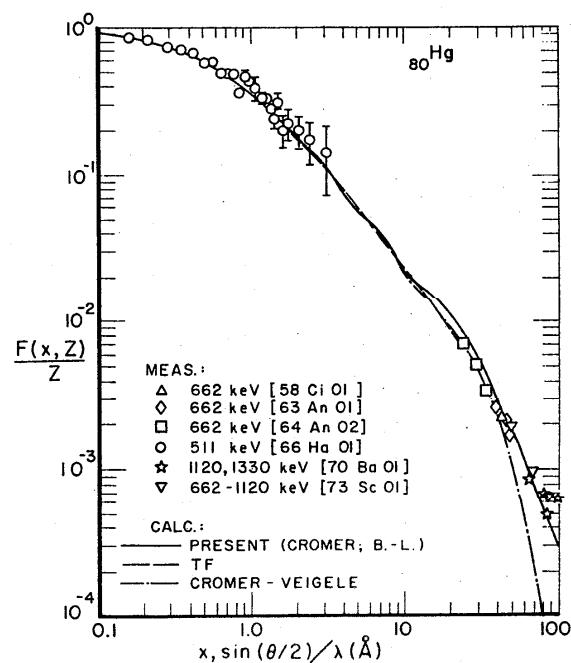
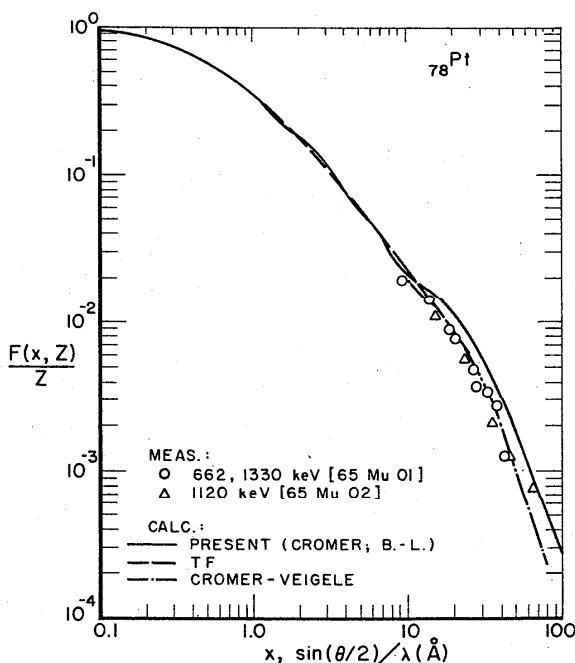
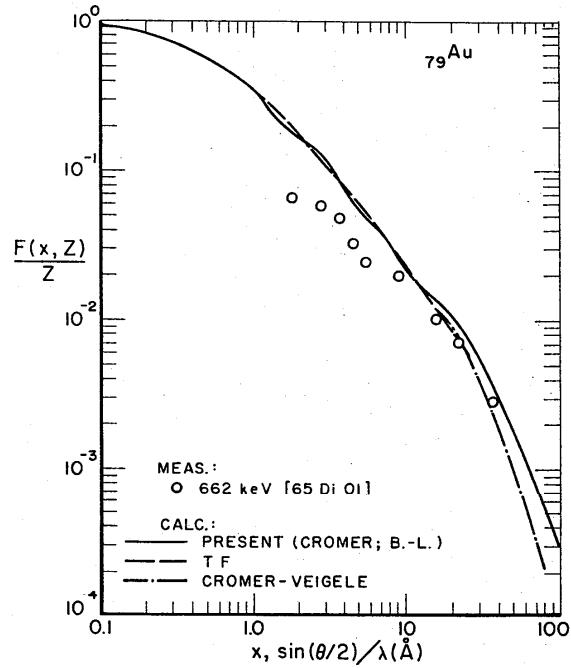
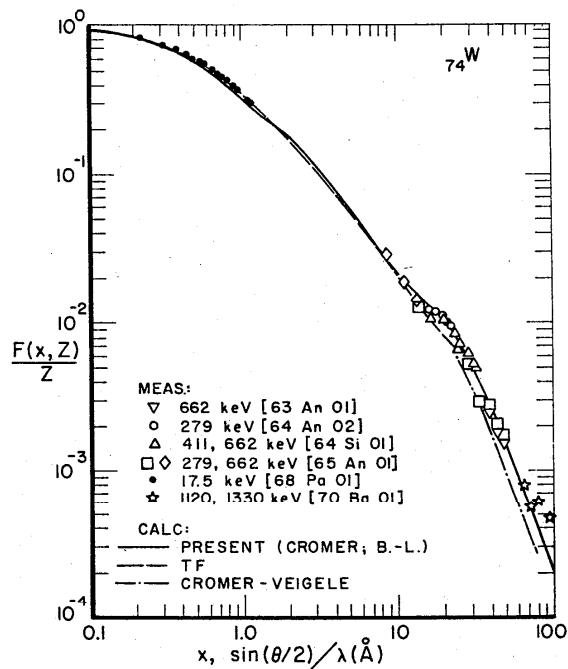


FIGURE 34. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Ta, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.



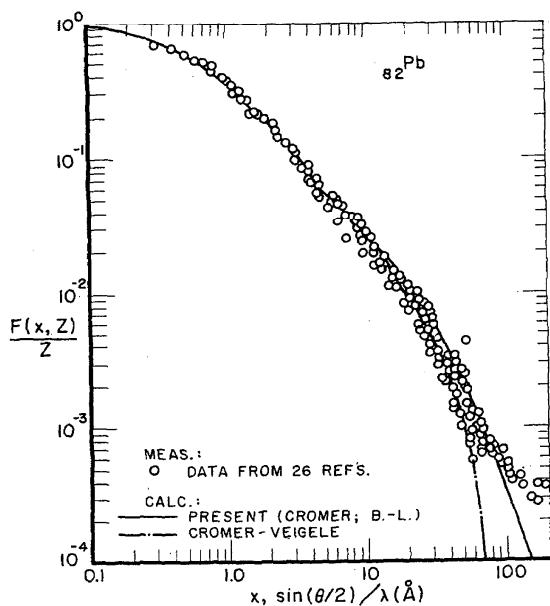


FIGURE 39. Comparison of present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Pb, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

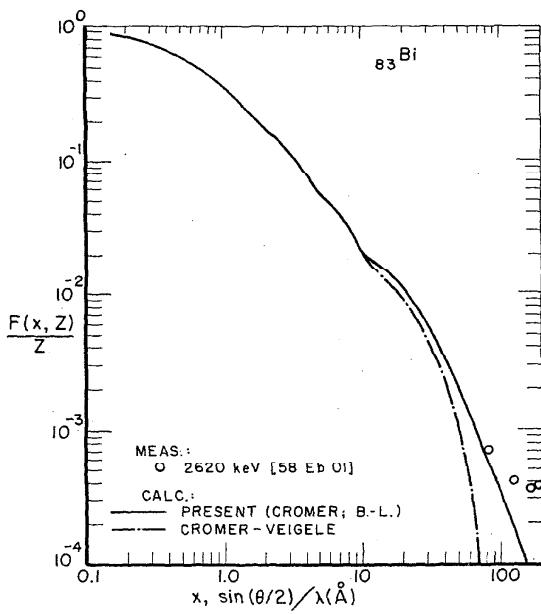


FIGURE 40. Comparison of present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for Bi, also the high- $x$  Cromer-Veigle [12], [20] values, with available measurements.

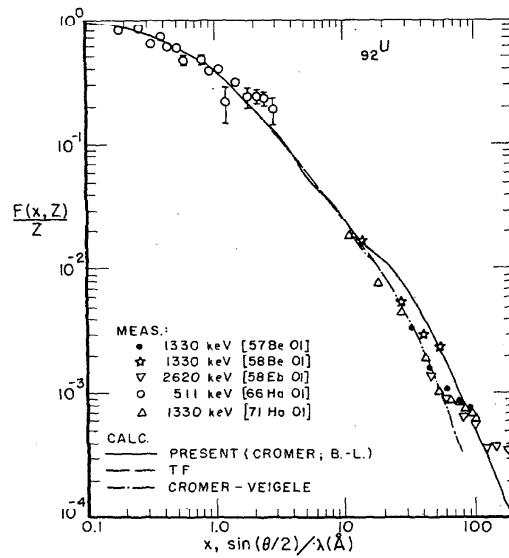


FIGURE 41. Comparison of Thomas-Fermi (TF) and present (Cromer [10], [20] for  $x \leq 10 \text{ \AA}^{-1}$ , Bethe-Levinger [29] for  $x > 10 \text{ \AA}^{-1}$ ) tabulated  $F(x, Z)$  values for U, also the high- $x$  Cromer-Veigle [12], [20] values with available measurements.

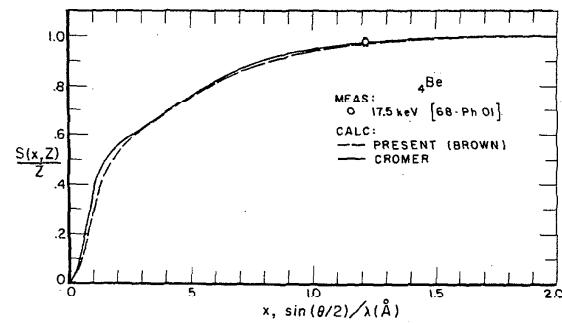


FIGURE 42. Comparison of the Cromer-Mann [17], [20] non-relativistic Hartree-Fock and the Brown [56] configuration-interaction (present tabulation) calculated  $S(x, Z)$  values for Be with the measurement by Phillips and Weiss [68 Ph 01].

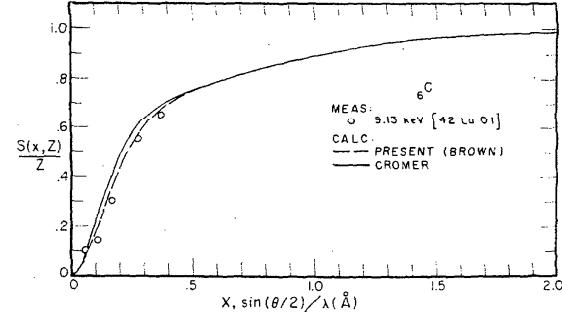


FIGURE 43. Comparison of the Cromer [18], [20] non-relativistic Hartree-Fock and the Brown [56] configuration interaction (present tabulation) calculated  $S(x, Z)$  values for C with the measurement by Laval [42 La 01].

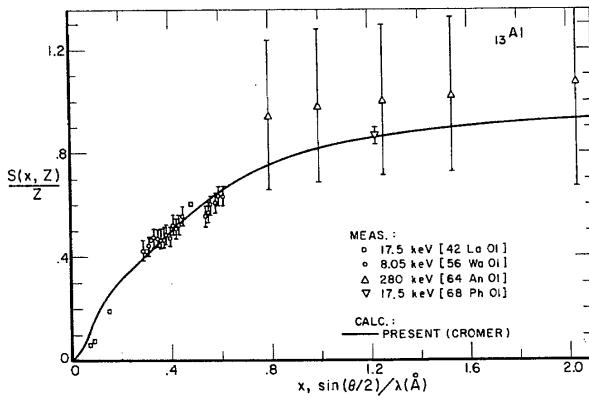


FIGURE 44. Comparison of the (present tabulation) Cromer [18], [20] non-relativistic Hartree-Fock calculated  $S(x, Z)$  values for Al with available measurements.

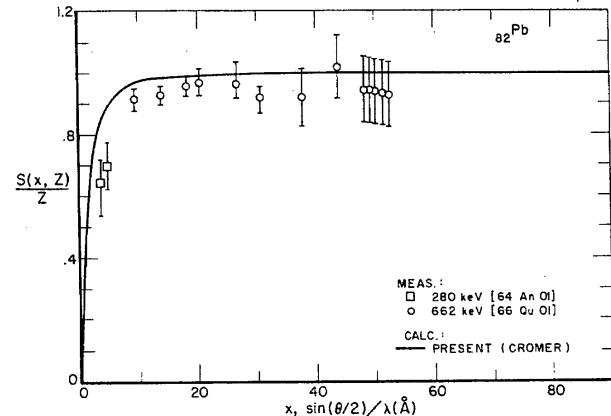


FIGURE 47. Comparison of the (present tabulation) Cromer [18], [20] non-relativistic Hartree-Fock calculated  $S(x, Z)$  values for Pb with available measurements.

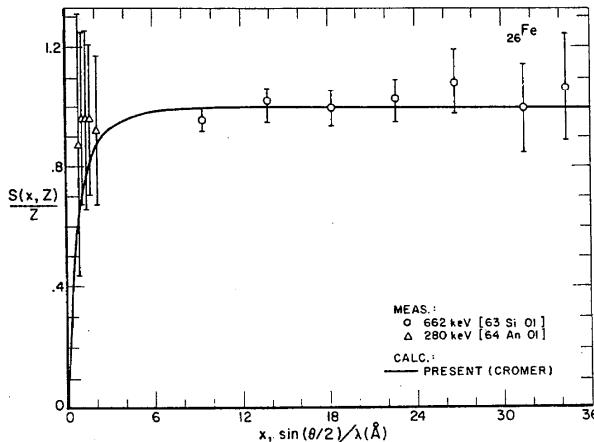


FIGURE 45. Comparison of the (present tabulation) Cromer [18], [20] non-relativistic Hartree-Fock calculated  $S(x, Z)$  values for Fe with available measurements.

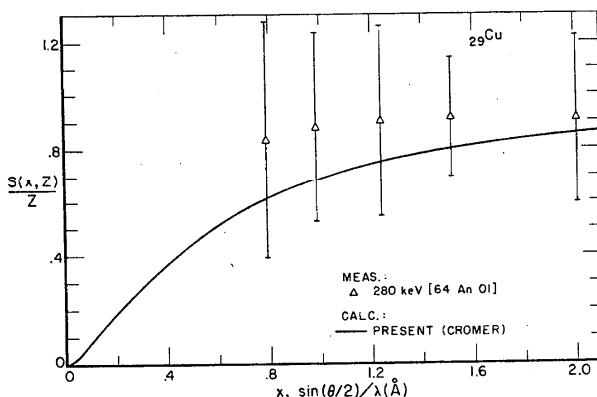


FIGURE 46. Comparison of the (present tabulation) Cromer-Mann [17], [20] non-relativistic Hartree-Fock calculated  $S(x, Z)$  values for Cu with available measurements.

## 5. Total Cross Sections for Coherent (Rayleigh) and Incoherent (Compton) Scattering of Photons by Atomic Electrons

### 5.1. Integration Procedures

Values for the coherent scattering cross section  $\sigma_{coh}$  and the incoherent scattering cross section  $\sigma_{inc}$  in table II and V were obtained by numerically performing the integrations indicated in equations (4) and (8), respectively, using  $F(x, Z)$  and  $S(x, Z)$  values from table I and IV. The  $\sigma_{inc}$  values also include the Mork [44] radiative and double-Compton correction as discussed in the following section 5.2. In table V the free-electron Klein-Nishina Compton cross section (also including the Mork correction) is listed for comparison.

Because of the extreme forward peaking of the coherent scattering angular distribution for the higher photon energies, considerable care was required in the numerical integration. For example, at 100 MeV for hydrogen, iron and plutonium, the entire integrated  $\sigma_{coh}$  cross section (to four figures) is contained within the angular range  $\theta=0^\circ$  to  $0.015^\circ$  ( $1-\cos\theta=3.4\times 10^{-8}$ ), to  $0.3^\circ$  ( $1-\cos\theta=1.3\times 10^{-5}$ ) and to  $4^\circ$  ( $1-\cos\theta=2.2\times 10^{-3}$ ), respectively. In addition, interpolation of  $F(x, Z)$  and  $S(x, Z)$  values from table I to the integration mesh-points was found to be sensitive by as much as 1% to the fitting-scheme used (e.g., log-log linear vs. log-log quadratic).

The integration variable was taken as  $1-\cos\theta$ , from which the values  $x=\sin(\theta/2)/\lambda(\text{\AA})=[(1-\cos\theta)/2]^{1/2}/\lambda(\text{\AA})$  could be computed arbitrarily close to  $\theta=0^\circ$  without loss of significance. For the incoherent scattering integrations the values for  $x$  were modified by the factor  $[1+(k^2+2k)\sin^2(\theta/2)]^{1/2}/[1+2k\sin^2(\theta/2)]$  as given in equation (2). The integration range used was from  $1-\cos\theta=10^{-12}$  to  $2.0$  ( $\theta=0.000081^\circ$  to  $180^\circ$ ), divided into intervals equally spaced in the logarithm

of  $1 - \cos\theta$ . Values of  $F(x, Z)$  and  $S(x, Z)$  at the integration mesh-points were obtained by log-log quadratic ( $\log f(x) = a + b \log x + c \log^2 x$ ) interpolation from values listed in table I, with the zero-values (first entry in the  $x$  list and the  $S(x, Z)$  lists) replaced by  $10^{-30}$  for purposes of this interpolation.<sup>12</sup>

A modified Simpson-rule procedure given by Spencer [101] was then used to perform the integrations. With this procedure, 1000 integration points (999 intervals) were found adequate for four-place accuracy in computing the total coherent and incoherent scattering cross sections in table II, requiring a total of 80 minutes on the NBS Univac 1108 computer. Figures 48 and 49 give these results as a function of  $Z$  for a few constant energies.

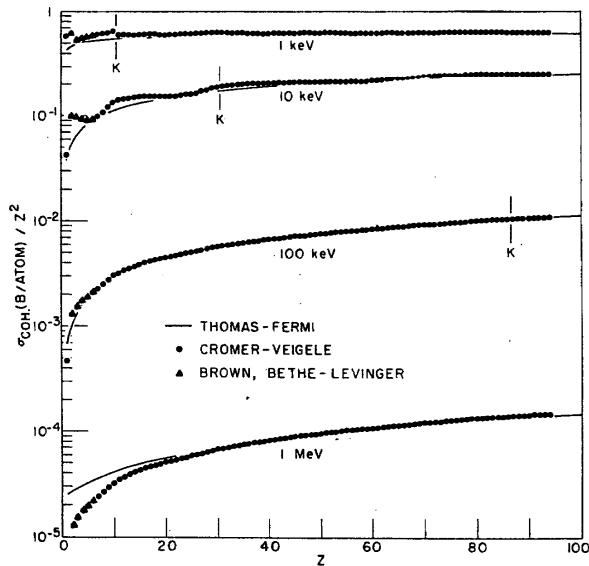


FIGURE 48. Comparison of integrated coherent (Rayleigh) scattering cross sections using  $F(x, Z)$  values from (a) the Thomas-Fermi model (solid curves), (b) the Cromer-Veigle [12], [20] tables (circles) and (c) the configuration-interaction results of Brown [56], [94] (triangles) as a function of  $Z$  for photon energies of 1, 10, 100, and 1000 keV.

<sup>12</sup>In the present Evaluated Nuclear Data File (ENDF) processing codes, no provision is made for log-log quadratic interpolation as used in the present integration procedure. However, the ENDF log-log linear and linear-linear interpolation provisions can be used as follows: An additional arbitrarily small value  $x' = \epsilon$  (e.g.,  $\epsilon = 10^{-20}$ ) may be inserted between  $x_1 = 0$  and  $x_2 = 0.005$ , for which  $F(x', Z) \approx F(x_1, Z)$ , and, making use of the  $x^2$  dependence of  $S(x, Z)$  for small  $x$ ,  $S(x', Z) = (x'/x_2)^2 S(x_2, Z)$ . Log-log linear interpolation can then be used for  $x' \leq x \leq 10^0$  to obtain  $F(x, Z)$  and  $S(x, Z)$  values with accuracies of the order of 1% or better. In the remaining small interval  $0 \leq x \leq x'$ , linear-linear interpolation will introduce negligible error in practical calculations. With the present table, linear-linear interpolation in the first interval  $x = 0$  to 0.005 results in a 5% error in the integrated  $\sigma_{inc}$  at 0.1 keV.

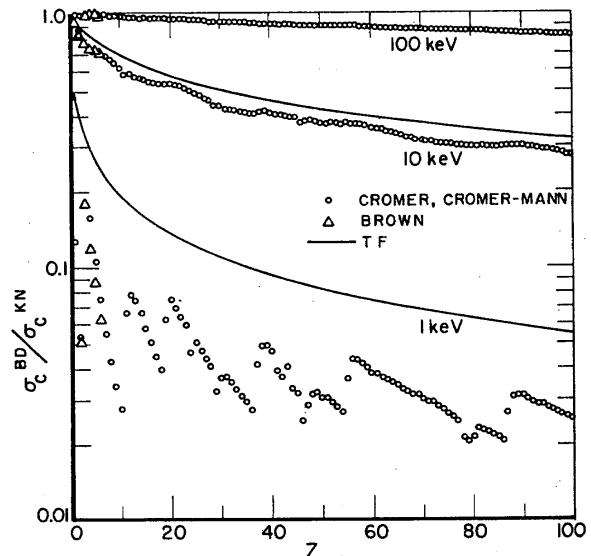


FIGURE 49. Comparison (as ratios to the Klein-Nishina free-electron Compton cross section  $\sigma_C^{KN}$ ) of the integrated incoherent (bound-electron Compton) cross section  $\sigma_C^{BD}$  calculated using (a) the Cromer-Mann-Veigle [12], [17], [18], [20] non-relativistic Hartree-Fock  $S(x, Z)$  values (circles); (b) the Brown [56], [94] configuration-interaction  $S(x, Z)$  values (triangles); and (c) the Thomas-Fermi model (solid curves) as a function of  $Z$  for photon energies of 1, 10, and 100 keV.

## 5.2. Radiative and Double-Compton Corrections to the Incoherent Scattering Cross Section

The radiative correction (of the order  $1/137$ ) is associated with emission and reabsorption of virtual photons, whereas in the double Compton effect an additional real photon, usually very low in energy, is emitted. Differential formulas (Brown and Feynman [102], Mandl and Skyrme [103]) for these two effects contain infrared divergencies, each of opposite sign.

Mork [44] has combined these two corrections to calculate a physically meaningful correction  $\Delta\sigma_{KN}^M$  to the free-electron Klein-Nishina Compton scattering total cross section  $\sigma_{KN}$ . This combined correction  $\Delta\sigma_{KN}^M$  is listed in table III and was included in the NSRDS-NBS 29 [43] photon cross section compilation, also in the Storm-Israel [23] compilation. The double-Compton scattering portion of this correction has also been treated by Ram and Wang [104].

Ideally, an angle-dependent combined correction  $\Delta\sigma_{inc}^M(\theta)$  should be included in the integration in equation (8). Since this is not readily available we apply the correction to the total cross section as

$$\sigma_{inc}(\text{corr.}) = \sigma_{inc} \cdot [1 + \Delta\sigma_{KN}^M] \quad (46)$$

to generate the incoherent scattering cross section values listed in table II.

## 6. Discussion

Although we offer this tabulation as an evaluated "state of the art" data set describing differential and integral scattering of photons by atomic electrons, we acknowledge that there are a number of additional theoretical developments, as discussed and evaluated by Tseng, Gavrila, and Pratt [99], which have yet to be exploited. These more sophisticated treatments, including the impulse approximation, the effects of atomic-electron velocities (particularly for backward-hemisphere incoherent scattering), and a more complete treatment of relativistic effects are not yet sufficiently available in numerical or analytical form for generating a data set such as the present all-Z, extended  $q$ - and energy-range general-purpose tabulations.

We again caution, as discussed in section 1.1 and as indicated in the comparisons with measurements (figures 11-47), that table I contains substantial uncertainties, particularly  $F(x, Z)$  for high- $x$  and high- $Z$ , also that additional elastic photon scattering processes (e.g., Delbrück and nuclear resonance scattering) may become much more important than Rayleigh (coherent) scattering for  $x \gtrsim 100 \text{ \AA}^{-1}$ .

Also, we emphasize that in order to provide a consistent set of  $F(x, Z)$  and  $S(x, Z)$  values, some accuracy in  $F(x, Z)$  has been sacrificed, as discussed in section 3, by neglecting relativistic effects for  $Z = 7$  to 100,  $x = 0$  to  $10 \text{ \AA}^{-1}$ . These relativistic corrections, as indicated in table VII, can be as much as 6% for the highest-Z elements at  $x = 2 \text{ \AA}^{-1}$ .

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TABLE I.  
ATOMIC FORM FACTOR,  $F(x,z)$ , AND INCOHERENT SCATTERING FUNCTION,  $S(x,z)$ 

| $x$                      | 1 H       | 2 HE      | 3 LI      | 4 BE      | 5 B       |
|--------------------------|-----------|-----------|-----------|-----------|-----------|
| $\sin(\theta/\lambda/2)$ | $F(x,z)$  | $S(x,z)$  | $F(x,z)$  | $S(x,z)$  | $F(x,z)$  |
| 0.00                     | 1.0000+00 | 0.0000    | 2.0000+00 | 0.0000    | 4.0000+00 |
| 5.00-03                  | 9.9945-01 | 1.1047-03 | 1.9993+00 | 2.1000-03 | 3.9975+00 |
| 1.00-02                  | 9.9779-01 | 4.4986-03 | 1.9992+00 | 5.0000-03 | 2.6505+00 |
| 1.50-02                  | 9.9504-01 | 9.8840-03 | 1.9990+00 | 8.8000-03 | 5.8475-02 |
| 2.00-02                  | 9.9121-01 | 1.7494-02 | 1.9920+00 | 1.4100-02 | 2.9472+00 |
| 2.50-02                  | 9.8632-01 | 2.7167-02 | 1.9891+C0 | 2.0590-02 | 2.9190+C0 |
| 3.00-02                  | 9.8039-01 | 3.8628-02 | 1.9844+00 | 2.9900-02 | 2.8850+00 |
| 4.00-02                  | 9.6554-01 | 6.7731-02 | 1.9724+00 | 5.1900-02 | 2.8044+00 |
| 5.00-02                  | 9.4693-01 | 1.0332-01 | 1.9569+00 | 8.0540-02 | 2.7106+00 |
| 7.00-02                  | 8.9987-01 | 1.9024-01 | 1.9169+00 | 1.5347-01 | 2.5071+00 |
| 9.00-02                  | 8.4238-01 | 2.9039-01 | 1.8660+00 | 2.4502-01 | 2.3090+00 |
| 1.00-01                  | 8.1082-01 | 3.4575-01 | 1.8364+00 | 2.9575-01 | 2.2190+00 |
| 1.25-01                  | 7.2711-01 | 4.7131-01 | 1.7551+00 | 4.3215-01 | 2.0358+00 |
| 1.50-01                  | 6.4129-01 | 5.8874-01 | 1.6612+00 | 5.8352-01 | 1.9060+00 |
| 1.75-01                  | 5.5811-01 | 6.8851-01 | 1.5603+00 | 7.3603-01 | 1.8184+00 |
| 2.00-01                  | 4.8078-01 | 7.6885-01 | 1.4585+00 | 8.8056-01 | 1.7425+00 |
| 2.50-01                  | 3.4974-01 | 8.7768-01 | 1.2522+00 | 1.1457-00 | 1.6258+00 |
| 3.00-01                  | 2.5127-01 | 9.3687-01 | 1.0586+C0 | 1.3624+00 | 1.5115+00 |
| 4.00-01                  | 1.3044-01 | 9.8298-01 | 7.3794-01 | 1.6566+00 | 2.1428+00 |
| 5.00-01                  | 7.0592-02 | 9.9502-01 | 5.0953-01 | 1.8175+00 | 1.0313+00 |
| 6.00-01                  | 4.0325-02 | 9.9837-01 | 3.5416-01 | 1.9023+00 | 6.2550-01 |
| 7.00-01                  | 2.4285-02 | 9.9941-01 | 2.4952-01 | 1.9467+00 | 6.5000-01 |
| 8.00-01                  | 1.5335-02 | 9.9977-01 | 1.7860-01 | 1.9702+00 | 5.1230-01 |
| 9.00-01                  | 1.0091-02 | 9.9990-01 | 1.2995-01 | 1.9829+00 | 4.0437-01 |
| 1.00+00                  | 6.8811-03 | 9.9995-01 | 9.6120-02 | 1.9899+00 | 3.2046-01 |
| 1.25+00                  | 2.9947-03 | 9.9999-01 | 4.8400-02 | 1.9971+00 | 1.8375-01 |
| 1.50+00                  | 1.4937-03 | 1.0000+00 | 2.6510-02 | 1.9990+00 | 1.1020-01 |
| 2.00+00                  | 4.8903-04 | 1.0000+00 | 9.6400-03 | 1.9999+00 | 4.4810-02 |
| 2.50+00                  | 2.0353-04 | 1.0000+00 | 4.1962-03 | 2.0000+00 | 2.0891-02 |
| 3.00+00                  | 9.9016-05 | 1.0000+00 | 2.0934-03 | 2.0000+00 | 1.0920-02 |
| 3.50+00                  | 5.3730-05 | 1.0000+00 | 1.1537-03 | 2.0000+00 | 6.1907-03 |
| 4.00+00                  | 3.1604-05 | 1.0000+00 | 4.4353-05 | 2.0000+00 | 2.5209-04 |
| 5.00+00                  | 1.2597-05 | 1.0000+00 | 1.8256-05 | 2.0000+00 | 1.0430-04 |
| 6.00+00                  | 6.2819-06 | 1.0000+00 | 1.3690-04 | 2.0000+00 | 7.8063-04 |
| 7.00+00                  | 3.3953-06 | 1.0000+00 | 7.5398-05 | 2.0000+00 | 4.2656-04 |
| 8.00+00                  | 1.9920-06 | 1.0000+00 | 4.4353-05 | 2.0000+00 | 2.5209-04 |
| 1.00+01                  | 8.1675-07 | 1.0000+00 | 1.8256-05 | 2.0000+00 | 1.0430-04 |
| 1.50+01                  | 1.6150-07 | 1.0000+00 | 3.6259-06 | 2.0000+00 | 2.0835-05 |
| 2.00+01                  | 5.1116-08 | 1.0000+00 | 1.1505-06 | 2.0000+00 | 6.6279-06 |
| 5.00+01                  | 1.3091-09 | 1.0000+00 | 2.9749-08 | 2.0000+00 | 1.7245-07 |
| 8.00+01                  | 1.9976-10 | 1.0000+00 | 4.5780-09 | 2.0000+00 | 2.6652-08 |
| 1.00+02                  | 8.1822-11 | 1.0000+00 | 1.8855-09 | 2.0000+00 | 1.1007-08 |
| 1.00+03                  | 8.1823-15 | 1.0000+00 | 2.4461-13 | 2.0000+00 | 1.4995-12 |
| 1.00+06                  | 8.1823-27 | 1.0000+03 | 5.1312-23 | 2.0000+00 | 4.4404-22 |
| 1.00+09                  | 8.1823-39 | 1.0000+00 | 5.1205-32 | 2.0000+00 | 4.4444-31 |

TABLE I. CONT.

| ATOMIC FORM FACTOR, $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION, $S(X, Z)$ |           |           |           |           |           |           |           |           |           |
|-------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| $X,$                                                                          | 6 C       | 7 N       | 8 O       | 9 F       | 10 NE     | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ |
| $\text{SIN}((\text{THETA}/2)$<br>/LAMRD)                                      | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ |
| 0.00                                                                          | 6.0000+00 | 0.0000    | 7.0000+00 | 0.0000    | 8.0000+00 | 0.0000    | 9.0000+00 | 0.0000    | 1.0000+01 |
| 5.00-03                                                                       | 5.9974+00 | 3.7900-03 | 6.9938+00 | 3.0000-03 | 7.9977+00 | 3.0000-03 | 8.9976+00 | 2.0000-03 | 9.9978+00 |
| 1.00-02                                                                       | 5.9899+00 | 1.2990-02 | 6.9870+00 | 1.3000-02 | 7.9912+00 | 1.1000-02 | 8.9919+00 | 1.0000-02 | 9.9926+00 |
| 1.50-02                                                                       | 5.9771+00 | 2.9534-02 | 6.9793+00 | 2.9200-02 | 7.9811+00 | 2.3000-02 | 8.9833+00 | 2.2400-02 | 9.9845+00 |
| 2.00-02                                                                       | 5.9594+00 | 5.1640-02 | 6.9633+00 | 5.1700-02 | 7.9669+00 | 4.4800-02 | 8.9693+00 | 3.9700-02 | 9.9724+00 |
| 2.50-02                                                                       | 5.9369+00 | 8.0494-02 | 6.9428+00 | 8.0400-02 | 7.9484+00 | 6.9800-02 | 8.9531+00 | 6.1900-02 | 9.9570+00 |
| 3.00-02                                                                       | 5.9093+00 | 1.1570-01 | 6.9179+00 | 1.1510-01 | 7.9259+00 | 1.0100-01 | 8.9326+00 | 7.8800-02 | 9.9382+00 |
| 4.00-02                                                                       | 5.8406+00 | 2.0150-02 | 6.8553+00 | 2.0170-01 | 7.8692+00 | 1.7610-01 | 8.8808+00 | 1.5620-01 | 9.8906+00 |
| 5.00-02                                                                       | 5.7544+00 | 3.0860-01 | 6.7760+00 | 3.1000-01 | 7.7974+00 | 2.7100-01 | 8.8153+00 | 2.4200-01 | 9.8300+00 |
| 7.00-02                                                                       | 5.5369+00 | 5.6877-01 | 6.5741+00 | 5.7970-01 | 7.6117+00 | 5.1370-01 | 8.6441+00 | 4.6100-01 | 9.6719+00 |
| 9.00-02                                                                       | 5.2702+00 | 8.7559-01 | 6.3217+00 | 9.0420-01 | 7.3757+00 | 8.1180-01 | 8.4255+00 | 7.3490-01 | 9.4682+00 |
| 1.00-01                                                                       | 5.1225+00 | 1.0392+00 | 6.1844+00 | 1.0800+00 | 7.2441+00 | 9.7700-01 | 8.3011+00 | 8.8800-01 | 9.3515+00 |
| 1.25-01                                                                       | 4.7407+00 | 1.4476+00 | 5.7961+00 | 1.5397+00 | 6.8748+00 | 1.4199+00 | 7.9501+00 | 1.3083+00 | 9.0193+00 |
| 1.50-01                                                                       | 4.3310+00 | 1.8662+00 | 5.3833+00 | 2.0303+00 | 6.4698+00 | 1.8853+00 | 7.5579+00 | 1.7610+00 | 8.6427+00 |
| 1.75-01                                                                       | 3.9371+00 | 2.2532+00 | 4.9622+00 | 2.4468+00 | 6.0466+00 | 2.3497+00 | 7.1384+00 | 2.2271+00 | 8.2330+00 |
| 2.00-01                                                                       | 3.5775+00 | 2.6041+00 | 4.5604+00 | 2.8580+00 | 5.6197+00 | 2.7990+00 | 6.7055+00 | 2.6910+00 | 7.8031+00 |
| 2.50-01                                                                       | 2.3614+00 | 3.1979+00 | 3.8221+00 | 3.5586+00 | 4.8084+00 | 3.6135+00 | 5.8475+00 | 3.5693+00 | 6.9254+00 |
| 3.00-01                                                                       | 2.5015+00 | 3.6426+00 | 3.2184+00 | 4.0970+00 | 4.0854+00 | 4.2930+00 | 5.0499+00 | 4.3470+00 | 6.0764+00 |
| 4.00-01                                                                       | 1.9512+00 | 4.1837+00 | 2.3939+00 | 4.7920+00 | 3.0031+00 | 5.2570+00 | 5.7550+00 | 5.5520+00 | 6.6440+00 |
| 5.00-01                                                                       | 1.6856+00 | 4.4777+00 | 1.9378+00 | 5.1820+00 | 2.3351+00 | 5.8280+00 | 2.8701+00 | 6.3330+00 | 3.5310+00 |
| 6.00-01                                                                       | 1.5353+00 | 4.6903+00 | 1.6948+00 | 5.4370+00 | 1.9445+00 | 6.1750+00 | 2.3062+00 | 6.8320+00 | 2.7864+00 |
| 7.00-01                                                                       | 1.4245+00 | 4.8778+00 | 1.5522+00 | 5.6350+00 | 1.7132+00 | 6.4110+00 | 1.9543+00 | 7.1510+00 | 2.2929+00 |
| 8.00-01                                                                       | 1.3206+00 | 5.0511+00 | 1.4664+00 | 5.0890+00 | 1.5667+00 | 6.5960+00 | 1.7360+00 | 7.3760+00 | 8.0850+00 |
| 9.00-01                                                                       | 1.2165+00 | 5.2085+00 | 1.3521+00 | 5.9680+00 | 1.4623+00 | 6.7550+00 | 1.5853+00 | 7.5200+00 | 1.7540+00 |
| 1.00-01                                                                       | 1.1121+00 | 5.3485+00 | 1.2620+00 | 6.1130+00 | 1.3763+00 | 6.9010+00 | 1.4810+00 | 7.7030+00 | 1.6073+00 |
| 1.25+01                                                                       | 8.6482-01 | 5.6153+00 | 1.0456+00 | 6.4157+00 | 1.1820+00 | 7.2159+00 | 1.2872+00 | 8.0243+00 | 1.3789+00 |
| 1.50+01                                                                       | 6.5662-01 | 5.7806+00 | 8.3780-01 | 6.6300+00 | 9.9610-01 | 7.4620+00 | 1.1192+00 | 8.2880+00 | 1.2174+00 |
| 2.00+01                                                                       | 3.7202-01 | 5.9302+00 | 5.2300-01 | 6.8599+00 | 6.7200-01 | 7.7642+00 | 8.0803-01 | 8.6479+00 | 9.2660-01 |
| 2.50+01                                                                       | 2.1465-01 | 5.9770+00 | 3.2340-01 | 6.9470+00 | 4.4170-01 | 7.8999+00 | 5.6210-01 | 8.8345+00 | 9.7524+00 |
| 3.00+01                                                                       | 1.2832-01 | 5.9917+00 | 2.2750-01 | 6.9790+00 | 3.1840-01 | 7.9570+00 | 4.1540-01 | 8.9230+00 | 5.1360-01 |
| 3.50+01                                                                       | 8.0452-02 | 5.9968+00 | 1.3170-01 | 6.9913+00 | 1.9510-01 | 7.9807+00 | 2.6870-01 | 8.9631+00 | 3.4910-01 |
| 4.00+01                                                                       | 5.2230-02 | 5.9986+00 | 1.0200-01 | 6.9960+00 | 1.5240-01 | 7.9910+00 | 2.1193-01 | 9.0000+00 | 4.9670-00 |
| 5.00+01                                                                       | 2.1330-02 | 5.9997+00 | 4.2500-02 | 6.9991+00 | 6.6900-02 | 7.9977+00 | 9.8200-02 | 8.9951+00 | 1.3630-01 |
| 6.00+01                                                                       | 1.2650-02 | 5.9999+00 | 2.2500-02 | 6.9998+00 | 3.6600-02 | 7.9993+00 | 5.4760-02 | 8.9885+00 | 7.9000-02 |
| 7.00+01                                                                       | 7.1471-03 | 6.0000+00 | 1.3100-02 | 6.9999+00 | 2.1100-02 | 7.9998+00 | 3.2500-02 | 8.9995+00 | 4.6900-02 |
| 8.00+01                                                                       | 4.3194-03 | 6.0001+00 | 1.0100-02 | 7.0000+00 | 1.5800-02 | 8.0000+00 | 2.4700-02 | 9.0000+00 | 3.5800-02 |
| 1.00+01                                                                       | 1.3164-03 | 6.0000+00 | 4.0000-03 | 7.0000+00 | 5.2000-03 | 8.0000+00 | 9.1000-03 | 9.0000+00 | 1.0000+01 |
| 1.50+01                                                                       | 3.7767-04 | 6.0000+00 | 7.6112-04 | 7.0000+00 | 1.2872-03 | 8.0000+00 | 2.0409-03 | 9.0000+00 | 3.0746-03 |
| 2.00+01                                                                       | 1.1571-04 | 6.0000+00 | 2.4622-04 | 7.0000+00 | 4.1908-04 | 8.0000+00 | 6.6893-04 | 9.0000+00 | 1.0151-03 |
| 5.00+01                                                                       | 3.2386-06 | 6.0000+00 | 6.6244-06 | 7.0000+00 | 1.1387-05 | 8.0000+00 | 1.8379-05 | 9.0000+00 | 2.8225-05 |
| 8.00+01                                                                       | 5.0734-07 | 6.0000+00 | 1.0425-06 | 7.0000+00 | 1.8006-06 | 8.0000+00 | 2.9203-06 | 9.0000+00 | 4.5067-06 |
| 1.00+02                                                                       | 2.1123-07 | 6.0000+00 | 4.353-07  | 7.0000+00 | 7.52-07   | 8.0000+00 | 1.2556-06 | 9.0000+00 | 1.0000+01 |
| 1.00+03                                                                       | 3.5964-11 | 6.0000+00 | 7.8857-11 | 7.0000+00 | 1.4474-10 | 8.0000+00 | 2.4844-05 | 9.0000+00 | 4.0445-10 |
| 1.00+05                                                                       | 1.6609-20 | 6.0000+00 | 3.964-20  | 7.0000+00 | 7.8204-20 | 8.0000+00 | 1.4260-19 | 9.0000+00 | 2.4468-19 |
| 1.00+09                                                                       | 1.6810-29 | 6.0000+00 | 4.0375-29 | 7.0000+00 | 7.9997-29 | 8.0000+00 | 1.4680-28 | 9.0000+00 | 2.5368-28 |

TABLE I--CONT. ATOMIC FORM FACTOR,  $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION,  $S(X, Z)$ 

| $X$     | $\sin(\theta/2)$ | 11 NA     | 12 MG     | 13 AL     | 14 SI     | 15 P      |
|---------|------------------|-----------|-----------|-----------|-----------|-----------|
|         | /LAMBDA          | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ |
| 0.00    | 1.1000+01        | 0.0000    | 1.2000+01 | 0.0000    | 1.3000+01 | 0.0000    |
| 5.00-03 | 1.0989+01        | 9.0000-03 | 1.1991+01 | 1.0000-02 | 1.2952+01 | 1.0000-02 |
| 1.00-02 | 1.0975+01        | 3.6000-02 | 1.1975+01 | 4.0000-02 | 1.2974+01 | 3.9000-02 |
| 1.50-02 | 1.0956+01        | 7.9300-02 | 1.1951+01 | 8.9700-02 | 1.2944+01 | 8.7000-02 |
| 2.00-02 | 1.0922+01        | 1.3780-01 | 1.1914+01 | 1.5720-01 | 1.2903+01 | 1.5300-01 |
| 2.50-02 | 1.0880+01        | 2.0920-01 | 1.1867+01 | 2.4110-01 | 1.2849+01 | 2.3530-01 |
| 3.00-02 | 1.0829+01        | 2.9120-01 | 1.1811+01 | 3.3930-01 | 1.2755+01 | 3.3550-01 |
| 4.00-02 | 1.0709+01        | 4.7640-01 | 1.1673+01 | 5.7020-01 | 1.2628+01 | 5.6420-01 |
| 5.00-02 | 1.0573+01        | 6.7400-01 | 1.1505+01 | 8.3100-01 | 1.2433+01 | 8.3200-01 |
| 7.00-02 | 1.0248+01        | 1.0490+00 | 1.1114+01 | 1.3721+00 | 1.1984+01 | 1.4192+00 |
| 9.00-02 | 9.9188+00        | 1.3642+00 | 1.0685+01 | 1.8578+00 | 1.1481+01 | 1.9967+00 |
| 1.00-01 | 9.7560+00        | 1.5030+00 | 1.0454+01 | 2.0660+00 | 1.1222+01 | 2.2640+00 |
| 1.25-01 | 9.3796+00        | 1.8282+00 | 9.9571+00 | 2.4913+00 | 1.0610+01 | 2.8508+00 |
| 1.50-01 | 9.0209+00        | 2.1600+00 | 9.4723+00 | 2.8290+00 | 1.0055+01 | 3.3240+00 |
| 1.75-01 | 8.6804+00        | 2.5159+00 | 9.0948+00 | 3.1354+00 | 9.5711+00 | 3.7123+00 |
| 2.00-01 | 8.3376+00        | 2.8910+00 | 8.7133+00 | 3.4440+00 | 9.1552+00 | 4.0470+00 |
| 2.50-01 | 7.6159+00        | 3.6672+00 | 8.0746+00 | 4.0957+00 | 8.4660+00 | 4.6536+00 |
| 3.00-01 | 6.8774+00        | 4.4310+00 | 7.4307+00 | 4.7710+00 | 7.8674+00 | 5.2640+00 |
| 4.00-01 | 5.4647+00        | 5.8040+00 | 6.1879+00 | 6.0640+00 | 6.7611+00 | 6.4330+00 |
| 5.00-01 | 4.2890+00        | 6.9030+00 | 5.0315+00 | 7.1810+00 | 5.6866+00 | 7.5230+00 |
| 6.00-01 | 3.3942+00        | 7.7240+00 | 4.0519+00 | 8.0860+00 | 4.7042+00 | 8.4590+00 |
| 7.00-01 | 2.7488+00        | 8.3130+00 | 3.2864+00 | 8.7840+00 | 3.8742+00 | 9.2250+00 |
| 8.00-01 | 2.2994+00        | 8.7290+00 | 2.7203+00 | 9.3040+00 | 3.2115+00 | 9.8300+00 |
| 9.00-01 | 1.9924+00        | 9.0280+00 | 2.3132+00 | 9.6890+00 | 2.7041+00 | 1.0226+01 |
| 1.00+00 | 1.7819+00        | 9.2520+00 | 2.0213+00 | 9.9750+00 | 2.3248+00 | 1.0652+01 |
| 1.25+00 | 1.4761+00        | 9.6465+00 | 1.5958+00 | 1.0449+01 | 1.7537+00 | 1.1233+01 |
| 1.50+00 | 1.3052+00        | 9.9390+00 | 1.3933+00 | 1.0766+01 | 1.4812+00 | 1.1592+01 |
| 2.00+00 | 1.0300+00        | 1.0376+01 | 1.1178+00 | 1.1229+01 | 1.1922+00 | 1.2083+01 |
| 2.50+00 | 7.8800-01        | 1.0654+01 | 8.8840-01 | 1.1543+01 | 9.7550-01 | 1.2422+01 |
| 3.00+00 | 6.1170-01        | 1.0813+01 | 7.0600-01 | 1.1738+01 | 7.9310-01 | 1.2652+01 |
| 3.50+00 | 4.3540-01        | 1.0946+01 | 5.2336-01 | 1.1852+01 | 6.1070-01 | 1.2794+01 |
| 4.00+00 | 3.5040-01        | 1.0946+01 | 4.2656-01 | 1.1916+01 | 5.0250-01 | 1.2879+01 |
| 5.00+00 | 1.8030-01        | 1.0983+01 | 2.3240-01 | 1.1972+01 | 2.8600-01 | 1.2957+01 |
| 6.00+00 | 1.0600-01        | 1.0994+01 | 1.3950-01 | 1.1990+01 | 1.7660-01 | 1.2994+01 |
| 7.00+00 | 6.5300-02        | 1.0998+01 | 8.7100-02 | 1.1996+01 | 1.1300-01 | 1.2993+01 |
| 8.00+00 | 4.9900-02        | 1.0995+01 | 6.7000-02 | 1.1998+01 | 8.7000-02 | 1.2997+01 |
| 1.00+01 | 1.9000-02        | 1.1000+01 | 2.6800-02 | 1.2000+01 | 3.4900-02 | 1.2999+01 |
| 1.50+01 | 4.4431-03        | 1.1000+01 | 6.2022-03 | 1.2000+01 | 8.4081-03 | 1.3000+01 |
| 2.00+01 | 1.4786-03        | 1.1000+01 | 2.0816-03 | 1.2000+01 | 2.8477-03 | 1.3000+01 |
| 5.00+01 | 4.1635-05        | 1.1000+01 | 5.9409-05 | 1.2000+01 | 8.2435-05 | 1.3000+01 |
| 8.00+01 | 6.6813-06        | 1.1000+01 | 9.5822-06 | 1.2000+01 | 1.3365-05 | 1.3000+01 |
| 1.00+02 | 2.8192-06        | 1.1000+01 | 4.0541-06 | 1.2000+01 | 5.6698-06 | 1.3000+01 |
| 1.00+03 | 6.3068-10        | 1.1000+01 | 9.4897-10 | 1.2000+01 | 1.3855-09 | 1.3000+01 |
| 1.00+06 | 3.9979-19        | 1.1000+01 | 6.2746-19 | 1.2000+01 | 9.5230-19 | 1.3000+01 |
| 1.00+09 | 4.1774-28        | 1.1000+01 | 6.6127-28 | 1.2000+01 | 1.0130-27 | 1.3000+01 |

TABLE I., CONT.  
ATOMIC FORM FACTOR,  $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION,  $S(X, Z)$ 

| $X$<br>$\sin(\theta/\lambda)/\lambda$ | 16 S      | 17 CL     | 18 AR     | 19 K      | 20 CA     |
|---------------------------------------|-----------|-----------|-----------|-----------|-----------|
| $F(X, Z)$                             | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ |
| 0.00                                  | 1.6000+01 | 0.0000    | 1.7000+01 | 0.0000    | 1.9000+01 |
| 5.00-03                               | 1.5994+01 | 7.0000-03 | 1.7994+01 | 6.0000-03 | 1.8983+01 |
| 1.00-02                               | 1.5978+01 | 2.9000+02 | 1.6979+01 | 2.6000+02 | 1.8961+01 |
| 1.50-02                               | 1.5952+01 | 6.4600+02 | 1.6954+01 | 5.9000+02 | 1.8916+01 |
| 2.00-02                               | 1.5914+01 | 1.1420+01 | 1.6919+01 | 1.0430+01 | 1.8853+01 |
| 2.50-02                               | 1.5866+01 | 1.7700+01 | 1.6874+01 | 1.6200+01 | 1.8774+01 |
| 3.00-02                               | 1.5808+01 | 2.5260+01 | 1.6819+01 | 2.3160+01 | 1.7829+01 |
| 4.00-02                               | 1.5664+01 | 4.3880+01 | 1.6682+01 | 4.0410+01 | 1.7699+01 |
| 5.00-02                               | 1.5483+01 | 6.6600+01 | 1.6510+01 | 6.1700+01 | 1.7535+01 |
| 7.00-02                               | 1.5027+01 | 1.2127+00 | 1.6070+01 | 1.1378+00 | 1.7114+01 |
| 9.00-02                               | 1.4474+01 | 1.8313+00 | 1.5528+01 | 1.7444+00 | 1.6445+00 |
| 1.00-01                               | 1.4172+01 | 2.1500+00 | 1.5229+01 | 2.0650+00 | 1.6295+01 |
| 1.25-01                               | 1.3378+01 | 2.9397+00 | 1.4425+01 | 2.8770+00 | 1.5494+01 |
| 1.50-01                               | 1.2574+01 | 3.6800+00 | 1.3587+01 | 3.6650+00 | 1.4639+01 |
| 1.75-01                               | 1.1805+01 | 4.3545+00 | 1.2762+01 | 4.4002+00 | 1.3776+01 |
| 2.00-01                               | 1.1099+01 | 4.9600+00 | 1.1980+01 | 5.0740+00 | 1.2937+01 |
| 2.50-01                               | 9.9162+00 | 5.9830+00 | 1.0621+01 | 6.2395+00 | 1.1428+01 |
| 3.00-01                               | 9.0285+00 | 6.7950+00 | 9.5646+00 | 7.1820+00 | 1.0204+01 |
| 4.00-01                               | 7.8477+00 | 8.0000+00 | 8.1680+00 | 8.5530+00 | 8.5424+00 |
| 5.00-01                               | 7.0114+00 | 8.9600+00 | 7.2976+00 | 9.5390+00 | 7.5635+00 |
| 6.00-01                               | 6.2418+00 | 9.8290+00 | 6.5848+00 | 1.0382+01 | 6.8649+00 |
| 7.00-01                               | 5.4892+00 | 1.0626+01 | 5.8982+00 | 1.1158+01 | 6.2366+00 |
| 8.00-01                               | 4.7754+00 | 1.1338+01 | 5.2273+00 | 1.1867+01 | 5.6196+00 |
| 9.00-01                               | 4.1262+00 | 1.1952+01 | 4.5915+00 | 1.2499+01 | 5.0165+00 |
| 1.00+00                               | 3.5583+00 | 1.2472+01 | 4.0097+00 | 1.3050+01 | 4.4333+00 |
| 1.25+00                               | 2.5200+00 | 1.3414+01 | 2.8628+00 | 1.4088+01 | 2.4175+00 |
| 1.50+00                               | 1.9280+00 | 1.3990+01 | 2.1551+00 | 1.5487+01 | 1.6034+00 |
| 2.00+00                               | 1.4044+00 | 1.4644+01 | 1.4941+00 | 1.5487+01 | 1.6324+01 |
| 2.50+00                               | 1.1769+00 | 1.5051+01 | 1.2340+00 | 1.5924+01 | 1.2929+00 |
| 3.00+00                               | 1.0101+00 | 1.5351+01 | 1.0711+00 | 1.6243+01 | 1.1298+00 |
| 3.50+00                               | 8.4330-01 | 1.5567+01 | 9.0820-01 | 1.6479+01 | 9.6680-01 |
| 4.00+00                               | 7.1810-01 | 1.5716+01 | 7.8160-01 | 1.6648+01 | 8.4090-01 |
| 5.00+00                               | 4.6780-01 | 1.5820+01 | 5.830-01  | 1.6843+01 | 5.8900-01 |
| 6.00+00                               | 3.0980-01 | 1.5948+01 | 3.6140+01 | 1.6930+01 | 4.1250+01 |
| 7.00+00                               | 2.0980-01 | 1.5977+01 | 2.4680-01 | 1.6968+01 | 2.8730-01 |
| 8.00+00                               | 1.6410-01 | 1.5989+01 | 1.9360-01 | 1.6985+01 | 2.2680-01 |
| 1.00+01                               | 7.2600-02 | 1.5997+01 | 8.7300-02 | 1.6996+01 | 1.0570-01 |
| 1.50+01                               | 1.8250-02 | 1.6000+01 | 2.2774-02 | 1.7000+01 | 2.7995-02 |
| 2.00+01                               | 6.3710-03 | 1.6000+01 | 8.3884-03 | 1.7000+01 | 9.9948-03 |
| 5.00+01                               | 1.9331-04 | 1.6000+01 | 2.4812-04 | 1.7000+01 | 3.1404-04 |
| 8.00+01                               | 3.1852-05 | 1.6000+01 | 4.1111-05 | 1.7000+01 | 5.2330-05 |
| 1.00+02                               | 1.3632-05 | 1.6000+01 | 2.7629-05 | 1.7000+01 | 2.6025-05 |
| 1.50+01                               | 1.8250-02 | 1.6000+01 | 5.0284-09 | 1.7000+01 | 6.4477-09 |
| 1.00+03                               | 3.7466-09 | 1.6000+01 | 5.0284-09 | 1.7000+01 | 8.0000+01 |
| 1.00+06                               | 2.8515-18 | 1.6000+01 | 3.9472-18 | 1.7000+01 | 5.3767-18 |
| 1.00+09                               | 3.1327-27 | 1.6000+01 | 4.3899-27 | 1.7000+01 | 6.0580-27 |

TABLE I. CONT. ATOMIC FORM FACTOR,  $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION,  $S(X, Z)$ 

| X.                      | 21 SC     | 22 TI     | 23 V      | 24 CR     | 25 VN     |
|-------------------------|-----------|-----------|-----------|-----------|-----------|
| SIN(THETA/2)<br>/LAMBDA | F(X,Z)    | S(X,Z)    | F(X,Z)    | S(X,Z)    | F(X,Z)    |
| 0.00                    | 2.1000+01 | 0.0000    | 2.2000+01 | 0.0000    | 2.4000+01 |
| 5.00-03                 | 2.0987+01 | 1.7000-02 | 2.1986+01 | 1.6000-02 | 2.3985+01 |
| 1.00-02                 | 2.0958+01 | 6.7000-02 | 2.1959+01 | 6.3000-02 | 2.3964+01 |
| 1.50-02                 | 2.0913+01 | 1.4880-01 | 2.1918+01 | 1.3910-01 | 2.3922+01 |
| 2.00-02                 | 2.0846+01 | 2.5970-01 | 2.1855+01 | 2.4320-01 | 2.2862+01 |
| 2.50-02                 | 2.0762+01 | 3.9630-01 | 2.1775+01 | 3.7200-01 | 2.2786+01 |
| 3.00-02                 | 2.0662+01 | 5.5470-01 | 2.1680+01 | 5.2230-01 | 2.2695+01 |
| 4.00-02                 | 2.0418+01 | 9.2000-01 | 2.1464+01 | 8.7210-01 | 2.2473+01 |
| 5.00-02                 | 2.0130+01 | 1.3210+00 | 2.1117+01 | 1.2630+00 | 2.2208+01 |
| 7.00-02                 | 1.9446+01 | 2.1220+00 | 2.0501+01 | 2.0626+00 | 2.1557+01 |
| 9.00-02                 | 1.8712+01 | 2.8255+00 | 1.9769+01 | 2.7890+00 | 2.0833+01 |
| 1.00-01                 | 1.8341+01 | 3.1360+00 | 1.9395+01 | 3.1160+00 | 2.0460+01 |
| 1.25-01                 | 1.7458+01 | 3.8342+00 | 1.8484+01 | 3.4565+00 | 1.9535+01 |
| 1.50-01                 | 1.6632+01 | 4.4920+00 | 1.7618+01 | 4.5230+00 | 1.8639+01 |
| 1.75-01                 | 1.5859+01 | 5.1478+00 | 1.6806+01 | 5.1927+00 | 1.7798+01 |
| 2.00-01                 | 1.5125+01 | 5.8010+00 | 1.6035+01 | 5.8600+00 | 1.6993+01 |
| 2.50-01                 | 1.3716+01 | 7.0456+00 | 1.4555+01 | 7.1366+00 | 1.5447+01 |
| 3.00-01                 | 1.2402+01 | 8.1690+00 | 1.3174+01 | 8.3120+00 | 1.4001+01 |
| 4.00-01                 | 1.0206+01 | 1.0071+01 | 1.0829+01 | 1.0304+01 | 1.1503+01 |
| 5.00-01                 | 8.6621+00 | 1.1561+01 | 9.1224+00 | 1.1901+01 | 9.6340+00 |
| 6.00-01                 | 7.6596+00 | 1.2684+01 | 7.9786+00 | 1.3140+01 | 8.3415+00 |
| 7.00-01                 | 6.9801+00 | 1.3545+01 | 7.2173+00 | 1.4093+01 | 7.4767+00 |
| 8.00-01                 | 6.4429+00 | 1.4256+01 | 6.6571+00 | 1.4856+01 | 6.8683+00 |
| 9.00-01                 | 5.9519+00 | 1.4885+01 | 6.1785+00 | 1.5509+01 | 6.3834+00 |
| 1.00+00                 | 5.4734+00 | 1.5460+01 | 5.7254+00 | 1.6095+01 | 5.9460+00 |
| 1.25+00                 | 4.3195+00 | 1.6694+01 | 4.6267+00 | 1.7353+01 | 4.9020+00 |
| 1.50+00                 | 3.3155+00 | 1.7630+01 | 3.6237+00 | 1.8334+01 | 3.9191+00 |
| 2.00+00                 | 2.0692+00 | 1.8782+01 | 2.2651+00 | 1.9585+01 | 2.4755+00 |
| 2.50+00                 | 1.5185+00 | 1.9397+01 | 1.6190+00 | 2.0259+01 | 1.7340+00 |
| 3.00+00                 | 1.3165+00 | 1.9794+01 | 1.3893+00 | 2.0682+01 | 1.4691+00 |
| 3.50+00                 | 1.1145+00 | 2.0093+01 | 1.1596+00 | 2.0294+01 | 1.2042+00 |
| 4.00+00                 | 9.9580-01 | 2.0326+01 | 1.0624+00 | 2.1239+01 | 1.0879+00 |
| 5.00+00                 | 7.5850-01 | 2.0646+01 | 8.0800-01 | 2.1580+01 | 8.5540+01 |
| 6.00+00                 | 5.6670-01 | 2.0813+01 | 6.1520-01 | 2.1774+01 | 6.5180-01 |
| 7.00+00                 | 4.1560-01 | 2.0930+01 | 4.6030-01 | 2.1879+01 | 5.0510-01 |
| 8.00+00                 | 3.3380-01 | 2.0949+01 | 3.7120-01 | 2.1935+01 | 4.0990-01 |
| 1.00+01                 | 1.7030-01 | 2.0985+01 | 1.9310-01 | 2.1980+01 | 2.1950-01 |
| 1.50+01                 | 4.8192-02 | 2.0999+01 | 5.9526-02 | 2.1998+01 | 6.5692-02 |
| 2.00+01                 | 1.7845-02 | 2.1000+01 | 2.1201-02 | 2.2000+01 | 2.4962-02 |
| 5.00+01                 | 5.9379-04 | 2.1000+01 | 7.1996-04 | 2.2000+01 | 8.6565-04 |

TABLE I., CONT.  
ATOMIC FORM FACTOR,  $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION,  $S(X, Z)$ 

| $X$<br>SIN(THETA/2)<br>/LAMRDA | 26 FE<br>$F(X, Z)$ | 26 CO<br>$S(X, Z)$ | 27 FE<br>$F(X, Z)$ | 27 CO<br>$S(X, Z)$ | 28 NI<br>$F(X, Z)$ | 28 CU<br>$S(X, Z)$ | 29 NI<br>$F(X, Z)$ | 29 CU<br>$S(X, Z)$ | 30 ZN<br>$F(X, Z)$ | 30 ZN<br>$S(X, Z)$ |
|--------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| 0.00                           | 2.6000+01          | 0.0000             | 2.7000+01          | 0.0000             | 2.8000+01          | 0.0000             | 2.9000+01          | 0.0000             | 3.0000+01          | 0.0000             |
| 5.00-03                        | 2.5983+01          | 1.2000-02          | 2.6983+01          | 1.2000-02          | 2.7944+01          | 1.1000-02          | 2.8984+01          | 9.0000-03          | 2.9984+01          | 1.0000-02          |
| 1.00-02                        | 2.5961+01          | 5.0000-02          | 2.6962+01          | 4.7000-02          | 2.7933+01          | 4.5000-02          | 2.8965+01          | 3.6000-02          | 2.9965+01          | 4.1000-02          |
| 1.50-02                        | 2.5932+01          | 1.1000-01          | 2.6935+01          | 1.0560-01          | 2.7938+01          | 1.0090-01          | 2.8947+01          | 8.1300-02          | 2.9942+01          | 9.2600-02          |
| 2.00-02                        | 2.5880+01          | 1.9470-01          | 2.6885+01          | 1.8560-01          | 2.7800+01          | 1.7740-01          | 2.8906+01          | 1.4300-01          | 2.9898+01          | 1.6310-01          |
| 2.50-02                        | 2.5814+01          | 2.9950-01          | 2.6822+01          | 2.8580-01          | 2.7829+01          | 2.7340-01          | 2.8854+01          | 2.2050-01          | 2.9841+01          | 2.5170-01          |
| 3.00-02                        | 2.5735+01          | 4.2330-01          | 2.6745+01          | 4.0440-01          | 2.7755+01          | 3.8720-01          | 2.8791+01          | 3.1250-01          | 2.9773+01          | 3.5710-01          |
| 4.00-02                        | 2.5538+01          | 7.1830-01          | 2.6556+01          | 6.8810-01          | 2.7513+01          | 6.6050-01          | 2.8635+01          | 5.3440-01          | 2.9603+01          | 6.1150-01          |
| 5.00-02                        | 2.5302+01          | 1.0600+00          | 2.6329+01          | 1.0190+00          | 2.7353+01          | 9.8100-01          | 2.8448+01          | 7.9600-01          | 2.9397+01          | 9.1200-01          |
| 7.00-02                        | 2.4707+01          | 1.8065+00          | 2.5751+01          | 1.7497+00          | 2.6733+01          | 1.6955+00          | 2.7962+01          | 1.3930+00          | 2.8868+01          | 1.5956+00          |
| 9.00-02                        | 2.4023+01          | 2.5442+00          | 2.5082+01          | 2.4834+00          | 2.6139+01          | 2.4230+00          | 2.7387+01          | 2.0288+00          | 2.8244+01          | 2.3073+00          |
| 1.00-01                        | 2.3666+01          | 2.8910+00          | 2.4732+01          | 2.8320+00          | 2.5795+01          | 2.7720+00          | 2.7081+01          | 2.3880+00          | 2.7914+01          | 2.6540+00          |
| 1.25-01                        | 2.2736+01          | 3.6841+00          | 2.3808+01          | 3.6358+00          | 2.4880+01          | 3.5820+00          | 2.6243+01          | 3.1392+00          | 2.7019+01          | 3.4700+00          |
| 1.50-01                        | 2.1803+01          | 4.4020+00          | 2.2874+01          | 4.3690+00          | 2.3966+01          | 4.3220+00          | 2.5356+01          | 3.9190+00          | 2.6095+01          | 4.2200+00          |
| 1.75-01                        | 2.0911+01          | 5.0963+00          | 2.1972+01          | 5.0697+00          | 2.3039+01          | 5.0287+00          | 2.4461+01          | 4.6918+00          | 2.5184+01          | 4.9322+00          |
| 2.00-01                        | 2.0002+01          | 5.7810+00          | 2.1079+01          | 5.7640+00          | 2.2135+01          | 5.7260+00          | 2.3538+01          | 5.4550+00          | 2.4266+01          | 5.6310+00          |
| 2.50-01                        | 1.8340+01          | 7.1381+00          | 1.9352+01          | 7.1428+00          | 2.0300+01          | 7.1149+00          | 2.1683+01          | 5.9310+00          | 2.2471+01          | 7.0236+00          |
| 3.00-01                        | 1.6729+01          | 8.4320+00          | 1.7698+01          | 8.4690+00          | 1.8699+01          | 8.4610+00          | 1.9869+01          | 8.3100+00          | 2.0720+01          | 8.3880+00          |
| 4.00-01                        | 1.3809+01          | 1.0735+01          | 1.4659+01          | 1.0844+01          | 1.5552+01          | 1.0894+01          | 1.6481+01          | 1.0778+01          | 1.7392+01          | 1.0901+01          |
| 5.00-01                        | 1.1468+01          | 1.2687+01          | 1.2172+01          | 1.2867+01          | 1.2980+01          | 1.2980+01          | 1.3667+01          | 1.2942+01          | 1.4519+01          | 1.3094+01          |
| 6.00-01                        | 9.7165+00          | 1.4343+01          | 1.0270+01          | 1.4596+01          | 1.0888+01          | 1.4780+01          | 1.1464+01          | 1.4847+01          | 1.2189+01          | 1.5020+01          |
| 7.00-01                        | 3.4697+01          | 1.5716+01          | 8.8843+00          | 1.6050+01          | 9.3455+00          | 1.6317+01          | 9.8091+00          | 1.6941+01          | 1.7079+01          | 1.7023+00          |
| 8.00-01                        | 7.6042+00          | 1.6831+01          | 7.9086+00          | 1.7249+01          | 8.2459+00          | 1.7602+01          | 8.6078+00          | 1.7885+01          | 1.0469+01          | 1.8163+01          |
| 9.00-01                        | 6.9889+00          | 1.7737+01          | 7.2189+00          | 1.8229+01          | 7.4714+00          | 1.8664+01          | 7.4792+00          | 1.9043+01          | 8.0754+00          | 1.9395+01          |
| 1.00+00                        | 6.5150+00          | 1.8488+01          | 6.7043+00          | 1.9035+01          | 6.9006+00          | 1.9543+01          | 7.1235+00          | 2.0002+01          | 7.3684+00          | 2.0427+01          |
| 1.25+00                        | 5.5586+00          | 1.9959+01          | 5.7358+00          | 2.0596+01          | 5.9013+00          | 2.1210+01          | 6.0619+00          | 2.1802+01          | 6.2194+00          | 2.2365+01          |
| 1.50+00                        | 4.6866+00          | 2.1097+01          | 4.8990+00          | 2.1777+01          | 5.0914+00          | 2.2445+01          | 5.2648+00          | 2.3107+01          | 5.4277+00          | 2.3745+01          |
| 2.00+00                        | 3.1488+00          | 2.2704+01          | 3.3726+00          | 2.3462+01          | 3.5901+00          | 2.4211+01          | 3.7933+00          | 2.4937+01          | 3.9972+00          | 2.5683+01          |
| 2.50+00                        | 2.1594+00          | 2.3650+01          | 2.3226+00          | 2.448C+01          | 2.4929+00          | 2.5302+01          | 2.6641+00          | 2.6119+01          | 2.8448+00          | 2.6919+01          |
| 3.00+00                        | 1.7578+00          | 2.4216+01          | 1.8698+00          | 2.5092+01          | 1.9832+00          | 2.5962+01          | 2.1103+00          | 2.6833+01          | 2.2412+00          | 2.7687+01          |
| 3.50+00                        | 1.3562+00          | 2.4598+01          | 1.4170+00          | 2.5497+01          | 1.4835+00          | 2.6394+01          | 1.5565+00          | 2.7291+01          | 1.6376+00          | 2.8181+01          |
| 4.00+00                        | 1.2304+00          | 2.4887+01          | 1.2831+00          | 2.5799+01          | 1.3351+00          | 2.6710+01          | 1.3989+00          | 2.7622+01          | 1.4639+00          | 2.8530+01          |
| 5.00+00                        | 9.7890-01          | 2.5310-01          | 1.0154+00          | 2.6238+01          | 1.0520+00          | 2.7166+01          | 1.0834+00          | 2.8093+01          | 1.1665+00          | 2.9021+01          |
| 6.00+00                        | 7.9530-01          | 2.5588+01          | 8.3530-01          | 2.6531+01          | 8.7200-01          | 2.7475+01          | 9.0700-01          | 2.8418+01          | 9.4080-01          | 2.9358+01          |
| 7.00+00                        | 6.3170-01          | 2.5755-01          | 6.7310-01          | 2.6717+01          | 7.1380-01          | 2.7676+01          | 7.4980-01          | 2.8634+01          | 7.8370-01          | 2.9588+01          |
| 8.00+00                        | 5.2270-01          | 2.5856+01          | 5.5930-01          | 2.6830+01          | 5.9720-01          | 2.7802+01          | 6.3080-01          | 2.8772+01          | 6.6390-01          | 2.9739+01          |
| 1.00+01                        | 3.0480-01          | 2.5949+01          | 3.3170-01          | 2.6938+01          | 3.640-01           | 2.7926+01          | 3.9290-01          | 2.8912+01          | 4.2420-01          | 2.9896+01          |
| 1.50+01                        | 9.8241-02          | 2.5995+01          | 1.1077-01          | 2.6994+01          | 1.241-01           | 2.7992+01          | 1.3827-01          | 2.8900+01          | 1.5320-01          | 2.9988+01          |
| 2.00+01                        | 3.8874-02          | 2.5995+01          | 4.4441-02          | 2.6994+01          | 5.046-02           | 2.7999+01          | 5.7051-02          | 2.8999+01          | 6.4113-02          | 2.9998+01          |
| 5.00+01                        | 1.4403-03          | 2.6000+01          | 1.6851-03          | 2.7000+01          | 1.9655-03          | 2.8000+01          | 2.2689-03          | 2.9000+01          | 2.6131-03          | 3.0000+01          |
| 8.00+01                        | 2.5212-04          | 2.6000+01          | 2.9693-04          | 2.7000+01          | 3.4779-04          | 2.8000+01          | 4.0527-04          | 2.9000+01          | 4.7001-04          | 3.0000+01          |
| 1.00+02                        | 1.1087-04          | 2.6000+01          | 1.3096-04          | 2.7000+01          | 1.534-04           | 2.8000+01          | 1.7979-04          | 2.9000+01          | 2.0913-04          | 3.0000+01          |
| 1.00+03                        | 4.2027-08          | 2.6000+01          | 5.1071-08          | 2.7000+01          | 6.1695-08          | 2.8000+01          | 7.4126-08          | 2.9000+01          | 8.8610-08          | 3.0000+01          |
| 1.00+06                        | 4.2589-17          | 2.6000+01          | 5.3236-17          | 2.7000+01          | 6.6111-17          | 2.8000+01          | 8.1828-17          | 2.9000+01          | 1.0072-16          | 3.0000+01          |
| 1.00+09                        | 5.4722-26          | 2.6000+01          | 6.9775-26          | 2.7000+01          | 8.8540-26          | 2.8000+01          | 1.1186-25          | 2.9000+01          | 1.4078-25          | 3.0000+01          |

TABLE I. CONT.

| $X^*$              | ATOMIC FORM FACTOR, $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION, $S(X, Z)$ |           |           |           |           |           | 35 BR     |           |           |           |
|--------------------|-------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                    | $\sin(\theta/\lambda)/2$                                                      | 31 GA     | 32 GE     | 33 AS     | 34 SE     | 35 BR     | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ |
| $\lambda/\text{Å}$ | $F(X, Z)$                                                                     | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ |
| 0.00               | 3.1000*01                                                                     | 0.0000    | 3.2000*01 | 0.0000    | 3.3000*01 | 0.0000    | 3.4000*01 | 0.0000    | 3.5000*01 | 0.0000    |
| 5.00-03            | 3.0979*01                                                                     | 1.1000-02 | 3.1983*01 | 1.1000-02 | 3.2986*01 | 1.0000-02 | 3.3988*01 | 0.9999*01 | 3.4996*01 | 9.0000-03 |
| 1.00-02            | 3.0957*01                                                                     | 4.4000*02 | 3.1960*01 | 4.4000*02 | 3.2963*01 | 4.0000*02 | 3.3966*01 | 3.8000*02 | 3.4967*01 | 3.6000-02 |
| 1.50-02            | 3.0932*01                                                                     | 9.8200*02 | 3.1931*01 | 9.4900*02 | 3.2931*01 | 9.0300*02 | 3.3932*01 | 8.9900*02 | 3.4933*01 | 8.1700-02 |
| 2.00-02            | 3.0883*01                                                                     | 1.7270*01 | 3.1877*01 | 1.6710*01 | 3.2877*01 | 1.5930*01 | 3.3879*01 | 1.5170*01 | 3.4881*01 | 1.4450*01 |
| 2.50-02            | 3.0815*01                                                                     | 2.6630*01 | 3.1809*01 | 2.5820*01 | 3.2809*01 | 2.4630*01 | 3.3811*01 | 2.3500*01 | 3.4815*01 | 2.2410*01 |
| 3.00-02            | 3.0735*01                                                                     | 3.7730*01 | 3.1727*01 | 3.6670*01 | 3.2726*01 | 3.5040*01 | 3.3730*01 | 3.3500*01 | 3.4735*01 | 3.2000*01 |
| 4.00-02            | 3.0535*01                                                                     | 6.4440*01 | 3.1522*01 | 6.3000*01 | 3.2521*01 | 6.0410*01 | 3.3525*01 | 5.8060*01 | 3.4534*01 | 5.5660*01 |
| 5.00-02            | 3.0306*01                                                                     | 9.5900*01 | 3.1275*01 | 9.4400*01 | 3.2268*01 | 9.0900*01 | 3.3272*01 | 8.7900*01 | 3.4283*01 | 8.4600*01 |
| 7.00-02            | 2.9706*01                                                                     | 1.6724*00 | 3.0645*01 | 1.6691*00 | 3.1625*01 | 1.6212*00 | 3.2628*01 | 1.5904*00 | 3.3642*01 | 1.5477*00 |
| 9.00-02            | 2.9016*01                                                                     | 2.4218*00 | 2.9907*01 | 2.4486*00 | 3.0859*01 | 2.3995*00 | 3.1847*01 | 2.3883*00 | 3.2856*01 | 2.3509*00 |
| 1.00-01            | 2.8657*01                                                                     | 2.7910*00 | 2.9519*01 | 2.8390*00 | 3.0450*01 | 2.7930*00 | 3.1424*01 | 2.7900*00 | 3.2450*01 | 2.7710*00 |
| 1.25-01            | 2.7703*01                                                                     | 3.6726*00 | 2.8914*01 | 3.7810*00 | 2.9361*01 | 3.7577*00 | 3.0290*01 | 3.8175*00 | 3.1260*01 | 3.8262*00 |
| 1.50-01            | 2.6740*01                                                                     | 4.4850*00 | 2.7660*01 | 4.6590*00 | 2.8260*01 | 4.6750*00 | 2.9127*01 | 4.7940*00 | 3.0047*01 | 4.8510*00 |
| 1.75-01            | 2.5819*01                                                                     | 5.2326*00 | 2.6478*01 | 5.4723*00 | 2.7201*01 | 5.5432*00 | 2.7993*01 | 5.7172*00 | 2.8846*01 | 5.8261*00 |
| 2.00-01            | 2.4907*01                                                                     | 5.9390*00 | 2.5527*01 | 6.2290*00 | 2.6187*01 | 6.3650*00 | 2.6908*01 | 6.5890*00 | 2.7690*01 | 6.7480*00 |
| 2.50-01            | 2.3157*01                                                                     | 7.2874*00 | 2.3761*01 | 7.6188*00 | 2.4346*01 | 7.8777*00 | 2.4953*01 | 8.1861*00 | 2.5601*01 | 8.4425*00 |
| 3.00-01            | 2.1477*01                                                                     | 8.5990*00 | 2.2184*01 | 8.9120*00 | 2.2695*01 | 9.2360*00 | 2.3249*01 | 9.6010*00 | 2.3808*01 | 9.9400*00 |
| 4.00-01            | 1.8246*01                                                                     | 1.1082*01 | 1.9014*01 | 1.1338*01 | 1.9691*01 | 1.1658*01 | 2.0289*01 | 1.2033*01 | 2.0829*01 | 1.2440*01 |
| 5.00-01            | 1.5374*01                                                                     | 1.3290*01 | 1.6192*01 | 1.3536*01 | 1.6951*01 | 1.3828*01 | 1.7642*01 | 1.4168*01 | 1.8262*01 | 1.4552*01 |
| 6.00-01            | 1.2951*01                                                                     | 1.5233*01 | 1.3123*01 | 1.5486*01 | 1.4485*01 | 1.5775*01 | 1.5216*01 | 1.6098*01 | 1.5902*01 | 1.6456*01 |
| 7.00-01            | 1.1011*01                                                                     | 1.6947*01 | 1.1679*01 | 1.7215*01 | 1.2374*01 | 1.7511*01 | 1.3075*01 | 1.7835*01 | 1.8185*01 | 1.8750*01 |
| 8.00-01            | 9.5351*00                                                                     | 1.8444*01 | 1.8744*01 | 1.9077*01 | 1.8741*01 | 1.9056*01 | 1.9063*01 | 1.9281*01 | 1.9198*01 | 1.9747*01 |
| 9.00-01            | 8.4473*00                                                                     | 1.9754*01 | 1.8673*00 | 2.0074*01 | 9.3346*01 | 2.0420*01 | 9.8422*01 | 2.0778*01 | 1.0391*01 | 2.1149*01 |
| 1.00+00            | 7.6499*00                                                                     | 2.0831*01 | 7.3681*01 | 2.1224*01 | 8.3277*00 | 2.1612*01 | 8.7306*00 | 2.2003*01 | 9.1754*00 | 2.2399*01 |
| 1.25+00            | 6.3821*00                                                                     | 2.2907*01 | 6.5559*00 | 2.3430*01 | 6.7470*00 | 2.3938*01 | 6.9608*00 | 2.4434*01 | 7.2023*00 | 2.4920*01 |
| 1.50+00            | 5.5837*00                                                                     | 2.4370*01 | 5.7274*00 | 2.4983*01 | 5.8649*00 | 2.5583*01 | 6.0025*00 | 2.6171*01 | 6.1467*00 | 2.6747*01 |
| 2.00+00            | 4.1907*00                                                                     | 2.6400*01 | 4.3732*00 | 2.7109*01 | 4.5438*00 | 2.7810*01 | 4.7024*00 | 2.8504*01 | 4.8492*00 | 2.9190*01 |
| 2.50+00            | 3.0276*00                                                                     | 2.7710*01 | 3.2108*00 | 2.8492*01 | 3.3924*00 | 2.9264*01 | 3.5702*00 | 3.0288*01 | 3.4426*00 | 3.0785*01 |
| 3.00+00            | 2.3777*00                                                                     | 2.8536*01 | 2.5178*00 | 2.9377*01 | 2.6608*00 | 3.0209*01 | 2.8054*00 | 3.1034*01 | 2.9508*00 | 3.1850*01 |
| 3.50+00            | 1.7272*00                                                                     | 2.9067*01 | 1.8247*00 | 2.9947*01 | 1.9292*00 | 3.0822*01 | 2.0470*00 | 3.1691*01 | 2.1591*00 | 2.2554*01 |
| 4.00+00            | 1.5348*00                                                                     | 2.9436*01 | 1.6112*00 | 3.0340*01 | 1.6926*00 | 3.1241*01 | 2.0025*00 | 2.6171*01 | 2.6747*00 | 2.7190*01 |
| 5.00+00            | 1.1500*00                                                                     | 2.9943*01 | 1.1843*00 | 3.1982*01 | 1.2195*00 | 3.1796*01 | 1.2564*00 | 2.7190*01 | 2.2961*00 | 3.3641*01 |
| 6.00+00            | 9.7330*01                                                                     | 3.0297*01 | 1.0039*00 | 3.1236*01 | 1.0330*00 | 3.2173*01 | 1.0618*00 | 3.3109*01 | 1.0902*00 | 3.4045*01 |
| 7.00+00            | 8.1820*01                                                                     | 3.0541*01 | 8.5260*01 | 3.1492*01 | 8.8600*01 | 3.2442*01 | 9.1610*01 | 3.3390*01 | 9.4180*01 | 3.4337*01 |
| 8.00+00            | 6.9690*01                                                                     | 3.0705*01 | 7.3070*01 | 3.1668*01 | 7.6290*01 | 3.2629*01 | 7.9300*01 | 3.3569*01 | 8.2020*01 | 3.4547*01 |
| 1.00+01            | 4.5420*01                                                                     | 3.0819*01 | 4.3860*01 | 3.1860*01 | 5.1660*01 | 3.2840*01 | 5.4680*01 | 3.3818*01 | 4.1884*01 | 3.5000*01 |
| 1.50+01            | 1.6889*01                                                                     | 3.0985*01 | 1.8530*01 | 3.1982*01 | 2.0242*01 | 3.2979*01 | 2.2019*01 | 3.3975*01 | 2.3858*01 | 3.4970*01 |
| 2.00+01            | 7.1690*02                                                                     | 3.0998*01 | 7.9186*02 | 3.1997*01 | 8.8404*02 | 3.2996*01 | 9.7545*02 | 3.3996*01 | 1.0721*01 | 3.5950*01 |
| 5.00+01            | 2.9958*03                                                                     | 3.1000*01 | 3.498*03  | 3.2000*01 | 3.8880*03 | 3.3000*01 | 4.4035*03 | 3.4000*01 | 4.9695*03 | 3.5000*01 |
| 8.00+01            | 5.4266*04                                                                     | 3.1000*01 | 6.2392*04 | 3.2000*01 | 7.1454*04 | 3.3000*01 | 8.1520*04 | 3.4000*01 | 9.2702*04 | 3.5000*01 |
| 1.00+02            | 2.4219*04                                                                     | 3.1000*01 | 2.7930*04 | 3.2000*01 | 3.2084*04 | 3.3000*01 | 3.6722*04 | 3.4000*01 | 4.1884*04 | 3.5000*01 |
| 1.00+03            | 1.0543*07                                                                     | 3.1000*01 | 1.2488*07 | 3.2000*01 | 1.4732*07 | 3.3000*01 | 1.7312*07 | 3.4000*01 | 2.3858*07 | 3.5000*01 |
| 1.00+06            | 1.2343*16                                                                     | 3.1000*01 | 1.5666*16 | 3.2000*01 | 1.8324*16 | 3.3000*01 | 2.2213*16 | 3.4000*01 | 2.6833*16 | 3.5000*01 |
| 1.00+09            | 1.7654*25                                                                     | 3.1000*01 | 2.2069*25 | 3.2000*01 | 2.7511*25 | 3.3000*01 | 3.4200*25 | 3.4000*01 | 4.2437*25 | 3.5000*01 |

TABLE I. CONT.

| $X_{\text{SIN}(\Theta)/2}$<br>/LAMBDA | $F(X, Z)$  | 36° KR     |            |            | 37° RB     |            |            | 38° SR     |            |            | 39° Y      |            |            | 40° ZR     |            |            |
|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
|                                       |            | $S(X, Z)$  | $F(X, Z)$  | $S(X, Z)$  |            |            |
| 0.00                                  | 3.6000+01  | 0.0000     | 3.7000+01  | 0.0000     | 3.8000+01  | 0.0000     | 3.9000+01  | 0.0000     | 3.9976+01  | 0.0000     | 4.0000+01  | 0.0000     | 4.0000+01  | 0.0000     | 4.0000+01  | 0.0000     |
| 5.00-03                               | 3.5990+01  | 9.0000-03  | 3.6973+01  | 2.0000-02  | 3.7972+01  | 2.3000-02  | 3.8964+01  | 2.1000-02  | 3.8937+01  | 2.2000-02  | 3.9982+01  | 2.1000-02  | 3.9982+01  | 2.1000-02  | 3.9982+01  | 2.1000-02  |
| 1.00-02                               | 3.5989+01  | 3.5000-02  | 3.6938+01  | 7.8000-02  | 3.7932+01  | 9.1000-02  | 3.8937+01  | 8.7000-02  | 3.8937+01  | 8.7000-02  | 3.9984+01  | 8.3000-02  | 3.9984+01  | 8.3000-02  | 3.9984+01  | 8.3000-02  |
| 1.50-02                               | 3.5985+01  | 7.7900-02  | 3.6889+01  | 1.7180-01  | 3.7876+01  | 2.0530-01  | 3.8880+01  | 1.9380-01  | 3.8880+01  | 1.9380-01  | 3.9884+01  | 1.8430-01  | 3.9884+01  | 1.8430-01  | 3.9884+01  | 1.8430-01  |
| 2.00-02                               | 3.5884+01  | 1.3770-01  | 3.6805+01  | 2.9640-01  | 3.7781+01  | 3.5120-01  | 3.8788+01  | 3.3770-01  | 3.8788+01  | 3.3770-01  | 3.9795+01  | 3.2180-01  | 3.9795+01  | 3.2180-01  | 3.9795+01  | 3.2180-01  |
| 2.50-02                               | 3.5819+01  | 2.1390-01  | 3.6699+01  | 4.4620-01  | 3.7662+01  | 5.3260-01  | 3.8672+01  | 5.1440-01  | 3.8672+01  | 5.1440-01  | 3.9683+01  | 4.9160-01  | 3.9683+01  | 4.9160-01  | 3.9683+01  | 4.9160-01  |
| 3.00-02                               | 3.5744+01  | 3.0560-01  | 3.6575+01  | 6.1490-01  | 3.7521+01  | 7.4000-01  | 3.8534+01  | 7.1850-01  | 3.8534+01  | 7.1850-01  | 3.9549+01  | 6.8910-01  | 3.9549+01  | 6.8910-01  | 3.9549+01  | 6.8910-01  |
| 4.00-02                               | 3.5544+01  | 5.3270-01  | 3.6278+01  | 9.8600-01  | 3.7180+01  | 1.2064+00  | 3.8198+01  | 1.1857+00  | 3.8198+01  | 1.1857+00  | 3.9221+01  | 1.1467+00  | 3.9221+01  | 1.1467+00  | 3.9221+01  | 1.1467+00  |
| 5.00-02                               | 3.5297+01  | 3.1200-01  | 3.5948+01  | 1.3720+00  | 3.6733+01  | 1.7010+00  | 3.7807+01  | 1.6940+00  | 3.7807+01  | 1.6940+00  | 3.8834+01  | 1.6540+00  | 3.8834+01  | 1.6540+00  | 3.8834+01  | 1.6540+00  |
| 7.00-02                               | 3.4663+01  | 1.4945+00  | 3.5146+01  | 2.1219+00  | 3.5862+01  | 2.6420+00  | 3.6858+01  | 2.7007+00  | 3.6858+01  | 2.7007+00  | 3.7889+01  | 2.6881+00  | 3.7889+01  | 2.6881+00  | 3.7889+01  | 2.6881+00  |
| 9.00-02                               | 3.3878+01  | 2.2858+00  | 3.4306+01  | 2.8525+00  | 3.4894+01  | 3.4571+00  | 3.5840+01  | 3.5939+00  | 3.5939+00  | 3.5939+00  | 3.6844+01  | 3.6332+00  | 3.6844+01  | 3.6332+00  | 3.6844+01  | 3.6332+00  |
| 1.00-01                               | 3.3444+01  | 2.7030+00  | 3.3861+01  | 3.2250+00  | 3.4406+01  | 3.8310+00  | 3.5322+01  | 3.9990+00  | 3.5322+01  | 3.9990+00  | 3.6313+01  | 4.0640+00  | 3.6313+01  | 4.0640+00  | 3.6313+01  | 4.0640+00  |
| 1.25-01                               | 3.2260+01  | 3.7635+00  | 3.2775+01  | 4.1893+00  | 3.3247+01  | 4.7378+00  | 3.4069+01  | 4.9485+00  | 3.4069+01  | 4.9485+00  | 3.4995+01  | 5.0647+00  | 3.4995+01  | 5.0647+00  | 3.4995+01  | 5.0647+00  |
| 1.50-01                               | 3.1009+01  | 4.8050+00  | 3.1632+01  | 5.1720+00  | 3.2113+01  | 5.6330+00  | 3.2859+01  | 5.8740+00  | 3.2859+01  | 5.8740+00  | 3.3714+01  | 6.0190+00  | 3.3714+01  | 6.0190+00  | 3.3714+01  | 6.0190+00  |
| 1.75-01                               | 2.9752+01  | 5.8050+00  | 3.0474+01  | 6.1346+00  | 3.1022+01  | 6.5695+00  | 3.1708+01  | 6.7965+00  | 3.1708+01  | 6.7965+00  | 3.2496+01  | 6.9586+00  | 3.2496+01  | 6.9586+00  | 3.2496+01  | 6.9586+00  |
| 2.00-01                               | 2.8530+01  | 6.7600+00  | 2.9327+01  | 7.0620+00  | 2.9942+01  | 7.4640+00  | 3.0594+01  | 7.7000+00  | 3.0594+01  | 7.7000+00  | 3.1322+01  | 7.8790+00  | 3.1322+01  | 7.8790+00  | 3.1322+01  | 7.8790+00  |
| 2.50-01                               | 2.6100+01  | 3.5474+00  | 2.7079+01  | 8.8125+00  | 2.7794+01  | 9.5930+00  | 2.8121+01  | 9.6206+00  | 2.8121+01  | 9.6206+00  | 2.9078+01  | 9.6206+00  | 2.9078+01  | 9.6206+00  | 2.9078+01  | 9.6206+00  |
| 3.00-01                               | 2.4394+01  | 1.0157+01  | 2.5079+01  | 1.0431+01  | 2.5079+01  | 1.0746+01  | 2.6399+01  | 1.1010+01  | 2.6399+01  | 1.1010+01  | 2.7008+01  | 1.1236+01  | 2.7008+01  | 1.1236+01  | 2.7008+01  | 1.1236+01  |
| 4.00-01                               | 2.1334+01  | 1.2828+01  | 2.1862+01  | 1.3206+01  | 2.248+01   | 1.3567+01  | 2.2990+01  | 1.3899+01  | 2.2990+01  | 1.3899+01  | 2.3518+01  | 1.4176+01  | 2.3518+01  | 1.4176+01  | 2.3518+01  | 1.4176+01  |
| 5.00-01                               | 1.8820+01  | 1.4969+01  | 1.9346+01  | 1.5410+01  | 1.9839+01  | 1.5860+01  | 2.0338+01  | 1.6279+01  | 2.0338+01  | 1.6279+01  | 2.0808+01  | 1.6658+01  | 2.0808+01  | 1.6658+01  | 2.0808+01  | 1.6658+01  |
| 6.00-01                               | 1.6535+01  | 1.6849+01  | 1.7112+01  | 1.7282+01  | 1.7636+01  | 1.7745+01  | 1.8134+01  | 1.8215+01  | 1.8134+01  | 1.8215+01  | 1.8614+01  | 1.8672+01  | 1.8614+01  | 1.8672+01  | 1.8614+01  | 1.8672+01  |
| 7.00-01                               | 1.4440+01  | 1.8562+01  | 1.5044+01  | 1.8974+01  | 1.5626+01  | 1.9420+01  | 1.6167+01  | 1.9891+01  | 1.6167+01  | 1.9891+01  | 1.6688+01  | 2.0373+01  | 1.6688+01  | 2.0373+01  | 1.6688+01  | 2.0373+01  |
| 8.00-01                               | 1.2558+01  | 2.0123+01  | 1.3174+01  | 2.0526+01  | 1.3776+01  | 2.0956+01  | 1.4358+01  | 2.1416+01  | 1.4358+01  | 2.1416+01  | 1.4911+01  | 2.1895+01  | 1.4911+01  | 2.1895+01  | 1.4911+01  | 2.1895+01  |
| 9.00-01                               | 1.0933+01  | 2.1535+01  | 1.1546+01  | 2.1940+01  | 1.2123+01  | 2.3637+01  | 1.2709+01  | 2.2820+01  | 1.2709+01  | 2.2820+01  | 1.3265+01  | 2.4583+01  | 1.3265+01  | 2.4583+01  | 1.3265+01  | 2.4583+01  |
| 1.00+00                               | 9.6573+00  | 2.2804+01  | 1.0174+01  | 2.3221+01  | 1.0699+01  | 2.3654+01  | 1.1242+01  | 2.4110+01  | 1.1242+01  | 2.4110+01  | 1.1778+01  | 2.4583+01  | 1.1778+01  | 2.4583+01  | 1.1778+01  | 2.4583+01  |
| 1.25+00                               | 7.4750+00  | 2.5401+01  | 7.7817+00  | 2.5880+01  | 8.1220+00  | 2.6361+01  | 8.4922+00  | 2.6849+01  | 8.4922+00  | 2.6849+01  | 8.8895+00  | 2.7347+01  | 8.8895+00  | 2.7347+01  | 8.8895+00  | 2.7347+01  |
| 1.50+00                               | 6.3022+00  | 2.7313+01  | 6.4893+00  | 2.7871+01  | 6.6766+00  | 2.8423+01  | 6.9156+00  | 2.8870+01  | 6.9156+00  | 2.8870+01  | 7.1494+00  | 2.9517+01  | 7.1494+00  | 2.9517+01  | 7.1494+00  | 2.9517+01  |
| 2.00+00                               | 4.9854+00  | 2.9870+01  | 5.1121+00  | 3.0543+01  | 5.2316+00  | 3.1210+01  | 5.3463+00  | 3.1870+01  | 5.3463+00  | 3.1870+01  | 5.4595+00  | 3.2522+01  | 5.4595+00  | 3.2522+01  | 5.4595+00  | 3.2522+01  |
| 2.50+00                               | 3.9082+00  | 3.1534+01  | 4.0652+00  | 3.2277+01  | 4.2129+00  | 3.3014+01  | 4.3495+00  | 3.3745+01  | 4.3495+00  | 3.3745+01  | 4.4766+00  | 3.4470+01  | 4.4766+00  | 3.4470+01  | 4.4766+00  | 3.4470+01  |
| 3.00+00                               | 3.0959+00  | 3.2659+01  | 3.2392+00  | 3.3461+01  | 3.3794+00  | 3.4255+01  | 3.5145+00  | 3.5043+01  | 3.5145+00  | 3.5145+01  | 3.6453+00  | 3.5825+01  | 3.6453+00  | 3.5825+01  | 3.6453+00  | 3.5825+01  |
| 3..50+00                              | 2.2836+00  | 3.3410+01  | 2.4132+00  | 3.4259+01  | 2.5459+00  | 3.5103+01  | 2.6796+00  | 3.5940+01  | 2.6796+00  | 3.5940+01  | 2.8113+00  | 3.6771+01  | 2.8113+00  | 3.6771+01  | 2.8113+00  | 3.6771+01  |
| 4..00+00                              | 1.9668+00  | 3.3919+01  | 2.0706+00  | 3.4803+01  | 2.1758+00  | 3.5682+01  | 2.2827+00  | 3.6557+01  | 2.2827+00  | 3.6557+01  | 2.3913+00  | 3.7426+01  | 2.3913+00  | 3.7426+01  | 2.3913+00  | 3.7426+01  |
| 5..00+00                              | 1.3339+00  | 3.5562+01  | 1.3853+00  | 3.5482+01  | 1.4355+00  | 3.6399+01  | 1.4890+00  | 3.7316+01  | 1.4890+00  | 3.7316+01  | 1.5461+00  | 3.8230+01  | 1.5461+00  | 3.8230+01  | 1.5461+00  | 3.8230+01  |
| 6..00+00                              | 1.1182+00  | 3.4980+01  | 1.1464+00  | 3.5915+01  | 1.1750+00  | 3.6888+01  | 1.2063+00  | 3.7782+01  | 1.2063+00  | 3.7782+01  | 1.2386+00  | 3.8715+01  | 1.2386+00  | 3.8715+01  | 1.2386+00  | 3.8715+01  |
| 7..00+00                              | 9.6620+01  | 3.5283+01  | 9.9220+01  | 3.6228+01  | 1.0188+00  | 3.7172+01  | 1.0450+00  | 3.8116+01  | 1.0450+00  | 3.8116+01  | 1.0701+00  | 3.9059+01  | 1.0701+00  | 3.9059+01  | 1.0701+00  | 3.9059+01  |
| 8..00+00                              | 8.4600-01  | 3.5504+01  | 8.7330-01  | 3.6459+01  | 9.0080-01  | 3.7413+01  | 9.2710-01  | 3.8366+01  | 9.2710-01  | 3.8366+01  | 9.5260-01  | 3.9318+01  | 9.5260-01  | 3.9318+01  | 9.5260-01  | 3.9318+01  |
| 1..00+01                              | 1.0506-03  | 3.6000+01  | 1.1869-03  | 3.7000+01  | 1.3370-03  | 3.8000+01  | 1.5019-03  | 3.9000+01  | 1.5019-03  | 3.9000+01  | 1.6826-03  | 4.0000+01  | 1.6826-03  | 4.0000+01  | 1.6826-03  | 4.0000+01  |
| 1..00+02                              | 4.7617-04  | 3.6000+01  | 5.3967-04  | 3.7000+01  | 6.0987-04  | 3.8000+01  | 6.8728-04  | 3.9000+01  | 6.8728-04  | 3.9000+01  | 7.7249-04  | 4.0000+01  | 7.7249-04  | 4.0000+01  | 7.7249-04  | 4.0000+01  |
| 1..00+03                              | 2.3655-07  | 3.6000+01  | 2.7517-07  | 3.7000+01  | 3.1914-07  | 3.8000+01  | 3.7953-07  | 3.9000+01  | 3.7953-07  | 3.9000+01  | 4.2572-07  | 4.0000+01  | 4.2572-07  | 4.0000+01  | 4.2572-07  | 4.0000+01  |
| 1..00+04                              | 1.5054+00  | 3.5959+01  | 2.7710-01  | 3.7000+01  | 2.9713-01  | 3.8000+01  | 3.1763-01  | 3.9000+01  | 3.1763-01  | 3.9000+01  | 3.8346+01  | 3.9938+01  | 3.8346+01  | 3.9938+01  | 3.8346+01  | 3.9938+01  |
| 1..00+05                              | 1.1739-01  | 3.5959+01  | 1.2809-01  | 3.7000+01  | 1.3929-01  | 3.7991-01  | 1.5099-01  | 3.8898+01  | 1.5099-01  | 3.8898+01  | 1.6319-01  | 3.9984+01  | 1.6319-01  | 3.9984+01  | 1.6319-01  | 3.9984+01  |
| 1..00+06                              | 3.2348-16  | 3..6000+01 | 3..8881-16 | 3..7000+01 | 4..6622-16 | 3..8000+01 | 5..5781-15 | 3..8000+01 | 5..5781-15 | 3..8000+01 | 6..6606-16 | 4..0000+01 | 6..6606-16 | 4..0000+01 | 6..6606-16 | 4..0000+01 |
| 1..00+07                              | 5..2541-25 | 3..6000+01 | 6..4936-25 | 3..7000+01 | 8..0130-25 | 3..8000+01 | 9..8745-25 | 3..9000+01 | 9..8745-25 | 3..9000+01 | 9..5260-01 | 4..0000+01 | 9..5260-01 | 4..0000+01 | 9..5260-01 | 4..0000+01 |

TABLE I. - CONT.

ATOMIC FORM FACTOR,  $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION,  $S(X, Z)$ 

| $X \cdot$<br>$\sin(\theta/\lambda)/\lambda$ | 41 NB      | 42 MO     | 43 TC      | 44 RU     | 45 RH      |
|---------------------------------------------|------------|-----------|------------|-----------|------------|
| $S(X, Z)$                                   | $F(X, Z)$  | $S(X, Z)$ | $F(X, Z)$  | $S(X, Z)$ | $F(X, Z)$  |
| 0.00                                        | 4.10000+01 | 0.00000   | 4.20000+01 | 0.00000   | 4.40000+01 |
| 5.00-03                                     | 4.09854+01 | 1.7000-02 | 4.1986+01  | 1.6000-02 | 4.3987+01  |
| 1.00-02                                     | 4.0951+01  | 6.8000-02 | 4.1954+01  | 6.5000-02 | 4.3957+01  |
| 1.50-02                                     | 4.0899+01  | 1.5160-01 | 4.1902+01  | 1.4290-01 | 4.3509+01  |
| 2.00-02                                     | 4.0821+01  | 2.6520-01 | 4.1827+01  | 2.5210-01 | 4.3839+01  |
| 2.50-02                                     | 4.0722+01  | 4.0610-01 | 4.1732+01  | 3.8680-01 | 4.2714+01  |
| 3.00-02                                     | 4.0604+01  | 5.7100-01 | 4.1618+01  | 5.4480-01 | 4.2592+01  |
| 4.00-02                                     | 4.0312+01  | 9.5760-01 | 4.3335+01  | 9.1177-01 | 4.2291+01  |
| 5.00-02                                     | 3.9960+01  | 1.3950+00 | 4.0991+01  | 1.3440+00 | 4.1924+01  |
| 7.00-02                                     | 3.9095+01  | 2.3251+00 | 4.0141+01  | 2.2641+00 | 4.1022+01  |
| 9.00-02                                     | 3.8104+01  | 3.2356+00 | 3.9155+01  | 3.1813+00 | 3.9982+01  |
| 1.00-01                                     | 3.7578+01  | 3.6720+00 | 3.8627+01  | 3.6250+00 | 3.9430+01  |
| 1.25-01                                     | 3.6238+01  | 4.7211+00 | 3.2677+01  | 4.6925+00 | 3.8023+01  |
| 1.50-01                                     | 3.4887+01  | 5.7350+00 | 3.5879+01  | 5.7200+00 | 3.6613+01  |
| 1.75-01                                     | 3.3557+01  | 6.7233+00 | 3.4022+01  | 6.7197+00 | 3.5234+01  |
| 2.00-01                                     | 3.2226+01  | 7.6840+00 | 3.2156+01  | 7.6900+00 | 3.3897+01  |
| 2.50-01                                     | 2.9815+01  | 9.5075+00 | 3.0599+01  | 9.5324+00 | 3.1353+01  |
| 3.00-01                                     | 2.7604+01  | 1.1213+01 | 2.8288+01  | 1.1260+01 | 2.9024+01  |
| 4.00-01                                     | 2.3980+01  | 1.4317+01 | 2.4460+01  | 1.4440+01 | 2.5120+01  |
| 5.00-01                                     | 2.1242+01  | 1.6949+01 | 2.1682+01  | 1.7196+01 | 2.2161+01  |
| 6.00-01                                     | 1.9072+01  | 1.9081+01 | 1.9494+01  | 1.9455+01 | 1.9904+01  |
| 7.00-01                                     | 1.7118+01  | 2.0847+01 | 1.7637+01  | 2.0360+01 | 1.8047+01  |
| 8.00-01                                     | 1.5442+01  | 2.2356+01 | 1.5932+01  | 2.2877+01 | 1.6377+01  |
| 9.00-01                                     | 1.3811+01  | 2.3789+01 | 1.3329+01  | 2.4288+01 | 1.4810+01  |
| 1.00+00                                     | 1.2313+01  | 2.5077+01 | 1.2837+01  | 2.5581+01 | 1.3339+01  |
| 1.25+00                                     | 9.3098+00  | 2.7860+01 | 9.7497+00  | 2.8378+01 | 1.0204+01  |
| 1.50+00                                     | 7.4077+00  | 3.0067+01 | 7.6940+00  | 3.0620+01 | 8.0082+00  |
| 2.00+00                                     | 5.5763+00  | 3.3167+01 | 5.6982+00  | 3.3808+01 | 5.8283+00  |
| 2.50+00                                     | 4.5934+00  | 3.5188+01 | 4.1043+00  | 3.5910+01 | 4.8096+00  |
| 3.00+00                                     | 3.7700+00  | 3.6601+01 | 3.8911+00  | 3.7370+01 | 4.0091+00  |
| 3.50+00                                     | 2.9463+00  | 3.7596+01 | 3.0780+00  | 3.8415+01 | 3.2087+00  |
| 4.00+00                                     | 2.6610+00  | 3.8221+01 | 2.6100+00  | 3.9150+01 | 2.9206+00  |
| 5.00+00                                     | 1.6078+00  | 3.9142+01 | 1.6740+00  | 4.0051+01 | 1.7445+00  |
| 6.00+00                                     | 1.2728+00  | 3.9644+01 | 1.3093+00  | 4.0578+01 | 1.3475+00  |
| 7.00+00                                     | 1.0953+00  | 4.0002+01 | 1.1206+00  | 4.0945+01 | 1.1460+00  |
| 8.00+00                                     | 9.7790-01  | 4.0270+01 | 1.0029+00  | 4.1221+01 | 1.0279+00  |
| 1.00+01                                     | 7.4310-01  | 4.0610+01 | 7.6750-01  | 4.1587+01 | 7.9170-01  |
| 1.50+01                                     | 3.5986-01  | 4.0930+01 | 3.8152-01  | 4.1920+01 | 4.0348-01  |
| 2.00+01                                     | 1.7586-01  | 4.0985+01 | 1.8901-01  | 4.1983+01 | 4.2000+01  |
| 5.00+01                                     | 9.6131-03  | 4.1000+01 | 1.0628-02  | 4.2000+01 | 1.1722-02  |
| 8.00+01                                     | 1.8802-03  | 4.1000+01 | 2.0961-03  | 4.2000+01 | 2.3313-03  |
| 1.00+02                                     | 4.6610-04  | 4.1000+01 | 9.8221-04  | 4.2000+01 | 6.4388-07  |
| 1.00+03                                     | 4.8981-07  | 4.1000+01 | 5.6221-07  | 4.2000+01 | 1.1222-15  |
| 1.00+06                                     | 7.9386-16  | 4.1000+01 | 9.4459-16  | 4.2000+01 | 2.5454-24  |
| 1.00+09                                     | 1.4945-24  | 4.1000+01 | 1.8362-24  | 4.2000+01 | 2.7664-24  |

TABLE I. CONT.

| $\sin(\theta/2)$<br>$\lambda$ | X <sub>0</sub><br>46 PD | 47 AG     |           |           | 48 CD     |           |           | 49 IN     |           |           | 50 SN     |           |           |
|-------------------------------|-------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                               |                         | F(X,Z)    | S(X,Z)    | F(X,Z)    | F(X,Z)    | S(X,Z)    | F(X,Z)    | F(X,Z)    | S(X,Z)    | F(X,Z)    | S(X,Z)    | F(X,Z)    | S(X,Z)    |
| 0.00                          | 4.6000+01               | 0.0000    | 4.7000+01 | 0.0000    | 4.8000+01 | 0.0000    | 4.9000+01 | 0.0000    | 5.0000+01 | 0.0000    | 5.0000+01 | 0.0000    | 5.0000+01 |
| 5.00-03                       | 4.5992+01               | 1.0000-02 | 4.6987+01 | 1.3000-02 | 4.7985+01 | 1.5000-02 | 4.8984+01 | 1.5000-02 | 4.9981-01 | 1.5000-02 | 4.9981-01 | 1.5000-02 | 4.9981-01 |
| 1.00-02                       | 4.5969+01               | 3.9000-02 | 4.6959+01 | 5.2000-02 | 4.7956+01 | 5.9000-02 | 4.8947+01 | 6.2000-02 | 4.9946+01 | 6.0000-02 | 4.9946+01 | 6.0000-02 | 4.9946+01 |
| 1.50-02                       | 4.5930+01               | 8.8100-02 | 4.6917+01 | 1.1660-01 | 4.7910+01 | 1.3240-01 | 4.8899+01 | 1.3750-01 | 4.9895+01 | 1.3440-01 | 4.9895+01 | 1.3440-01 | 4.9895+01 |
| 2.00-02                       | 4.5875+01               | 1.5550-01 | 4.6852+01 | 2.0510-01 | 4.7841+01 | 2.3240-01 | 4.8821+01 | 2.4170-01 | 4.9814+01 | 2.3650-01 | 4.9814+01 | 2.3650-01 | 4.9814+01 |
| 2.50-02                       | 4.5805+01               | 2.4210-01 | 4.6770+01 | 3.1610-01 | 4.7753+01 | 3.5820-01 | 4.8722+01 | 3.7220-01 | 4.9712+01 | 3.6480-01 | 4.9712+01 | 3.6480-01 | 4.9712+01 |
| 3.00-02                       | 4.5720+01               | 3.4620-01 | 4.4780-01 | 5.6672+01 | 4.7647+01 | 5.0750-01 | 4.8603+01 | 5.2690-01 | 4.9588+01 | 5.1750-01 | 4.9588+01 | 5.1750-01 | 4.9588+01 |
| 4.00-02                       | 4.5507+01               | 6.0430+01 | 4.6425+01 | 7.6490-01 | 4.7383+01 | 8.6650-01 | 4.8508+01 | 8.9820-01 | 4.9280+01 | 8.8610-01 | 4.9280+01 | 8.8610-01 | 4.9280+01 |
| 5.00-02                       | 4.5238+01               | 9.2300-01 | 4.6123+01 | 1.1390+00 | 4.7059+01 | 1.2880+00 | 4.7952+01 | 1.3340+00 | 4.8906+01 | 1.3230+00 | 4.8906+01 | 1.3230+00 | 4.8906+01 |
| 7.00-02                       | 4.4545+01               | 1.7050+00 | 4.5356+01 | 1.9902+00 | 4.6239+01 | 2.2373+00 | 4.7054+01 | 2.3160+00 | 4.7964+01 | 2.3215+00 | 4.7964+01 | 2.3215+00 | 4.7964+01 |
| 9.00-02                       | 4.3675+01               | 2.6188+00 | 4.4435+01 | 2.9013+00 | 4.5263+01 | 3.2201+00 | 4.6010+01 | 3.3444+00 | 4.6862+01 | 3.3857+00 | 4.6862+01 | 3.3857+00 | 4.6862+01 |
| 1.00-01                       | 4.3185+01               | 3.1030+00 | 4.3930+01 | 3.3620+00 | 4.4733+01 | 3.7000+00 | 4.5453+01 | 3.8520+00 | 4.6274+01 | 3.9170+00 | 4.6274+01 | 3.9170+00 | 4.6274+01 |
| 1.25-01                       | 4.1838+01               | 4.3342+00 | 4.2576+01 | 4.5059+00 | 4.3329+01 | 4.8433+00 | 4.6000+01 | 5.0700+00 | 4.4743+01 | 5.2044+00 | 4.4743+01 | 5.2044+00 | 4.4743+01 |
| 1.50-01                       | 4.0366+01               | 5.5360+00 | 4.1131+01 | 5.6310+00 | 4.1859+01 | 5.9210+00 | 4.2510+01 | 6.2070+00 | 4.3192+01 | 6.4160+00 | 4.3192+01 | 6.4160+00 | 4.3192+01 |
| 1.75-01                       | 3.8829+01               | 6.6665+00 | 3.9643+01 | 6.7268+00 | 4.0376+01 | 6.9607+00 | 4.1031+01 | 7.2757+00 | 4.1683+01 | 7.5495+00 | 4.1683+01 | 7.5495+00 | 4.1683+01 |
| 2.00-01                       | 3.7274+01               | 7.7250+00 | 3.8137+01 | 7.7850+00 | 3.8899+01 | 7.9800+00 | 3.9579+01 | 8.2970+00 | 4.0212+01 | 8.6150+00 | 4.0212+01 | 8.6150+00 | 4.0212+01 |
| 2.50-01                       | 3.4239+01               | 9.6554+00 | 3.5153+01 | 9.7770+00 | 3.5964+01 | 9.9556+00 | 3.6719+01 | 1.0244+01 | 3.7388+01 | 1.0589+01 | 3.7388+01 | 1.0589+01 | 3.7388+01 |
| 3.00-01                       | 3.1444+01               | 1.1441+01 | 3.2341+01 | 1.1598+01 | 3.3184+01 | 1.1812+01 | 3.3999+01 | 1.2083+01 | 3.4719+01 | 1.2415+01 | 3.4719+01 | 1.2415+01 | 3.4719+01 |
| 4.00-01                       | 2.6836+01               | 1.4824+01 | 2.7576+01 | 1.4969+01 | 2.8343+01 | 1.5185+01 | 2.9125+01 | 1.5444+01 | 2.9894+01 | 1.5746+01 | 2.9894+01 | 1.5746+01 | 2.9894+01 |
| 5.00-01                       | 2.3472+01               | 1.7943+01 | 2.4019+01 | 1.8082+01 | 2.4619+01 | 1.8263+01 | 2.5260+01 | 1.8489+01 | 2.5932+01 | 1.8760+01 | 2.5932+01 | 1.8760+01 | 2.5932+01 |
| 6.00-01                       | 2.1036+01               | 2.0653+01 | 2.1440+01 | 2.0858+01 | 2.1883+01 | 2.1064+01 | 2.2360+01 | 2.1288+01 | 2.2881+01 | 2.1541+01 | 2.2881+01 | 2.1541+01 | 2.2881+01 |
| 7.00-01                       | 1.9169+01               | 2.2904+01 | 1.9509+01 | 2.3212+01 | 1.9857+01 | 2.3501+01 | 2.0244+01 | 2.0779+01 | 2.0611+01 | 2.4559+01 | 2.0611+01 | 2.4559+01 | 2.0611+01 |
| 8.00-01                       | 1.7589+01               | 2.4749+01 | 1.7927+01 | 2.5162+01 | 1.8249+01 | 2.5546+01 | 1.8655+01 | 2.5900+01 | 1.8885+01 | 2.6252+01 | 1.8885+01 | 2.6252+01 | 1.8885+01 |
| 9.00-01                       | 1.6134+01               | 2.6316+01 | 1.6504+01 | 2.6792+01 | 1.6845+01 | 2.7252+01 | 1.7165+01 | 2.7691+01 | 1.7469+01 | 2.8113+01 | 1.7469+01 | 2.8113+01 | 1.7469+01 |
| 1.00+00                       | 1.4747+01               | 2.7677+01 | 1.5156+01 | 2.8195+01 | 1.5533+01 | 2.8705+01 | 1.5882+01 | 2.9203+01 | 1.6205+01 | 2.9687+01 | 1.6205+01 | 2.9687+01 | 1.6205+01 |
| 1.25+00                       | 1.1591+01               | 3.0549+01 | 1.2045+01 | 3.1106+01 | 1.2484+01 | 3.1666+01 | 1.2905+01 | 3.2229+01 | 1.3304+01 | 3.2794+01 | 1.3304+01 | 3.2794+01 | 1.3304+01 |
| 1.50+00                       | 9.0843+00               | 3.2888+01 | 9.4790+00 | 3.3465+01 | 9.8830+00 | 3.4046+01 | 1.0922+01 | 3.4634+01 | 1.0699+01 | 3.5226+01 | 1.0699+01 | 3.5226+01 | 1.0699+01 |
| 2.00+00                       | 6.2974+00               | 3.6343+01 | 6.4852+00 | 3.6983+01 | 6.6907+00 | 3.7618+01 | 6.9144+00 | 3.8255+01 | 7.1560+00 | 3.8894+01 | 7.1560+00 | 3.8894+01 | 7.1560+00 |
| 2.50+00                       | 5.1029+00               | 3.8703+01 | 5.2013+00 | 3.9395+01 | 5.3031+00 | 4.0085+01 | 5.4102+00 | 4.0774+01 | 5.5243+00 | 4.1462+01 | 5.5243+00 | 4.1462+01 | 5.5243+00 |
| 3.00+00                       | 4.3373+00               | 4.0389+01 | 4.4433+00 | 4.1131+01 | 4.5486+00 | 4.1870+01 | 4.6561+00 | 4.2605+01 | 4.7608+00 | 4.3338+01 | 4.7608+00 | 4.3338+01 | 4.7608+00 |
| 3.50+00                       | 3.5716+00               | 4.1627+01 | 3.6852+00 | 4.2415+01 | 3.7941+00 | 4.3198+01 | 3.8797+00 | 4.3977+01 | 3.9969+00 | 4.4751+01 | 3.9969+00 | 4.4751+01 | 3.9969+00 |
| 4.00+00                       | 3.0394+00               | 4.2859+01 | 3.1430+00 | 4.3465+01 | 3.8830+00 | 4.4046+01 | 4.1092+01 | 4.6334+01 | 4.3924+00 | 4.5817+01 | 4.3924+00 | 4.5817+01 | 4.3924+00 |
| 4.50+00                       | 1.9751+00               | 4.3658+01 | 2.0585+00 | 4.4550+01 | 2.1445+00 | 4.5437+01 | 2.2330+00 | 4.6321+01 | 2.3238+00 | 4.7200+01 | 2.3238+00 | 4.7200+01 | 2.3238+00 |
| 5.00+00                       | 1.4788+00               | 4.4298+01 | 1.5278+00 | 4.5217+01 | 1.5603+00 | 4.6139+01 | 1.6552+00 | 4.7060+01 | 1.6924+00 | 4.7977+01 | 1.6924+00 | 4.7977+01 | 1.6924+00 |
| 7.00+00                       | 1.2248+00               | 4.4710+01 | 1.2543+00 | 4.5650+01 | 1.2859+00 | 4.6589+01 | 1.3196+00 | 4.7526+01 | 1.3552+00 | 4.8463+01 | 1.3552+00 | 4.8463+01 | 1.3552+00 |
| 8.00+00                       | 1.1038+00               | 4.5019+01 | 1.1303+00 | 4.5968+01 | 1.1580+00 | 4.6915+01 | 1.1870+00 | 4.7863+01 | 1.2170+00 | 4.8810+01 | 1.2170+00 | 4.8810+01 | 1.2170+00 |
| 1.00+01                       | 8.6180-01               | 4.5444+01 | 8.8220-01 | 4.6406+01 | 9.0210-01 | 4.7368+01 | 9.2180-01 | 4.8328+01 | 9.4070-01 | 4.9288+01 | 9.4070-01 | 4.9288+01 | 9.4070-01 |
| 1.50+01                       | 4.7080-01               | 4.5877+01 | 4.9360-01 | 4.6864+01 | 5.1653-01 | 4.7850+01 | 5.3054-01 | 4.8835+01 | 5.6262-01 | 4.9200+01 | 5.6262-01 | 4.9200+01 | 5.6262-01 |
| 2.00+01                       | 2.4597-01               | 4.5971+01 | 2.6123-01 | 4.6968+01 | 2.7687-01 | 4.7963+01 | 2.9287-01 | 4.9000+01 | 3.0921-01 | 4.9954+01 | 3.0921-01 | 4.9954+01 | 3.0921-01 |
| 5.00+01                       | 1.5518-02               | 4.6000+01 | 1.6968-02 | 4.7000+01 | 1.8518-02 | 4.8000+01 | 2.0171-02 | 4.9000+01 | 1.9192-02 | 5.0000+01 | 1.9192-02 | 5.0000+01 | 1.9192-02 |
| 8.00+01                       | 3.1668-03               | 4.6000+01 | 3.4933-03 | 4.7000+01 | 3.8464-03 | 4.8000+01 | 4.2277-03 | 4.9000+01 | 4.6388-03 | 5.0000+01 | 4.6388-03 | 5.0000+01 | 4.6388-03 |
| 1.00+02                       | 1.4838-03               | 4.6000+01 | 1.6453-03 | 4.7000+01 | 1.8153-03 | 4.8000+01 | 2.0023-03 | 4.9000+01 | 2.0474-03 | 5.0000+01 | 2.0474-03 | 5.0000+01 | 2.0474-03 |
| 1.00+03                       | 9.5540-07               | 4.6000+01 | 1.0857-03 | 4.7000+01 | 1.2316-03 | 4.8000+01 | 1.3948-06 | 4.9000+01 | 1.5777-06 | 5.0000+01 | 1.5777-06 | 5.0000+01 | 1.5777-06 |
| 1.00+06                       | 1.8670-15               | 4.6000+01 | 2.074-15  | 4.7000+01 | 2.6074-15 | 4.8000+01 | 3.0773-15 | 4.9000+01 | 3.6293-15 | 5.0000+01 | 3.6293-15 | 5.0000+01 | 3.6293-15 |
| 1.00+09                       | 4.1612-24               | 4.6000+01 | 5.1019-24 | 4.7000+01 | 6.2552-24 | 4.8000+01 | 7.6697-24 | 4.9000+01 | 9.4057-24 | 5.0000+01 | 9.4057-24 | 5.0000+01 | 9.4057-24 |

TABLE I. • CONT. ATOMIC FORM FACTORS,  $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION,  $S(X, Z)$ 

| $X$                     | $\sin(\theta/2)$ | 51 SB     | 52 TE     | 53 I      | 54 XE     | 55 CS     |
|-------------------------|------------------|-----------|-----------|-----------|-----------|-----------|
| $\lambda/\text{Lambda}$ | $F(X, Z)$        | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ |
| 0.00                    | 5.1000+01        | 0.0000    | 5.2000+01 | 0.0000    | 5.4000+01 | 0.0000    |
| 5.00-03                 | 5.0583+01        | 1.5000-02 | 5.1985+01 | 1.4000-02 | 5.2986+01 | 1.3000-02 |
| 1.00-02                 | 5.0948+01        | 5.8000-02 | 5.1950+01 | 5.6000-02 | 5.2952+01 | 5.4000-02 |
| 1.50-02                 | 5.0944+01        | 1.2970-01 | 5.1894+01 | 1.2500-01 | 5.2895+01 | 1.2050-01 |
| 2.00-02                 | 5.0812+01        | 2.2840-01 | 5.1813+01 | 2.2050-01 | 5.2814+01 | 2.1200-01 |
| 2.50-02                 | 5.0708+01        | 3.5270-01 | 5.1709+01 | 3.4120-01 | 5.2711+01 | 3.2950-01 |
| 3.00-02                 | 5.0553+01        | 5.0080-01 | 5.1583+01 | 4.8540-01 | 5.2586+01 | 4.6950-01 |
| 4.00-02                 | 5.0270+01        | 8.5980-01 | 5.1269+01 | 8.3740-01 | 5.2273+01 | 8.1320-01 |
| 5.00-02                 | 4.9886+01        | 1.2870+00 | 5.0881+01 | 1.2610+00 | 5.1884+01 | 1.2300+00 |
| 7.00-02                 | 4.8920+01        | 2.2731+00 | 4.9020+01 | 2.2554+00 | 5.0900+01 | 2.2213+00 |
| 9.00-02                 | 4.7775+01        | 3.3358+00 | 4.8728+01 | 3.3494+00 | 4.9707+01 | 3.3314+00 |
| 1.00-01                 | 4.7161+01        | 3.8710+00 | 4.8093+01 | 3.9070+00 | 4.9057+01 | 3.9030+00 |
| 1.25-01                 | 4.5555+01        | 5.1866+00 | 4.6423+01 | 5.2839+00 | 4.7335+01 | 5.3281+00 |
| 1.50-01                 | 4.3930+01        | 6.4530+00 | 4.4724+01 | 6.6100+00 | 4.5668+01 | 6.7050+00 |
| 1.75-01                 | 4.2357+01        | 7.6627+00 | 4.3075+01 | 7.8759+00 | 4.3842+01 | 8.0300+00 |
| 2.00-01                 | 4.0843+01        | 8.8110+00 | 4.1500+01 | 9.0760+00 | 4.2195+01 | 9.2870+00 |
| 2.50-01                 | 3.8005+01        | 1.0908+01 | 3.8601+01 | 1.1260+01 | 3.9199+01 | 1.1579+01 |
| 3.00-01                 | 3.5378+01        | 1.2777+01 | 3.5983+01 | 1.3171+01 | 3.6555+01 | 1.3554+01 |
| 4.00-01                 | 3.0628+01        | 1.6088+01 | 3.1314+01 | 1.6466+01 | 3.1950+01 | 1.6876+01 |
| 5.00-01                 | 2.6619+01        | 1.9067+01 | 2.7304+01 | 1.9407+01 | 2.7973+01 | 1.9777+01 |
| 6.00-01                 | 2.3440+01        | 2.1823+01 | 2.4029+01 | 2.2134+01 | 2.4636+01 | 2.2471+01 |
| 7.00-01                 | 2.1036+01        | 2.4349+01 | 2.1496+01 | 2.4655+01 | 2.1990+01 | 2.4900+01 |
| 8.00-01                 | 1.9218+01        | 2.6590+01 | 1.9574+01 | 2.6927+01 | 1.9958+01 | 2.7289+01 |
| 9.00-01                 | 1.7766+01        | 2.8518+01 | 1.8065+01 | 2.8912+01 | 1.8314+01 | 2.9288+01 |
| 1.00+00                 | 1.6507+01        | 3.0157+01 | 1.6795+01 | 3.0613+01 | 1.7076+01 | 3.1056+01 |
| 1.25+00                 | 1.3678+01        | 3.3358+01 | 1.4028+01 | 3.3918+01 | 1.4354+01 | 3.4474+01 |
| 1.50+00                 | 1.1100+01        | 3.5822+01 | 1.1491+01 | 3.6422+01 | 1.1867+01 | 3.7044+01 |
| 2.00+00                 | 7.4147+00        | 3.9536+01 | 7.6893+00 | 4.0181+01 | 7.9779+00 | 4.0827+01 |
| 2.50+00                 | 5.6471+00        | 4.2151+00 | 5.7801+00 | 4.2840+01 | 5.9245+00 | 4.3559+01 |
| 3.00+00                 | 4.8621+00        | 4.4069+01 | 4.9804+00 | 4.4798+01 | 5.0953+00 | 4.5526+01 |
| 3.50+00                 | 4.0911+00        | 4.5522+01 | 4.1807+00 | 4.6290+01 | 4.2662+00 | 4.7054+01 |
| 4.00+00                 | 3.5329+00        | 4.6626+01 | 3.6239+00 | 4.7431+01 | 3.7244+00 | 4.8233+01 |
| 5.00+00                 | 2.4165+00        | 4.8075+01 | 2.5104+00 | 4.8945+01 | 2.6408+00 | 4.9811+01 |
| 6.00+00                 | 1.7531+00        | 4.8892+01 | 1.8172+00 | 4.9804+01 | 1.8844+00 | 5.0714+01 |
| 7.00+00                 | 1.3922+00        | 4.9399+01 | 1.4309+00 | 5.0333+01 | 1.4721+00 | 5.1266+01 |
| 8.00+00                 | 1.2478+00        | 4.9756+01 | 1.2799+00 | 5.0702+01 | 1.3138+00 | 5.1647+01 |
| 1.00+01                 | 9.5910-01        | 5.0248+01 | 9.7790-01 | 5.1207+01 | 9.9730-01 | 5.2155+01 |
| 1.50+01                 | 5.8573-01        | 5.0804+01 | 6.0884-01 | 5.1787+01 | 6.3193-01 | 5.2770+01 |
| 2.00+01                 | 3.2587-01        | 5.0949+01 | 3.4283-01 | 5.1943+01 | 3.6008-01 | 5.2957+01 |
| 5.00+01                 | 2.3805-02        | 5.1000+01 | 2.5795-02 | 5.1999+01 | 2.7907-02 | 5.2999+01 |
| 7.00+01                 | 1.4159-23        | 5.1000+01 | 1.4309+00 | 5.0333+01 | 1.4721+00 | 5.1266+01 |
| 8.00+01                 | 5.0817-03        | 5.1000+01 | 5.5581-03 | 5.2000+01 | 6.0699-03 | 5.3000+01 |
| 1.00+02                 | 2.4240-03        | 5.1000+01 | 2.6611-03 | 5.2000+01 | 2.9170-03 | 5.3000+01 |
| 1.50+02                 | 1.7811-06        | 5.1000+01 | 2.0084-06 | 5.2000+01 | 2.2617-06 | 5.3000+01 |
| 2.00+02                 | 3.2587-01        | 5.0949+01 | 3.4283-01 | 5.1943+01 | 3.6008-01 | 5.2957+01 |
| 5.00+02                 | 2.3805-02        | 5.1000+01 | 2.5795-02 | 5.1999+01 | 2.7907-02 | 5.2999+01 |
| 7.00+02                 | 1.4159-23        | 5.1000+01 | 1.4309+00 | 5.0333+01 | 1.4721+00 | 5.1266+01 |
| 8.00+02                 | 5.0817-03        | 5.1000+01 | 5.5581-03 | 5.2000+01 | 6.0699-03 | 5.3000+01 |
| 1.00+03                 | 2.4240-03        | 5.1000+01 | 2.6611-03 | 5.2000+01 | 2.9170-03 | 5.3000+01 |
| 1.50+03                 | 1.7811-06        | 5.1000+01 | 2.0084-06 | 5.2000+01 | 2.2617-06 | 5.3000+01 |
| 2.00+03                 | 3.2587-01        | 5.0949+01 | 3.4283-01 | 5.1943+01 | 3.6008-01 | 5.2957+01 |
| 5.00+03                 | 2.3805-02        | 5.1000+01 | 2.5795-02 | 5.1999+01 | 2.7907-02 | 5.2999+01 |
| 7.00+03                 | 1.4159-23        | 5.1000+01 | 1.4309+00 | 5.0333+01 | 1.4721+00 | 5.1266+01 |
| 8.00+03                 | 5.0817-03        | 5.1000+01 | 5.5581-03 | 5.2000+01 | 6.0699-03 | 5.3000+01 |
| 1.00+04                 | 2.4240-03        | 5.1000+01 | 2.6611-03 | 5.2000+01 | 2.9170-03 | 5.3000+01 |
| 1.50+04                 | 1.7811-06        | 5.1000+01 | 2.0084-06 | 5.2000+01 | 2.2617-06 | 5.3000+01 |
| 2.00+04                 | 3.2587-01        | 5.0949+01 | 3.4283-01 | 5.1943+01 | 3.6008-01 | 5.2957+01 |
| 5.00+04                 | 2.3805-02        | 5.1000+01 | 2.5795-02 | 5.1999+01 | 2.7907-02 | 5.2999+01 |
| 7.00+04                 | 1.4159-23        | 5.1000+01 | 1.4309+00 | 5.0333+01 | 1.4721+00 | 5.1266+01 |
| 8.00+04                 | 5.0817-03        | 5.1000+01 | 5.5581-03 | 5.2000+01 | 6.0699-03 | 5.3000+01 |
| 1.00+05                 | 2.4240-03        | 5.1000+01 | 2.6611-03 | 5.2000+01 | 2.9170-03 | 5.3000+01 |
| 1.50+05                 | 1.7811-06        | 5.1000+01 | 2.0084-06 | 5.2000+01 | 2.2617-06 | 5.3000+01 |
| 2.00+05                 | 3.2587-01        | 5.0949+01 | 3.4283-01 | 5.1943+01 | 3.6008-01 | 5.2957+01 |
| 5.00+05                 | 2.3805-02        | 5.1000+01 | 2.5795-02 | 5.1999+01 | 2.7907-02 | 5.2999+01 |
| 7.00+05                 | 1.4159-23        | 5.1000+01 | 1.4309+00 | 5.0333+01 | 1.4721+00 | 5.1266+01 |
| 8.00+05                 | 5.0817-03        | 5.1000+01 | 5.5581-03 | 5.2000+01 | 6.0699-03 | 5.3000+01 |
| 1.00+06                 | 2.4240-03        | 5.1000+01 | 2.6611-03 | 5.2000+01 | 2.9170-03 | 5.3000+01 |
| 1.50+06                 | 1.7811-06        | 5.1000+01 | 2.0084-06 | 5.2000+01 | 2.2617-06 | 5.3000+01 |
| 2.00+06                 | 3.2587-01        | 5.0949+01 | 3.4283-01 | 5.1943+01 | 3.6008-01 | 5.2957+01 |
| 5.00+06                 | 2.3805-02        | 5.1000+01 | 2.5795-02 | 5.1999+01 | 2.7907-02 | 5.2999+01 |
| 7.00+06                 | 1.4159-23        | 5.1000+01 | 1.4309+00 | 5.0333+01 | 1.4721+00 | 5.1266+01 |
| 8.00+06                 | 5.0817-03        | 5.1000+01 | 5.5581-03 | 5.2000+01 | 6.0699-03 | 5.3000+01 |
| 1.00+07                 | 2.4240-03        | 5.1000+01 | 2.6611-03 | 5.2000+01 | 2.9170-03 | 5.3000+01 |
| 1.50+07                 | 1.7811-06        | 5.1000+01 | 2.0084-06 | 5.2000+01 | 2.2617-06 | 5.3000+01 |
| 2.00+07                 | 3.2587-01        | 5.0949+01 | 3.4283-01 | 5.1943+01 | 3.6008-01 | 5.2957+01 |
| 5.00+07                 | 2.3805-02        | 5.1000+01 | 2.5795-02 | 5.1999+01 | 2.7907-02 | 5.2999+01 |
| 7.00+07                 | 1.4159-23        | 5.1000+01 | 1.4309+00 | 5.0333+01 | 1.4721+00 | 5.1266+01 |
| 8.00+07                 | 5.0817-03        | 5.1000+01 | 5.5581-03 | 5.2000+01 | 6.0699-03 | 5.3000+01 |
| 1.00+08                 | 2.4240-03        | 5.1000+01 | 2.6611-03 | 5.2000+01 | 2.9170-03 | 5.3000+01 |
| 1.50+08                 | 1.7811-06        | 5.1000+01 | 2.0084-06 | 5.2000+01 | 2.2617-06 | 5.3000+01 |
| 2.00+08                 | 3.2587-01        | 5.0949+01 | 3.4283-01 | 5.1943+01 | 3.6008-01 | 5.2957+01 |
| 5.00+08                 | 2.3805-02        | 5.1000+01 | 2.5795-02 | 5.1999+01 | 2.7907-02 | 5.2999+01 |
| 7.00+08                 | 1.4159-23        | 5.1000+01 | 1.4309+00 | 5.0333+01 | 1.4721+00 | 5.1266+01 |
| 8.00+08                 | 5.0817-03        | 5.1000+01 | 5.5581-03 | 5.2000+01 | 6.0699-03 | 5.3000+01 |
| 1.00+09                 | 2.4240-03        | 5.1000+01 | 2.6611-03 | 5.2000+01 | 2.9170-03 | 5.3000+01 |
| 1.50+09                 | 1.7811-06        | 5.1000+01 | 2.0084-06 | 5.2000+01 | 2.2617-06 | 5.3000+01 |
| 2.00+09                 | 3.2587-01        | 5.0949+01 | 3.4283-01 | 5.1943+01 | 3.6008-01 | 5.2957+01 |
| 5.00+09                 | 2.3805-02        | 5.1000+01 | 2.5795-02 | 5.1999+01 | 2.7907-02 | 5.2999+01 |
| 7.00+09                 | 1.4159-23        | 5.1000+01 | 1.4309+00 | 5.0333+01 | 1.4721+00 | 5.1266+01 |

TABLE I\*, CONT. ATOMIC FORM FACTOR,  $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION,  $S(X, Z)$ 

| $X_*$   | $\sin(\theta/2)$ | 56 BA     | 57 LA     | 58 CE     | 59 PR     | 60 ND     |
|---------|------------------|-----------|-----------|-----------|-----------|-----------|
|         | /LAMBDA          | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ |
| 0.00    | 5.6000+01        | 0.0000    | 5.7000+01 | 0.0000    | 5.9000+01 | 0.0000    |
| 5.00-03 | 5.5970+01        | 3.1000-02 | 5.6964+01 | 3.0000-02 | 5.7963+01 | 2.9000-02 |
| 1.00-02 | 5.5912+01        | 1.2400-01 | 5.6909+01 | 1.1900-01 | 5.7909+01 | 1.1600-01 |
| 1.50-02 | 5.5823+01        | 2.7230-01 | 5.6827+01 | 2.6220-01 | 5.7831+01 | 2.5620-01 |
| 2.00-02 | 5.5688+01        | 4.7070-01 | 5.6695+01 | 4.5500+01 | 5.7702+01 | 4.4490-01 |
| 2.50-02 | 5.5519+01        | 7.0990-01 | 5.6530+01 | 6.8950-01 | 5.7540+01 | 6.7470-01 |
| 3.00-02 | 5.5320+01        | 9.8060-01 | 5.6333+01 | 9.5720-01 | 5.7346+01 | 9.3770-01 |
| 4.00-02 | 5.4841+01        | 1.5777+00 | 5.5856+01 | 1.5590+00 | 5.6878+01 | 1.5304+00 |
| 5.00-02 | 5.4292+01        | 2.1966+00 | 5.5309+01 | 2.1950+00 | 5.6342+01 | 2.1620+00 |
| 7.00-02 | 5.3013+01        | 3.3564+00 | 5.3989+01 | 3.4326+00 | 5.5036+01 | 3.3896+00 |
| 9.00-02 | 5.1679+01        | 4.3976+00 | 5.2587+01 | 4.5424+00 | 5.3645+01 | 4.4987+00 |
| 1.00-01 | 5.0000+01        | 4.9020+00 | 5.1867+01 | 5.0680+00 | 5.2929+01 | 5.0250+00 |
| 1.25-01 | 4.9357+01        | 6.1754+00 | 5.0125+01 | 6.3669+00 | 5.1188+01 | 6.3245+00 |
| 1.50-01 | 4.7715+01        | 7.4684+00 | 4.8000+01 | 7.6710+00 | 4.9454+01 | 7.6340+00 |
| 1.75-01 | 4.6068+01        | 8.7405+00 | 4.6717+01 | 8.9563+00 | 4.7763+01 | 8.9301+00 |
| 2.00-01 | 4.4439+01        | 9.9760+00 | 4.5074+01 | 1.0204+01 | 4.6103+01 | 1.0190+01 |
| 2.50-01 | 4.1277+01        | 1.2343+01 | 4.1887+01 | 1.2583+01 | 4.2862+01 | 1.2592+01 |
| 3.00-01 | 3.8407+01        | 1.4544+01 | 3.8997+01 | 1.4814+01 | 3.9200+01 | 1.4844+01 |
| 4.00-01 | 3.3652+01        | 1.8201+01 | 3.4207+01 | 1.8603+01 | 3.4951+01 | 1.8713+01 |
| 5.00-01 | 2.9775+01        | 2.1073+01 | 3.0345+01 | 2.1555+01 | 3.0981+01 | 2.1737+01 |
| 6.00-01 | 2.6431+01        | 2.3655+01 | 2.7010+01 | 2.4109+01 | 2.7573+01 | 2.4334+01 |
| 7.00-01 | 2.1590+01        | 2.6083+01 | 2.4333+01 | 2.6502+01 | 2.4626+01 | 2.6750+01 |
| 8.00-01 | 2.1269+01        | 2.8359+01 | 2.1740+01 | 2.8755+01 | 2.2163+01 | 2.9055+01 |
| 9.00-01 | 1.9424+01        | 3.0453+01 | 1.9812+01 | 3.0854+01 | 2.0169+01 | 3.1143+01 |
| 1.00+00 | 1.7954+01        | 3.2336+01 | 1.8273+01 | 3.2758+01 | 1.8576+01 | 3.3083+01 |
| 1.25+00 | 1.5210+01        | 3.6100+01 | 1.5469+01 | 3.6622+01 | 1.5714+01 | 3.7075+01 |
| 1.50+00 | 1.2894+01        | 3.8836+01 | 1.3202+01 | 3.9438+01 | 1.3483+01 | 4.0001+01 |
| 2.00+00 | 8.1052+00        | 4.2784+01 | 9.2253+00 | 4.3443+01 | 9.5267+00 | 4.4104+01 |
| 2.50+00 | 6.4336+00        | 4.5605+01 | 6.6302+00 | 4.6301+01 | 6.8321+00 | 4.7006+01 |
| 3.00+00 | 5.4686+00        | 4.7709+01 | 5.6045+00 | 4.8436+01 | 5.7439+00 | 4.9175+01 |
| 7.00+00 | 1.5106+00        | 5.4055+01 | 1.6608+00 | 5.4981+01 | 1.7128+00 | 5.5906+01 |
| 8.00+00 | 4.5036+00        | 4.9336+01 | 4.5788+00 | 5.0094+01 | 4.6557+00 | 5.0860+01 |
| 4.00+00 | 3.1642+00        | 5.0615+01 | 4.4446+00 | 5.1403+01 | 4.1253+00 | 5.2197+01 |
| 5.00+00 | 2.3854+00        | 5.2383+01 | 2.9761+00 | 5.3233+01 | 3.0644+00 | 5.4083+01 |
| 6.00+00 | 2.0990+00        | 5.3424+01 | 2.1731+00 | 5.4320+01 | 2.2471+00 | 5.5217+01 |
| 7.00+00 | 1.5106+00        | 5.4055+01 | 1.6608+00 | 5.7000+01 | 1.7128+00 | 5.5906+01 |
| 8.00+00 | 1.4241+00        | 5.4477+01 | 1.4633+00 | 5.5419+01 | 1.5038+00 | 5.6361+01 |
| 1.00+01 | 1.0512+00        | 5.5038+01 | 1.0683+00 | 5.5995+01 | 1.0858+00 | 5.6951+01 |
| 1.50+01 | 7.0983-01        | 5.5713+01 | 7.2360-01 | 5.6692+01 | 7.4625-01 | 5.7671+01 |
| 2.00+01 | 4.1335-01        | 5.5917+01 | 4.3155-01 | 5.6902+01 | 4.4995-01 | 5.7901+01 |
| 5.00+01 | 3.5014-02        | 5.6000+01 | 3.7656-02 | 5.7000+01 | 4.0442-02 | 5.8000+01 |
| 8.00+01 | 7.8387-03        | 5.6000+01 | 8.5133-03 | 5.7000+01 | 9.2343-03 | 5.8000+01 |
| 1.00+01 | 5.5970+01        | 3.1000-02 | 5.6964+01 | 3.0000-02 | 5.7963+01 | 2.9000-02 |
| 1.50+01 | 5.5912+01        | 1.2400-01 | 5.6909+01 | 1.1900-01 | 5.7909+01 | 1.1600-01 |
| 2.00+01 | 5.5823+01        | 2.7230-01 | 5.6827+01 | 2.6220-01 | 5.7831+01 | 2.5620-01 |
| 5.00+01 | 5.5688+01        | 4.7070-01 | 5.6695+01 | 4.5500+01 | 5.7702+01 | 4.4490-01 |
| 8.00+01 | 7.8387-03        | 5.6000+01 | 8.5133-03 | 5.7000+01 | 9.2343-03 | 5.8000+01 |
| 1.00+02 | 3.8103-03        | 5.6000+01 | 7.0000+01 | 5.7000+01 | 4.2338-03 | 5.8000+01 |
| 1.00+03 | 3.2058-06        | 5.6000+01 | 3.5947-06 | 5.7000+01 | 4.0254-06 | 5.8000+01 |
| 1.00+06 | 9.6656-15        | 5.6000+01 | 1.3368-14 | 5.7000+01 | 1.3370-14 | 5.9000+01 |
| 1.00+01 | 3.9747-23        | 5.7000+01 | 3.9747-23 | 5.8000+01 | 4.8975-23 | 5.9000+01 |

TABLE I., CONT.

| $\chi$                         | 61 PM        | 62 SM        | 63 EU        | 64 GD        | 65 TB        |
|--------------------------------|--------------|--------------|--------------|--------------|--------------|
| $\sin(\theta/\lambda)/\lambda$ | $F(\chi, z)$ | $S(\chi, z)$ | $F(\chi, z)$ | $S(\chi, z)$ | $F(\chi, z)$ |
| 0.00                           | 6.1000+01    | 0.0000       | 6.2000+01    | 0.0000       | 6.4000+01    |
| 5.00-03                        | 6.0967+01    | 2.8000-02    | 6.1966+01    | 2.8000-02    | 6.2966+01    |
| 1.00-02                        | 6.0915+01    | 1.1200-01    | 6.1916+01    | 1.0000-01    | 6.3912+01    |
| 1.50-02                        | 6.0840+01    | 2.4750-01    | 6.1843+01    | 2.4310+01    | 6.3890-01    |
| 2.00-02                        | 6.0718+01    | 4.2930-01    | 6.1724+01    | 4.2180-01    | 6.2728+01    |
| 2.50-02                        | 6.0565+01    | 6.5030-01    | 6.1573+01    | 6.3950-01    | 6.2581+01    |
| 3.00-02                        | 6.0384+01    | 9.0270-01    | 6.1395+01    | 8.8830-01    | 6.2045+01    |
| 4.00-02                        | 5.9945+01    | 1.4694+00    | 6.0963+01    | 1.4483+00    | 6.1980+01    |
| 5.00-02                        | 5.9442+01    | 2.0710+00    | 6.0468+01    | 2.0450+00    | 6.1493+01    |
| 7.00-02                        | 5.8222+01    | 3.2373+00    | 5.9268+01    | 2.2067+00    | 6.0307+01    |
| 9.00-02                        | 5.6937+01    | 4.3038+00    | 5.7988+01    | 4.2721+00    | 5.9037+01    |
| 1.00-01                        | 5.6269+01    | 4.8180+00    | 5.9325+01    | 4.7860+00    | 5.8379+01    |
| 1.25-01                        | 5.4632+01    | 6.1117+00    | 5.5694+01    | 6.0762+00    | 5.6756+01    |
| 1.50-01                        | 5.2962+01    | 7.4322+00    | 5.4026+01    | 7.3950+00    | 5.5010+01    |
| 1.75-01                        | 5.1287+01    | 8.7425+00    | 5.2353+01    | 8.7080+00    | 5.3422+01    |
| 2.00-01                        | 4.9598+01    | 1.0014+01    | 5.0659+01    | 9.9840+00    | 5.1725+01    |
| 2.50-01                        | 4.6204+01    | 1.2426+01    | 4.7240+01    | 1.2401+01    | 4.8250+01    |
| 3.00-01                        | 4.3012+01    | 1.4682+01    | 4.4002+01    | 1.4661+01    | 4.5005+01    |
| 4.00-01                        | 3.7526+01    | 1.8644+01    | 3.3844+01    | 1.8652+01    | 3.9264+01    |
| 5.00-01                        | 3.3111+01    | 2.1856+01    | 3.3849+01    | 2.1919+01    | 3.4069+01    |
| 6.00-01                        | 2.9374+01    | 2.4634+01    | 3.0017+01    | 2.4741+01    | 3.0680+01    |
| 7.00-01                        | 2.6156+01    | 2.7153+01    | 2.6125+01    | 2.7325+01    | 2.7192+01    |
| 8.00-01                        | 2.3453+01    | 2.9529+01    | 2.3930+01    | 2.9730+01    | 2.4423+01    |
| 9.00-01                        | 2.1252+01    | 3.1776+01    | 2.1652+01    | 3.1975+01    | 2.0866+01    |
| 1.00+00                        | 1.9493+01    | 3.3832+01    | 1.9826+01    | 3.4062+01    | 2.0170+01    |
| 1.25+00                        | 1.6415+01    | 3.8212+01    | 1.6646+01    | 3.8554+01    | 1.6878+01    |
| 1.50+00                        | 1.4232+01    | 4.1522+01    | 1.4460+01    | 4.1953+01    | 1.4679+01    |
| 2.00+00                        | 1.0386+01    | 4.6040+01    | 1.0664+01    | 4.6669+01    | 1.0913+01    |
| 2.50+00                        | 7.4747+00    | 4.9119+01    | 7.7021+00    | 4.9816+01    | 7.9320+00    |
| 3.00+00                        | 6.1860+00    | 5.1398+01    | 6.3423+00    | 5.2136+01    | 6.5020+00    |
| 3.50+00                        | 4.8974+00    | 5.3166+01    | 4.9825+00    | 5.3932+01    | 5.0710+00    |
| 4.00+00                        | 4.3712+00    | 5.4579+01    | 4.4548+00    | 5.5399+00    | 4.6159+00    |
| 5.00+00                        | 3.3188+00    | 5.6621+01    | 3.3995+00    | 5.7461+01    | 3.4777+00    |
| 6.00+00                        | 2.4764+00    | 5.7892+01    | 2.5535+00    | 5.8777+01    | 2.6301+00    |
| 7.00+00                        | 1.8776+00    | 5.8674+01    | 1.9374+00    | 5.9592+01    | 1.9984+00    |
| 8.00+00                        | 1.6318+00    | 5.9181+01    | 1.6783+00    | 6.0119+01    | 1.7260+00    |
| 1.00+01                        | 1.1402+00    | 5.9821+01    | 1.1601+00    | 6.0777+01    | 1.1811+00    |
| 1.50+01                        | 8.1325+01    | 6.0605+01    | 8.3523+01    | 6.1581+01    | 8.4771+01    |
| 2.00+01                        | 5.0614+01    | 6.0874+01    | 5.2514+01    | 6.1864+01    | 5.4426+01    |
| 5.00+01                        | 4.9713+02    | 6.0993+01    | 5.3123+02    | 6.1999+01    | 5.6701+02    |
| 8.00+01                        | 1.1700-02    | 6.1000+01    | 1.2632-02    | 6.2000+01    | 1.3624-02    |
| 1.00+02                        | 5.8012-03    | 6.1000+01    | 6.2889-03    | 6.2000+01    | 6.8105-03    |
| 1.50+02                        | 5.6215-06    | 6.1000+01    | 6.2729-06    | 6.2000+01    | 6.9944-06    |
| 2.00+02                        | 2.1751-14    | 6.1000+01    | 2.5587-14    | 6.2000+01    | 3.0108-14    |
| 1.00+09                        | 9.2179-23    | 6.1000+01    | 1.1407-22    | 6.2000+01    | 1.4134-22    |

TABLE I. CONT.

| SIN(THETA/2) | X <sub>λ</sub> | 66 DY     | 67 HO      | 68 EF     | 69 TM      | 70 YB     |
|--------------|----------------|-----------|------------|-----------|------------|-----------|
| F(X,Z)       | S(X,Z)         | F(X,Z)    | S(X,Z)     | F(X,Z)    | S(X,Z)     | F(X,Z)    |
| 0.00         | 6.6000+01      | 0.00000   | 6.70000+01 | 0.00000   | 6.80000+01 | 0.00000   |
| 5.00-03      | 6.5966+01      | 2.6000-02 | 6.6666+01  | 2.5000-02 | 6.7666+01  | 2.5000-02 |
| 1.00-02      | 6.5919+01      | 1.0300-01 | 6.6320+01  | 1.0100-01 | 6.7921+01  | 9.9000-02 |
| 1.50-02      | 6.5854+01      | 2.2720-01 | 6.6556+01  | 2.2360-01 | 6.7858+01  | 2.2020-01 |
| 2.00-02      | 6.5742+01      | 3.9500-01 | 6.6746+01  | 3.8890-01 | 6.7750+01  | 3.8310-01 |
| 2.50-02      | 6.5602+01      | 6.0000-01 | 6.6608+01  | 5.9110-01 | 6.7614+01  | 5.8240-01 |
| 3.00-02      | 6.5434+01      | 8.3560-01 | 6.6643+01  | 8.2360-01 | 6.7452+01  | 8.1190-01 |
| 4.00-02      | 6.5028+01      | 1.3701+00 | 6.6463+01  | 1.3521+00 | 6.7057+01  | 1.3346+00 |
| 5.00-02      | 6.4562+01      | 1.9460+00 | 6.5584+01  | 1.9230+00 | 6.6004+01  | 1.9010+00 |
| 7.00-02      | 6.3416+01      | 3.0873+00 | 6.4450+01  | 3.0585+00 | 6.5433+01  | 3.0302+00 |
| 9.00-02      | 6.2180+01      | 4.1444+00 | 6.3225+01  | 4.1128+00 | 6.4270+01  | 4.0815+00 |
| 1.00-01      | 6.1538+01      | 4.6540+00 | 6.2589+01  | 4.6210+00 | 6.3638+01  | 4.5880+00 |
| 1.25-01      | 5.9939+01      | 5.9312+00 | 6.0999+01  | 5.9374+00 | 6.2057+01  | 5.8656+00 |
| 1.50-01      | 5.8290+01      | 7.2450+00 | 5.9357+01  | 7.2040+00 | 6.0422+01  | 7.1640+00 |
| 1.75-01      | 5.6635+01      | 8.5686+00 | 5.7707+01  | 8.5283+00 | 5.8779+01  | 8.4875+00 |
| 2.00-01      | 5.4938+01      | 9.8670+00 | 5.6012+01  | 9.8300+00 | 5.7086+01  | 9.7920+00 |
| 2.50-01      | 5.1458+01      | 1.2335+01 | 5.2250+01  | 1.2308+01 | 5.3525+01  | 1.2279+01 |
| 3.00-01      | 4.8079+01      | 1.4647+01 | 4.9200+01  | 1.4628+01 | 5.0168+01  | 1.4609+01 |
| 4.00-01      | 4.2011+01      | 1.8799+01 | 4.2557+01  | 1.8810+01 | 4.3916+01  | 1.8817+01 |
| 5.00-01      | 3.7007+01      | 2.2282+01 | 3.7842+01  | 2.2338+01 | 3.8693+01  | 2.2387+01 |
| 6.00-01      | 3.2779+01      | 2.5284+01 | 3.3514+01  | 2.5383+01 | 3.4265+01  | 2.5471+01 |
| 7.00-01      | 2.9124+01      | 2.8001+01 | 2.9768+01  | 2.8137+01 | 3.0420+01  | 2.8058+01 |
| 8.00-01      | 2.5999+01      | 3.0512+01 | 2.6557+01  | 3.0678+01 | 2.7131+01  | 3.0830+01 |
| 9.00-01      | 2.3396+01      | 3.2845+01 | 2.3871+01  | 3.3039+01 | 2.4362+01  | 3.3216+01 |
| 1.00-00      | 2.1277+01      | 3.5021+01 | 2.1674+01  | 3.5240+01 | 2.2086+01  | 3.5440+01 |
| 1.25+00      | 1.7595+01      | 3.9832+01 | 1.7846+01  | 4.0121+01 | 1.8105+01  | 4.0387+01 |
| 1.50+00      | 1.5296+01      | 4.3713+01 | 1.5930+01  | 4.4101+01 | 1.5638+01  | 4.4463+01 |
| 2.00+00      | 1.1686+01      | 4.9082+01 | 1.1918+01  | 4.9656+01 | 1.2141+01  | 5.0210+01 |
| 2.50+00      | 8.6356+00      | 5.2567+01 | 5.3241+01  | 5.3039+01 | 5.3906+01  | 5.3668+01 |
| 3.00+00      | 6.9987+00      | 5.5073+01 | 7.1869+00  | 5.5803+01 | 7.3408+00  | 5.6528+01 |
| 7.00+00      | 2.1867+00      | 6.3244+01 | 2.2220+00  | 6.4151+01 | 2.3168+00  | 6.5057+01 |
| 8.00+00      | 1.8746+00      | 6.3858+01 | 1.9259+00  | 6.4789+01 | 1.9772+00  | 6.5775+00 |
| 1.00+01      | 1.2503+00      | 6.4596+01 | 1.2738+00  | 6.5550+01 | 1.2979+00  | 6.6504+01 |
| 1.20+01      | 9.2106-01      | 6.5483+01 | 9.4950-01  | 6.1631+00 | 3.8340+00  | 6.2460+01 |
| 1.50+01      | 6.0211-01      | 6.5820+01 | 6.2152-01  | 6.6808+01 | 3.0094+00  | 6.4037+01 |
| 2.00+01      | 6.8488-02      | 6.5999+01 | 7.2785-02  | 6.6999+01 | 7.7273-02  | 6.7799+01 |
| 8.00+01      | 1.6986-02      | 6.6000+01 | 1.8247-02  | 6.7000+01 | 1.9583-02  | 6.8000+01 |
| 1.00+02      | 8.5990-03      | 6.6000+01 | 9.2769-03  | 6.7000+01 | 9.9994-03  | 6.8000+01 |
| 1.00+03      | 9.6554-06      | 6.6000+01 | 1.037-05   | 6.7000+01 | 1.1934-05  | 6.8000+01 |
| 1.00+06      | 4.9144-14      | 6.6000+01 | 5.7910-14  | 6.7000+01 | 6.8275-14  | 6.8000+01 |
| 1.00+09      | 2.7110-22      | 6.6000+01 | 3.3785-22  | 6.7000+01 | 4.2171-22  | 6.8000+01 |

TABLE I. - CONT.

| SIN(THETA/2)<br>/LAMBDA | ATOMIC FORM FACTOR, F(X,Z), AND INCOHERENT SCATTERING FUNCTION, S(X,Z) |           |           |           |           |           | 75 RE     |           |
|-------------------------|------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                         | X,<br>71 LU                                                            | F(X,Z)    | S(X,Z)    | F(X,Z)    | S(X,Z)    | F(X,Z)    | S(X,Z)    | F(X,Z)    |
| 0.00                    | 7.1000+01                                                              | 0.0000    | 7.2000+01 | 0.0000    | 7.3000+01 | 0.0000    | 7.4000+01 | 0.0000    |
| 5.00+03                 | 7.0962+01                                                              | 2.4000+02 | 7.1959+01 | 2.3000+02 | 7.2959+01 | 2.2000+02 | 7.3960+01 | 2.1000+02 |
| 1.00+02                 | 7.0919+01                                                              | 9.3000+02 | 7.1917+01 | 9.0000+02 | 7.2917+01 | 8.7000+02 | 7.3919+01 | 8.3000+02 |
| 1.50+02                 | 7.0865+01                                                              | 2.0740+01 | 7.1867+01 | 1.9980+01 | 7.2870+01 | 1.9250+01 | 7.3873+01 | 1.8590+01 |
| 2.00+02                 | 7.0761+01                                                              | 3.6200+01 | 7.1766+01 | 3.4950+01 | 7.2771+01 | 3.3730+01 | 7.3775+01 | 3.2590+01 |
| 2.50+02                 | 7.0630+01                                                              | 5.5270+01 | 7.1637+01 | 5.3480+01 | 7.2644+01 | 5.1700+01 | 7.3651+01 | 5.0010+01 |
| 3.00+02                 | 7.0473+01                                                              | 7.7420+01 | 7.1482+01 | 7.5110+01 | 7.2492+01 | 7.2750+01 | 7.4511+01 | 7.0490+01 |
| 4.00+02                 | 7.0090+01                                                              | 1.2865+00 | 7.1022+01 | 1.2560+00 | 7.2117+01 | 1.2221+00 | 7.3132+01 | 1.1884+00 |
| 5.00+02                 | 6.9646+01                                                              | 1.8540+00 | 7.0660+01 | 1.8230+00 | 7.1675+01 | 1.7830+00 | 7.2697+01 | 1.7410+00 |
| 7.00+02                 | 6.8521+01                                                              | 3.0186+00 | 6.9528+01 | 3.0089+00 | 7.0547+01 | 2.9742+00 | 7.1572+01 | 2.9291+00 |
| 9.00+02                 | 6.7280+01                                                              | 4.1145+00 | 6.8259+01 | 4.1424+00 | 6.9262+01 | 4.1285+00 | 7.0280+01 | 4.0946+00 |
| 1.00+01                 | 6.6635+01                                                              | 4.6344+00 | 6.7601+01 | 4.6790+00 | 6.8595+01 | 4.6760+00 | 6.9606+01 | 4.6490+00 |
| 1.25+01                 | 6.4989+01                                                              | 5.9002+00 | 6.5888+01 | 5.9695+00 | 6.6832+01 | 5.9877+00 | 6.7805+01 | 5.9666+00 |
| 1.50+01                 | 6.3301+01                                                              | 7.1760+00 | 6.4135+01 | 7.2540+00 | 6.5024+01 | 7.2505+00 | 6.5953+01 | 7.2380+00 |
| 1.75+01                 | 6.1646+01                                                              | 8.4711+00 | 6.2434+01 | 8.5318+00 | 6.3271+01 | 8.5350+00 | 6.4149+01 | 8.5057+00 |
| 2.00+01                 | 5.9951+01                                                              | 9.7620+00 | 6.0701+01 | 9.8150+00 | 6.1491+01 | 9.8110+00 | 6.2321+01 | 9.7730+00 |
| 2.50+01                 | 5.6495+01                                                              | 1.2254+01 | 5.7299+01 | 1.2305+01 | 5.7971+01 | 1.2354+01 | 6.2368+01 | 1.2222+01 |
| 3.00+01                 | 5.3079+01                                                              | 1.4807+01 | 5.3828+01 | 1.4667+01 | 5.4555+01 | 1.4663+01 | 5.5275+01 | 1.4671+01 |
| 4.00+01                 | 4.6693+01                                                              | 1.8919+01 | 4.7460+01 | 1.9037+01 | 4.8183+01 | 1.9123+01 | 4.8877+01 | 1.9193+01 |
| 5.00+01                 | 4.1239+01                                                              | 2.2640+01 | 4.2003+01 | 2.2850+01 | 4.2731+01 | 2.3042+01 | 4.3424+01 | 2.3224+01 |
| 6.00+01                 | 3.6575+01                                                              | 2.5838+01 | 3.7320+01 | 2.6110+01 | 3.8043+01 | 2.6385+01 | 3.8740+01 | 2.6662+01 |
| 7.00+01                 | 3.2513+01                                                              | 2.8679+01 | 3.3225+01 | 2.8989+01 | 3.3930+01 | 2.9288+01 | 3.4621+01 | 2.9621+01 |
| 8.00+01                 | 2.8983+01                                                              | 3.1332+01 | 2.9647+01 | 3.1624+01 | 3.0317+01 | 3.1938+01 | 3.0986+01 | 3.2273+01 |
| 9.00+01                 | 2.5972+01                                                              | 3.3778+01 | 2.6572+01 | 3.4070+01 | 2.7188+01 | 3.4335+01 | 2.7813+01 | 3.4719+01 |
| 1.00+00                 | 2.3454+01                                                              | 3.6059+01 | 2.3978+01 | 3.6354+01 | 2.4522+01 | 3.6669+01 | 2.5083+01 | 3.7003+01 |
| 1.25+00                 | 1.8957+01                                                              | 4.1159+01 | 1.9282+01 | 4.1465+01 | 1.9628+01 | 4.1465+01 | 1.9994+01 | 4.2123+01 |
| 1.50+00                 | 1.6279+01                                                              | 4.5711+01 | 1.6884+01 | 4.7711+01 | 1.6705+01 | 4.8180+01 | 1.6168+01 | 4.6756+01 |
| 2.00+00                 | 1.2759+01                                                              | 5.1782+01 | 1.2952+01 | 5.2285+01 | 1.3138+01 | 5.2777+01 | 1.3315+01 | 5.3262+01 |
| 2.50+00                 | 9.7895+00                                                              | 5.5846+01 | 1.0019+01 | 5.6475+01 | 1.0233+01 | 5.7095+01 | 1.0464+01 | 5.7707+01 |
| 3.00+00                 | 7.8673+00                                                              | 8.0485+00 | 5.9375+01 | 8.2304+00 | 6.0072+01 | 8.4128+00 | 6.0764+01 | 8.5951+00 |
| 3.50+00                 | 5.9450+00                                                              | 6.0785+01 | 6.0784+00 | 6.1532+01 | 6.2174+00 | 6.2277+01 | 6.3621+00 | 6.3018+01 |
| 4.00+00                 | 5.3044+00                                                              | 6.2851+01 | 5.4138+00 | 6.3227+01 | 5.5264+00 | 6.4002+01 | 5.6424+00 | 6.4775+01 |
| 5.00+00                 | 4.0243+00                                                              | 6.4936+01 | 4.0846+00 | 6.5755+01 | 4.1441+00 | 6.6572+01 | 4.2031+00 | 6.7388+01 |
| 6.00+00                 | 3.2161+00                                                              | 6.6633+01 | 3.2842+00 | 6.7492+01 | 3.3505+00 | 6.8348+01 | 3.4150+00 | 6.9218+01 |
| 7.00+00                 | 2.5134+00                                                              | 6.7759+01 | 2.5806+00 | 6.8653+01 | 2.6457+01 | 6.9245+01 | 2.7103+00 | 7.0435+01 |
| 8.00+00                 | 2.1334+00                                                              | 6.8497+01 | 2.1874+00 | 6.9419+01 | 2.2404+00 | 7.0334+01 | 2.2933+00 | 7.1256+01 |
| 1.00+01                 | 1.3734+00                                                              | 6.9361+01 | 1.4010+00 | 7.0311+01 | 1.4298+00 | 7.1261+01 | 1.4598+00 | 7.2210+01 |
| 1.50+01                 | 1.0230+00                                                              | 7.0351+01 | 1.0427+00 | 7.1323+01 | 1.0621+00 | 7.2226+01 | 1.0812+00 | 7.3267+01 |
| 2.00+01                 | 6.9941+01                                                              | 7.0755+01 | 7.1889+01 | 7.1741+01 | 7.3834+01 | 7.2726+01 | 7.5777+01 | 7.3711+01 |
| 5.00+01                 | 9.1934+02                                                              | 7.0998+01 | 9.7236+02 | 7.1998+01 | 1.0275+01 | 7.2938+01 | 1.0849+01 | 7.3998+01 |
| 8.00+01                 | 2.4081+02                                                              | 7.1000+01 | 2.5756+02 | 7.2000+01 | 2.4074+02 | 7.2930+01 | 2.9394+02 | 7.4000+01 |
| 1.00+02                 | 1.2460+02                                                              | 7.1000+01 | 1.3387+02 | 7.2000+01 | 1.4372+02 | 7.3000+01 | 1.5418+02 | 7.4000+01 |
| 1.50+02                 | 1.6333+02                                                              | 7.1000+01 | 1.8118+02 | 7.2000+01 | 2.0090+02 | 7.3000+01 | 2.2268+02 | 7.4000+01 |
| 2.00+02                 | 1.1229+13                                                              | 7.1000+01 | 1.3272+13 | 7.2000+01 | 1.5701+13 | 7.3000+01 | 1.8578+13 | 7.4000+01 |
| 1.00+03                 | 1.00+06                                                                | 7.1000+01 | 1.0418+21 | 7.2000+01 | 1.3123+21 | 7.3000+01 | 1.6564+21 | 7.4000+01 |
| 1.00+09                 | 8.2867+22                                                              | 7.1000+01 | 8.2867+22 | 7.1000+01 | 8.2867+22 | 7.1000+01 | 8.0951+21 | 7.5000+01 |

TABLE I. CONT.  
ATOMIC FORM FACTOR,  $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION,  $S(X, Z)$ 

| $\chi_*$<br>/LAMBDA | 76 QS     | 77 TR     | 78 PT     | 79 AU     | 80 HG     |           |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| SIN(THETA/2)        | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ | $S(X, Z)$ | $F(X, Z)$ |           |
| 0.00                | 7.6000+01 | 0.0000    | 7.7000+01 | 0.0000    | 7.8000+01 | 0.0000    |
| 5.00+03             | 7.5965+01 | 2.0000-02 | 7.6968+01 | 1.9000-02 | 7.7972+01 | 1.6000-02 |
| 1.00-02             | 7.5926+01 | 7.8000-02 | 7.6930+01 | 7.6000-02 | 7.7937+01 | 6.4000-02 |
| 1.50-02             | 7.5878+01 | 1.7410-01 | 7.6880+01 | 1.6880-01 | 7.7892+01 | 1.4200-01 |
| 2.00-02             | 7.5784+01 | 3.0560-01 | 7.6788+01 | 2.9660-01 | 7.7809+01 | 2.4980-01 |
| 2.50-02             | 7.5665+01 | 4.7000-01 | 7.6671+01 | 4.5660-01 | 7.7702+01 | 3.8520-01 |
| 3.00-02             | 7.5520+01 | 6.6400-01 | 7.6529+01 | 6.4570-01 | 7.7574+01 | 5.4590-01 |
| 4.00-02             | 7.5163+01 | 1.1262+00 | 7.6177+01 | 1.0977+00 | 7.7253+01 | 9.3300-01 |
| 5.00-02             | 7.4734+01 | 1.6610+00 | 7.5733+01 | 1.6240+00 | 7.6865+01 | 1.3900+00 |
| 7.00-02             | 7.3630+01 | 2.8368+00 | 7.4661+01 | 2.7909+00 | 7.5854+01 | 2.4347+00 |
| 9.00-02             | 7.2338+01 | 4.0201+00 | 7.3373+01 | 3.804+00  | 7.4638+01 | 3.5557+00 |
| 1.00-01             | 7.1653+01 | 4.5900+00 | 7.2688+01 | 4.5580+00 | 7.3976+01 | 4.1230+00 |
| 1.25-01             | 6.9810+01 | 5.9469+00 | 7.0833+01 | 5.3818+00 | 7.2162+01 | 5.5322+00 |
| 1.50-01             | 6.7893+01 | 7.2440+00 | 6.8893+01 | 7.2580+00 | 7.0212+01 | 6.9170+00 |
| 1.75-01             | 6.5999+01 | 8.5207+00 | 6.6961+01 | 8.5542+00 | 6.8220+01 | 8.2699+00 |
| 2.00-01             | 6.4083+01 | 9.7910+00 | 6.5006+01 | 9.8410+00 | 6.6180+01 | 9.5890+00 |
| 2.50-01             | 6.0331+01 | 1.2294+01 | 6.1170+01 | 1.2367+01 | 6.2139+01 | 1.2130+01 |
| 3.00-01             | 5.6745+01 | 1.4715+01 | 5.7500+01 | 1.4803+01 | 5.8291+01 | 1.4583+01 |
| 4.00-01             | 5.0213+01 | 1.9321+01 | 5.0873+01 | 1.9427+01 | 5.1466+01 | 1.9337+01 |
| 5.00-01             | 4.4725+01 | 2.3533+01 | 4.5324+01 | 2.3694+01 | 4.5893+01 | 2.3766+01 |
| 6.00-01             | 4.0049+01 | 2.7177+01 | 4.0663+01 | 2.7429+01 | 4.1237+01 | 2.7638+01 |
| 7.00-01             | 3.5947+01 | 3.0274+01 | 3.6577+01 | 3.0602+01 | 3.7192+01 | 3.0910+01 |
| 8.00-01             | 3.2306+01 | 3.2981+01 | 3.2949+01 | 3.3349+01 | 3.3589+01 | 3.3713+01 |
| 9.00-01             | 2.9079+01 | 3.5437+01 | 2.9711+01 | 3.5817+01 | 3.0347+01 | 3.6204+01 |
| 1.00+00             | 2.6244+01 | 3.7719+01 | 2.6836+01 | 3.8100+01 | 2.7439+01 | 3.8491+01 |
| 1.25+00             | 2.0790+01 | 4.2839+01 | 2.1219+01 | 4.3217+01 | 2.1664+01 | 4.3610+01 |
| 1.50+00             | 1.7422+01 | 4.7266+01 | 1.7687+01 | 4.7651+01 | 1.7965+01 | 4.8049+01 |
| 2.00+00             | 1.3651+01 | 5.4211+01 | 1.3812+01 | 5.4678+01 | 1.3970+01 | 5.5142+01 |
| 2.50+00             | 1.0886+01 | 5.8908+01 | 1.1084+01 | 5.9496+01 | 1.1282+01 | 6.0077+01 |
| 3.00+00             | 8.7769+00 | 6.2134+01 | 8.9578+00 | 6.2811+01 | 9.1378+00 | 6.3483+01 |
| 3.50+00             | 6.6678+00 | 6.4491+01 | 6.8232+00 | 6.5223+01 | 6.9934+00 | 6.5953+01 |
| 4.00+00             | 5.8853+00 | 6.6314+01 | 6.0117+00 | 6.7081+01 | 6.1414+00 | 6.7847+01 |
| 5.00+00             | 4.3203+00 | 6.9013+01 | 4.3768+00 | 6.9824+01 | 4.4374+00 | 7.0633+01 |
| 6.00+00             | 3.5388+00 | 7.0902+01 | 3.5981+00 | 7.1749+01 | 3.6552+00 | 7.2593+01 |
| 7.00+00             | 2.8399+00 | 7.2206+01 | 2.9030+00 | 7.3088+01 | 2.9635+00 | 7.3968+01 |
| 8.00+00             | 2.4014+00 | 7.3085+01 | 2.4551+00 | 7.3997+01 | 2.5077+00 | 7.4906+01 |
| 1.00+01             | 1.5244+00 | 7.4106+01 | 1.5594+00 | 7.5052+01 | 1.5962+00 | 7.5997+01 |
| 1.50+01             | 1.1186+00 | 7.5210+01 | 1.1370+00 | 7.6181+01 | 1.1550+00 | 7.7152+01 |
| 2.00+01             | 7.9650+01 | 7.5680+01 | 8.1579+01 | 7.6663+01 | 8.3501+01 | 7.7647+01 |
| 2.50+01             | 1.2064+01 | 7.5998+01 | 1.2270+01 | 7.6997+01 | 1.3374+01 | 7.7997+01 |
| 3.00+01             | 3.3446+02 | 7.6000+01 | 3.5639+02 | 7.7000+01 | 3.7949+02 | 7.8000+01 |
| 4.00+02             | 1.7707+02 | 7.6000+01 | 1.8957+02 | 7.7000+01 | 2.0282+02 | 7.8000+01 |
| 5.00+02             | 1.00-02   | 7.5026+02 | 1.0269+02 | 7.6000+02 | 1.1550+02 | 7.8000+02 |
| 1.00+03             | 2.7333+05 | 7.6000+01 | 3.0269+05 | 7.7000+01 | 3.3512+05 | 7.8000+01 |
| 1.00+06             | 2.6120+13 | 7.6000+01 | 3.1009+13 | 7.7000+01 | 4.3841+13 | 7.8000+01 |
| 1.00+09             | 2.6558+21 | 7.6000+01 | 3.3741+21 | 7.7000+01 | 4.2969+21 | 7.8000+01 |

TABLE I. - CONT.

| X.<br>/LAMBDA | ATOMIC FORM FACTOR, F(X,Z), AND INCOHERENT SCATTERING FUNCTION, S(X,Z) |           |           |           |           |           | 85 AT     |           |
|---------------|------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|               | SIN(THETA/2)                                                           | F(X,Z)    | S(X,Z)    | F(X,Z)    | S(X,Z)    | F(X,Z)    | S(X,Z)    | F(X,Z)    |
| 0.00          | 8.1000+01                                                              | 0.0000    | 8.2000+01 | 0.0000    | 8.3000+01 | 0.0000    | 8.4000+01 | 0.0000    |
| 5.00+03       | 8.0973+01                                                              | 1.8000-02 | 8.1975+01 | 1.8000-02 | 8.2977+01 | 1.7000-02 | 8.3980+01 | 1.7000-02 |
| 1.00+02       | 8.0932+01                                                              | 7.3000-02 | 8.1932+01 | 7.2000-02 | 8.2933+01 | 7.0000-02 | 8.3936+01 | 6.8000-02 |
| 1.50+02       | 8.0873+01                                                              | 1.6200-01 | 8.1868+01 | 1.5980-01 | 8.2866+01 | 1.5580-01 | 8.3865+01 | 1.4760-01 |
| 2.00+02       | 8.0776+01                                                              | 2.8488+01 | 8.1167+01 | 2.8130-01 | 8.2763+01 | 2.7440-01 | 8.3761+01 | 2.6050-01 |
| 2.50+02       | 8.0652+01                                                              | 4.3870-01 | 8.1638+01 | 4.3390-01 | 8.2632+01 | 4.2350-01 | 8.3629+01 | 4.1350-01 |
| 3.00+02       | 8.0503+01                                                              | 6.2100-01 | 8.1482+01 | 6.1520-01 | 8.2473+01 | 5.0100-01 | 8.3469+01 | 5.8790-01 |
| 4.00+02       | 8.0133+01                                                              | 1.0580+00 | 8.1096+01 | 1.0528+00 | 8.2078+01 | 1.0304+00 | 8.3069+01 | 1.0126+00 |
| 5.00+02       | 7.9687+01                                                              | 1.5730+00 | 8.0626+01 | 1.5710+00 | 8.1592+01 | 1.5400+00 | 8.2575+01 | 1.5220+00 |
| 7.00+02       | 7.3549+01                                                              | 2.7370+00 | 7.9435+01 | 2.5544+00 | 8.0368+01 | 2.7146+00 | 8.1328+01 | 2.7120+00 |
| 9.00+02       | 7.7214+01                                                              | 3.9647+00 | 7.8834+01 | 4.0221+00 | 7.8914+01 | 3.9811+00 | 7.9834+01 | 4.0170+00 |
| 1.00+01       | 7.5495+01                                                              | 4.5750+00 | 7.7222+01 | 4.6580+00 | 7.8131+01 | 4.6220+00 | 7.9025+01 | 4.6820+00 |
| 1.25+01       | 7.4593+01                                                              | 6.0563+00 | 7.5302+01 | 6.2119+00 | 7.6070+01 | 6.2096+00 | 7.6890+01 | 6.3350+00 |
| 1.50+01       | 7.2604+01                                                              | 7.4600+00 | 7.3252+01 | 7.6940+00 | 7.3956+01 | 7.7570+00 | 7.4403+01 | 7.9450+00 |
| 1.75+01       | 7.0608+01                                                              | 8.7999+00 | 7.1236+01 | 9.0990+00 | 7.1877+01 | 9.2502+00 | 7.2548+01 | 9.4960+00 |
| 2.00+01       | 6.8596+01                                                              | 1.0096+01 | 6.9223+01 | 1.0437+01 | 6.9835+01 | 1.0676+01 | 7.0456+01 | 1.0976+01 |
| 2.50+01       | 6.4590+01                                                              | 1.2608+01 | 6.5210+01 | 1.2964+01 | 6.5950+01 | 1.3314+01 | 6.6880+01 | 1.3794+01 |
| 3.00+01       | 6.0712+01                                                              | 1.5041+01 | 6.1453+01 | 1.5368+01 | 6.2135+01 | 1.5734+01 | 6.2765+01 | 1.6133+01 |
| 4.00+01       | 5.3657+01                                                              | 1.9702+01 | 5.4423+01 | 1.9964+01 | 5.5173+01 | 2.0268+01 | 5.5893+01 | 2.0606+01 |
| 5.00+01       | 4.7780+01                                                              | 2.4127+01 | 4.8459+01 | 2.4337+01 | 4.9154+01 | 2.4586+01 | 4.9855+01 | 2.4863+01 |
| 6.00+01       | 4.2944+01                                                              | 2.8197+01 | 4.3529+01 | 2.8408+01 | 4.4131+01 | 2.8642+01 | 4.4750+01 | 2.8893+01 |
| 7.00+01       | 3.8876+01                                                              | 3.1750+01 | 3.9415+01 | 3.2020+01 | 3.9954+01 | 3.2294+01 | 4.0501+01 | 3.2568+01 |
| 8.00+01       | 3.5322+01                                                              | 3.4777+01 | 3.5858+01 | 3.5121+01 | 3.6377+01 | 3.5462+01 | 3.6889+01 | 3.5795+01 |
| 9.00+01       | 3.2114+01                                                              | 3.7390+01 | 3.2662+01 | 3.7790+01 | 3.3190+01 | 3.8190+01 | 3.3701+01 | 3.8581+01 |
| 1.00+00       | 2.9185+01                                                              | 3.9724+01 | 2.9741+01 | 4.0151+01 | 3.0281+01 | 4.0585+01 | 3.0804+01 | 4.1016+01 |
| 1.25+00       | 2.3103+01                                                              | 4.4844+01 | 2.3604+01 | 4.5277+01 | 2.4109+01 | 4.5722+01 | 2.4615+01 | 4.6177+01 |
| 1.50+00       | 1.8908+01                                                              | 4.9283+01 | 1.9220+01 | 4.9713+01 | 1.9628+01 | 5.0156+01 | 5.0702+01 | 5.1011+01 |
| 2.00+00       | 1.4434+01                                                              | 5.6529+01 | 1.4592+01 | 5.6993+01 | 1.4754+01 | 5.7459+01 | 1.4923+01 | 5.7930+01 |
| 2.50+00       | 1.1819+01                                                              | 6.1779+01 | 1.1949+01 | 6.2335+01 | 1.2140+01 | 6.2887+01 | 1.2229+01 | 6.3435+01 |
| 3.00+00       | 9.5644+00                                                              | 6.5461+01 | 9.8351+00 | 6.6108+01 | 1.0003+01 | 6.6751+01 | 1.0168+01 | 6.7387+01 |
| 3.50+00       | 7.5094+00                                                              | 6.8116+01 | 7.6867+00 | 6.8829+01 | 7.8655+00 | 6.9538+01 | 8.0452+00 | 7.0242+01 |
| 4.00+00       | 6.5460+00                                                              | 7.0129+01 | 6.6853+00 | 7.0885+01 | 6.8261+00 | 7.1638+01 | 6.9633+00 | 7.2389+01 |
| 5.00+00       | 4.6192+00                                                              | 7.3053+01 | 4.6825+00 | 7.3858+01 | 4.7474+00 | 7.4662+01 | 4.8144+00 | 7.5465+01 |
| 6.00+00       | 3.3192+00                                                              | 7.5111+01 | 3.8714+00 | 7.5956+01 | 3.9226+00 | 7.6793+01 | 3.9859+01 | 7.7628+01 |
| 7.00+00       | 3.1425+00                                                              | 7.6592+01 | 3.2009+00 | 7.7463+01 | 3.2579+00 | 7.8332+01 | 3.3136+00 | 7.9199+01 |
| 8.00+00       | 2.5664+00                                                              | 7.7620+01 | 2.7184+00 | 7.8521+01 | 2.7695+00 | 7.9419+01 | 2.8196+00 | 7.0242+00 |
| 1.00+01       | 1.7142+00                                                              | 7.8822+01 | 1.7534+00 | 7.9767+01 | 1.7927+00 | 8.0706+01 | 1.8317+00 | 7.1115+00 |
| 1.50+01       | 1.2076+00                                                              | 8.0063+01 | 1.2246+00 | 8.1033+01 | 1.2414+00 | 8.2002+01 | 1.2579+00 | 8.2972+01 |
| 2.00+01       | 8.3221+01                                                              | 8.0594+01 | 9.1110+01 | 8.1576+01 | 9.2989+01 | 8.2558+01 | 9.4859+01 | 8.3539+01 |
| 5.00+01       | 1.5521+01                                                              | 8.0996+01 | 1.6288+01 | 8.1996+01 | 1.7081+01 | 8.2996+01 | 1.7901+01 | 8.3995+01 |
| 8.00+01       | 4.5637+02                                                              | 8.1000+01 | 4.8470+02 | 8.2000+01 | 5.1448+02 | 8.3000+01 | 5.4578+02 | 8.4000+01 |
| 1.00+02       | 2.4749+02                                                              | 8.1000+01 | 2.6445+02 | 8.2000+01 | 2.8179+02 | 8.3000+01 | 3.0044+02 | 8.4000+01 |
| 1.50+02       | 1.2076+00                                                              | 8.0063+01 | 1.2246+00 | 8.1033+01 | 5.0257+05 | 8.2000+01 | 6.1501+05 | 8.4000+01 |
| 2.00+02       | 8.3221+01                                                              | 8.0594+01 | 9.1110+01 | 8.1576+01 | 8.2989+01 | 8.3000+01 | 9.6717+01 | 8.4520+01 |
| 1.00+03       | 4.5425+05                                                              | 8.1000+01 | 4.6825+00 | 7.3858+01 | 7.4347+13 | 8.2000+01 | 8.8855+13 | 7.8463+01 |
| 1.00+06       | 6.2268+13                                                              | 8.1000+01 | 7.1586+20 | 8.2000+01 | 1.4945+20 | 8.3000+01 | 1.9333+20 | 2.5084+20 |
| 1.00+09       | 9.0060+21                                                              | 8.1000+01 | 9.0060+21 | 8.1000+01 | 9.0060+21 | 8.1000+01 | 9.0064+01 | 8.0064+01 |

TABLE I., CONT.

| X <sub>•</sub> |           | 86 RN     |           | 87 FR     |           | 88 RA     |           | 89 AC     |           | 90 TH     |           |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| SIN(THETAT/2)  | /LAMBDA   | F(X,Z)    | S(X,Z)    |
| 0.00           | 8.6000+01 | 0.0000    | 8.7000+01 | 0.0000    | 8.8000+01 | 0.0000    | 8.9000+01 | 0.0000    | 9.0000+01 | 0.0000    | 9.0000+01 |
| 5.00-03        | 8.5984+01 | 1.6000-02 | 8.6969+01 | 3.1000-02 | 8.7568+01 | 3.6000-02 | 8.8963+01 | 3.5000-02 | 8.9959+01 | 3.4000-02 | 8.9959+01 |
| 1.00-02        | 8.5940+01 | 6.4000-02 | 8.6905+01 | 1.2200-01 | 8.7897+01 | 1.4400-01 | 8.8893+01 | 1.4000-01 | 8.9891+01 | 1.3500-01 | 8.9891+01 |
| 1.50-02        | 8.5868+01 | 1.4360-01 | 8.6804+01 | 2.6840-01 | 8.7783+01 | 3.1700-01 | 8.8787+01 | 3.0830-01 | 8.9791+01 | 2.9860-01 | 8.9791+01 |
| 2.00-02        | 8.5762+01 | 2.5320-01 | 8.6657+01 | 4.6070-01 | 8.7619+01 | 5.4700-01 | 8.8624+01 | 5.3400-01 | 8.9631+01 | 5.1870-01 | 8.9631+01 |
| 2.50-02        | 8.5630+01 | 3.9220-01 | 8.6472+01 | 6.8950-01 | 8.7413+01 | 8.2340-01 | 8.8420+01 | 8.0770-01 | 8.9430+01 | 7.8730-01 | 8.9430+01 |
| 3.00-02        | 8.5469+01 | 5.5960-01 | 8.6255+01 | 9.4480-01 | 8.7170+01 | 1.1346+00 | 8.8178+01 | 1.1192+00 | 8.9190+01 | 1.0953+00 | 8.9190+01 |
| 4.00-02        | 8.5068+01 | 9.6800-01 | 8.5735+01 | 1.5005+00 | 8.6585+01 | 1.8169+00 | 8.792+01  | 1.8144+00 | 8.8606+01 | 1.7920+00 | 8.8606+01 |
| 5.00-02        | 8.4567+01 | 1.4650+00 | 8.5138+01 | 2.0780+00 | 8.5910+01 | 2.5200+00 | 8.6912+01 | 2.4480+00 | 8.7927+01 | 2.5400+00 | 8.7927+01 |
| 7.00-02        | 8.3298+01 | 2.6449+00 | 8.3735+01 | 3.2516+00 | 8.3251+01 | 3.8479+00 | 8.5293+01 | 3.9624+00 | 8.6275+01 | 4.0165+00 | 8.6275+01 |
| 9.00-02        | 8.1753+01 | 3.9684+00 | 8.2198+01 | 4.4821+00 | 8.2700+01 | 5.0824+00 | 8.3557+01 | 5.2647+00 | 8.4478+01 | 5.3826+00 | 8.4478+01 |
| 1.00-01        | 8.0904+01 | 4.6520+00 | 8.1375+01 | 5.1240+00 | 8.1853+01 | 5.6960+00 | 8.2659+01 | 5.5980+00 | 8.3542+01 | 6.0390+00 | 8.3542+01 |
| 1.25-01        | 7.8649+01 | 6.3706+00 | 7.9263+01 | 6.7708+00 | 7.9750+01 | 7.2665+00 | 8.0454+01 | 7.4878+00 | 8.1238+01 | 7.6634+00 | 8.1238+01 |
| 1.50-01        | 7.6314+01 | 8.0630+00 | 7.7046+01 | 8.4150+00 | 7.7611+01 | 8.8580+00 | 8.824+01  | 8.0920+00 | 8.7894+01 | 9.2890+00 | 8.7894+01 |
| 1.75-01        | 7.4003+01 | 9.7216+00 | 7.4775+01 | 1.0030+01 | 7.5431+01 | 1.0427+01 | 7.6046+01 | 1.0674+01 | 7.6674+01 | 1.0889+01 | 7.6674+01 |
| 2.00-01        | 7.1776+01 | 1.1329+01 | 7.2551+01 | 1.1609+01 | 7.3259+01 | 1.1964+01 | 7.3862+01 | 1.2220+01 | 7.4471+01 | 1.2446+01 | 7.4471+01 |
| 2.50-01        | 6.7644+01 | 1.4317+01 | 6.8332+01 | 1.4614+01 | 6.9044+01 | 1.4934+01 | 6.962+01  | 1.5214+01 | 7.0214+01 | 1.5442+01 | 7.0214+01 |
| 3.00-01        | 6.3917+01 | 1.6929+01 | 6.4512+01 | 1.7303+01 | 6.5162+01 | 1.7672+01 | 6.5751+01 | 1.7992+01 | 6.6313+01 | 1.8271+01 | 6.6313+01 |
| 4.00-01        | 5.7222+01 | 2.1382+01 | 5.7829+01 | 2.1816+01 | 5.8406+01 | 2.2270+01 | 5.9066+01 | 2.2715+01 | 5.9585+01 | 2.3139+01 | 5.9585+01 |
| 5.00-01        | 5.1241+01 | 2.5557+01 | 5.1898+01 | 2.5878+01 | 5.2522+01 | 2.6283+01 | 5.3154+01 | 2.6712+01 | 5.3774+01 | 2.7162+01 | 5.3774+01 |
| 6.00-01        | 4.6031+01 | 2.9669+01 | 4.6671+01 | 2.9791+01 | 4.7309+01 | 3.0139+01 | 4.7937+01 | 3.0511+01 | 4.8563+01 | 3.0909+01 | 4.8563+01 |
| 7.00-01        | 4.1630+01 | 3.3133+01 | 4.2210+01 | 3.3463+01 | 4.2802+01 | 3.3790+01 | 4.3356+01 | 3.4133+01 | 4.3974+01 | 3.4496+01 | 4.3974+01 |
| 8.00-01        | 3.7911+01 | 3.6460+01 | 3.8433+01 | 3.6795+01 | 3.8963+01 | 3.7136+01 | 3.9491+01 | 3.7483+01 | 4.0023+01 | 3.7842+01 | 4.0023+01 |
| 9.00-01        | 3.4686+01 | 3.9358+01 | 3.5175+01 | 3.9740+01 | 3.5661+01 | 4.0121+01 | 3.614+01  | 4.0498+01 | 3.6634+01 | 4.0879+01 | 4.0879+01 |
| 1.00+00        | 3.1801+01 | 4.1885+01 | 3.2282+01 | 4.2315+01 | 3.2752+01 | 4.2744+01 | 3.3219+01 | 4.3164+01 | 3.3681+01 | 4.3582+01 | 4.3582+01 |
| 1.25+00        | 2.5618+01 | 4.7118+01 | 2.6109+01 | 4.7602+01 | 2.6590+01 | 4.8093+01 | 2.7064+01 | 4.8588+01 | 2.7527+01 | 4.9085+01 | 2.7527+01 |
| 1.50+00        | 2.0821+01 | 5.1533+01 | 2.1244+01 | 5.2013+01 | 2.1669+01 | 5.2502+01 | 2.2104+01 | 5.2510+01 | 2.2545+01 | 5.3510+01 | 2.2545+01 |
| 2.00+00        | 1.5285+01 | 5.8864+01 | 1.5482+01 | 5.9368+01 | 1.5689+01 | 5.958+01  | 1.5909+01 | 6.0356+01 | 1.6114+01 | 6.0860+01 | 1.6114+01 |
| 2.50+00        | 1.2574+01 | 6.4521+01 | 1.2709+01 | 6.5062+01 | 1.2842+01 | 6.5602+01 | 1.2972+01 | 6.6142+01 | 1.3102+01 | 6.6682+01 | 1.3102+01 |
| 3.00+00        | 1.0490+01 | 6.8646+01 | 1.0646+01 | 6.9268+01 | 1.0801+01 | 6.9885+01 | 1.0954+01 | 7.0497+01 | 1.1105+01 | 7.1107+01 | 1.1105+01 |
| 2.50+00        | 8.4049+00 | 7.1639+01 | 8.5835+00 | 7.2331+01 | 8.7605+00 | 7.3018+01 | 8.9353+00 | 7.3702+01 | 9.1074+00 | 7.4381+01 | 9.1074+00 |
| 4.00+00        | 2.7255+00 | 7.382+01  | 7.4006+00 | 7.4624+01 | 7.5553+00 | 7.5263+01 | 7.6897+00 | 7.6099+01 | 7.8336+00 | 7.6832+01 | 7.6832+01 |
| 5.00+00        | 4.9574+00 | 7.7067+01 | 5.0348+00 | 7.7866+01 | 5.1150+00 | 7.8664+01 | 5.1984+00 | 7.9461+01 | 5.2859+00 | 8.0257+01 | 5.2859+00 |
| 6.00+00        | 4.0733+00 | 7.9226+01 | 4.1235+00 | 8.0128+01 | 4.1737+00 | 8.0960+01 | 4.2238+00 | 8.1738+00 | 8.2513+00 | 8.2619+01 | 8.2619+01 |
| 7.00+00        | 3.4218+00 | 8.0927+01 | 3.4742+00 | 8.1789+01 | 3.5255+00 | 8.2649+01 | 3.5733+00 | 8.2419+01 | 8.3508+01 | 8.4365+01 | 8.4365+01 |
| 8.00+00        | 2.9173+00 | 8.2102+01 | 2.9655+00 | 8.2992+01 | 3.0135+00 | 8.3881+01 | 3.0615+00 | 8.4767+01 | 3.1089+00 | 8.5652+01 | 3.1089+00 |
| 1.00+00        | 1.9084+00 | 8.3515+01 | 1.9480+00 | 8.4449+01 | 1.9896+00 | 8.5381+01 | 2.0340+00 | 8.6311+01 | 2.0856+00 | 8.7241+01 | 2.0856+00 |
| 1.50+00        | 1.2901+00 | 8.4910+01 | 1.3059+00 | 8.5879+01 | 1.3214+00 | 8.6847+01 | 1.3366+00 | 8.7816+01 | 1.3516+00 | 8.8784+01 | 1.3516+00 |
| 2.00+00        | 9.8565+01 | 8.5511+01 | 1.0040+00 | 8.6481+01 | 1.0223+00 | 8.7461+01 | 1.0404+00 | 8.8441+01 | 1.0584+00 | 8.9421+01 | 1.0584+00 |
| 5.00+01        | 1.9623+01 | 8.5955+01 | 2.0527+01 | 8.6994+01 | 2.1458+01 | 8.7949+01 | 2.2419+01 | 8.8993+01 | 2.3410+01 | 8.9993+01 | 2.3410+01 |
| 8.00+01        | 6.1316+02 | 8.6000+01 | 6.4938+02 | 8.7000+01 | 6.8739+02 | 8.8000+01 | 7.2725+02 | 8.9000+01 | 7.6906+02 | 9.0000+01 | 7.6906+02 |
| 1.00+02        | 3.4100+02 | 8.6000+01 | 3.6302+02 | 8.7000+01 | 3.8629+02 | 8.8000+01 | 4.1085+02 | 8.9000+01 | 4.3679+02 | 9.0000+01 | 4.3679+02 |
| 1.50+02        | 1.2901+02 | 8.6000+01 | 1.4910+02 | 8.7000+01 | 9.2072+02 | 8.8000+C1 | 1.0186+02 | 8.9000+01 | 1.1269+02 | 9.0000+01 | 1.1269+02 |
| 2.00+02        | 9.8565+02 | 8.6000+01 | 1.8421+12 | 8.7000+01 | 2.189+12  | 8.8000+01 | 2.6773+12 | 8.9000+01 | 3.2361+12 | 9.0000+01 | 3.2361+12 |
| 1.00+06        | 1.5318+12 | 8.6000+01 | 4.2611+20 | 8.7000+01 | 5.8052+20 | 8.8000+01 | 7.3326+20 | 8.9000+01 | 9.6681+20 | 9.0000+01 | 9.6681+20 |

TABLE I. CONT.

| $X^*$   | $\sin(\theta/\lambda)/2$ | 91 PA     | 92 U      | 93 NP     | 94 PU     | 95 AM     |
|---------|--------------------------|-----------|-----------|-----------|-----------|-----------|
| 0.00    | 9.1000+01                | 0.000C+01 | 9.2000+01 | 0.0000    | 9.4000+01 | 9.5000+01 |
| 5.00-03 | 9.0960+01                | 3.400C-02 | 9.1959+01 | 3.3000-02 | 9.3963+01 | 9.4962+01 |
| 1.00-02 | 9.0893+01                | 1.3400-01 | 9.1894+01 | 1.3200-01 | 9.3000-02 | 3.3000-02 |
| 1.50-02 | 9.0794+01                | 2.9610-01 | 9.1797+01 | 2.9100-01 | 1.3000-01 | 1.2900-01 |
| 2.00-02 | 9.0637+01                | 5.137C-01 | 9.1643+01 | 5.0510-01 | 2.8100-01 | 2.8600-01 |
| 2.50-02 | 9.0439+01                | 7.7840-01 | 9.1448+01 | 7.6590-01 | 7.5650-01 | 7.6200-01 |
| 3.00-02 | 9.0204+01                | 1.0870+00 | 9.1216+01 | 1.0643-00 | 9.2228+01 | 1.0521+00 |
| 4.00-02 | 8.9634+01                | 1.7605+00 | 9.0854+01 | 1.7371+00 | 9.1673+01 | 1.7194+01 |
| 5.00-02 | 8.8974+01                | 2.4850+00 | 9.0003+01 | 2.4570+00 | 9.1030+01 | 2.4424+00 |
| 7.00-02 | 8.7374+01                | 3.9044+00 | 8.8415+01 | 3.8752+00 | 8.9456+01 | 9.2077+01 |
| 9.00-02 | 8.5643+01                | 5.2277+00 | 8.6690+01 | 5.2029+00 | 8.7739+01 | 5.1947+00 |
| 1.00-01 | 8.4740+01                | 5.873C+00 | 8.5788+01 | 5.8510+00 | 8.6839+01 | 5.8460+00 |
| 1.25-01 | 8.2507+01                | 7.4975+00 | 8.3549+01 | 7.4819+00 | 8.4597+01 | 7.4835+00 |
| 1.50-01 | 8.0239+01                | 9.143C+00 | 8.1264+01 | 9.1360+00 | 8.2298+01 | 9.1430+00 |
| 1.75-01 | 7.7974+01                | 1.0767+01 | 7.8978+01 | 1.0771+01 | 7.9598+01 | 1.0784+01 |
| 2.00-01 | 7.5730+01                | 1.2345+01 | 7.6706+01 | 1.2359+01 | 7.7701+01 | 1.2375+01 |
| 2.50-01 | 7.1325+01                | 1.5364+01 | 7.2221+01 | 1.5387+01 | 7.5044+01 | 1.5422+01 |
| 3.00-01 | 6.7246+01                | 1.8189+01 | 6.8050+01 | 1.8222+01 | 6.8887+01 | 1.8442+01 |
| 4.00-01 | 6.0221+01                | 2.3062+01 | 6.0844+01 | 2.3157+01 | 6.1532+01 | 2.3230+01 |
| 5.00-01 | 5.4276+01                | 2.7163+01 | 5.4841+01 | 2.7321+01 | 5.5416+01 | 2.7426+01 |
| 6.00-01 | 4.9034+01                | 3.0988+01 | 4.9568+01 | 3.1178+01 | 5.0099+01 | 3.1349+01 |
| 7.00-01 | 4.4448+01                | 3.4631+01 | 4.4761+01 | 3.4842+01 | 4.5464+01 | 3.5038+01 |
| 8.00-01 | 4.0510+01                | 3.8032+01 | 4.1002+01 | 3.8270+01 | 4.1484+01 | 3.8955+01 |
| 9.00-01 | 3.7131+01                | 4.1137+01 | 4.1418+01 | 4.1418+01 | 3.8077+01 | 4.1683+01 |
| 1.00-00 | 3.4185+01                | 4.3916+01 | 3.4655+01 | 4.4254+01 | 3.5117+01 | 4.4513+01 |
| 1.25+00 | 2.8018+01                | 4.9565+01 | 2.8488+01 | 5.0036+01 | 5.0464+01 | 5.0924+01 |
| 1.50+00 | 2.5986+01                | 5.4030+01 | 2.3433+01 | 5.4051+01 | 2.3881+01 | 5.5072+01 |
| 2.00+00 | 1.6379+01                | 6.1374+01 | 1.6633+01 | 6.1894+01 | 1.6898+01 | 6.2204+01 |
| 2.50+00 | 1.3229+01                | 6.7219+01 | 1.3359+01 | 6.7760+01 | 1.3491+01 | 6.8304+01 |
| 3.00+00 | 1.1248+01                | 7.1707+01 | 1.1393+01 | 7.2306+01 | 1.1536+01 | 7.2902+01 |
| 3.50+00 | 9.2669+00                | 7.505C+01 | 9.4265+00 | 7.5717+01 | 9.5815+00 | 7.6380+01 |
| 4.00+00 | 7.9698+00                | 7.7558+01 | 8.1074+00 | 7.8282+01 | 8.2429+00 | 7.9001+01 |
| 5.00+00 | 5.3757+00                | 8.1053+01 | 5.4622+00 | 8.1846+01 | 5.6566+01 | 5.6630+00 |
| 6.00+00 | 4.3259+00                | 8.3451+01 | 4.3781+00 | 8.4280+01 | 4.4312+00 | 4.4856+00 |
| 7.00+00 | 3.6696+00                | 8.5224+00 | 3.7151+00 | 8.6081+01 | 3.7603+00 | 8.6936+01 |
| 8.00+00 | 3.1555+00                | 8.6537+01 | 3.2016+00 | 8.7420+01 | 3.2478+00 | 8.8302+01 |
| 1.00+01 | 2.1272+00                | 8.8170+01 | 2.1746+00 | 8.9097+01 | 2.2229+00 | 9.0023+01 |
| 1.25+01 | 1.3664+00                | 8.9752+01 | 1.3810+00 | 9.0719+01 | 1.3953+00 | 9.1684+01 |
| 2.00+01 | 1.0763+00                | 9.0400+01 | 1.0940+00 | 9.1379+01 | 1.1116+00 | 9.2358+01 |
| 5.00+01 | 2.4431-01                | 9.0999+01 | 2.5483-01 | 9.1992+01 | 2.6566-01 | 9.2991+01 |
| 8.00+01 | 8.1287-02                | 9.1000+01 | 8.5879-02 | 9.0200+01 | 9.0690-02 | 9.3000+01 |
| 1.00+02 | 4.6418-02                | 9.1000+01 | 4.9307-02 | 9.2000+01 | 5.2357-02 | 9.3000+01 |
| 1.25+02 | 1.00+03                  | 9.1000+01 | 1.3800-04 | 9.2000+01 | 1.5257-04 | 9.3000+01 |
| 2.00+02 | 1.0763+00                | 9.0400+01 | 4.7543-12 | 9.2000+01 | 5.7797-12 | 9.3000+01 |
| 3.00+02 | 3.9187-12                | 9.1000+01 | 1.6690-19 | 9.2000+01 | 7.0407-12 | 9.4000+01 |
| 5.00+02 | 1.2793-19                | 9.1000+01 | 2.4431-01 | 9.2000+01 | 3.0314-19 | 9.3000+01 |

TABLE I., CONT.  
ATOMIC FORM FACTOR,  $F(X, Z)$ , AND INCOHERENT SCATTERING FUNCTION,  $S(X, Z)$ 

| $X$                    | $96 \text{ CM}$ | $97 \text{ BK}$ | $98 \text{ CF}$ | $99 \text{ ES}$ | $100 \text{ FM}$ |
|------------------------|-----------------|-----------------|-----------------|-----------------|------------------|
| $\sin(\theta)/\lambda$ | $F(X, Z)$       | $S(X, Z)$       | $F(X, Z)$       | $S(X, Z)$       | $F(X, Z)$        |
| 0.00                   | 9.6000+01       | 0.0000          | 9.7000+01       | 0.0000          | 9.9000+01        |
| 5.00-03                | 9.5956+01       | 3.1800-02       | 9.5956+01       | 3.1600-02       | 9.8962+01        |
| 1.00-02                | 9.5895+01       | 1.2430-01       | 9.6695+01       | 1.2230-01       | 9.7902+01        |
| 1.50-02                | 9.5809+01       | 2.7560-01       | 9.6812+01       | 2.7190-01       | 9.7815+01        |
| 2.00-02                | 9.5664+01       | 4.7920-01       | 9.6668+01       | 4.7300-01       | 9.7673+01        |
| 2.50-02                | 9.5480+01       | 7.2830-01       | 9.6487+01       | 7.1920-01       | 9.7495+01        |
| 3.00-02                | 9.5261+01       | 1.0149+00       | 9.6271+01       | 1.0027+00       | 9.7283+01        |
| 4.00-02                | 9.4726+01       | 1.6663+00       | 9.5174+01       | 1.6489+00       | 9.6769+01        |
| 5.00-02                | 9.4109+01       | 2.3810+00       | 9.5133+01       | 2.3605+00       | 9.6174+01        |
| 7.00-02                | 9.2573+01       | 3.7915+00       | 9.3611+01       | 3.7660+00       | 9.4715+01        |
| 9.00-02                | 9.0886+01       | 5.1345+00       | 9.1934+01       | 5.1096+00       | 9.3116+01        |
| 1.00-01                | 8.9998+01       | 5.7832+00       | 9.1051+01       | 5.7589+00       | 9.2271+01        |
| 1.25-01                | 8.7761+01       | 7.4322+00       | 8.8819+01       | 7.4096+00       | 9.0134+01        |
| 1.50-01                | 8.5442+01       | 9.1157+00       | 8.6499+01       | 9.1003+00       | 8.7881+01        |
| 1.75-01                | 8.3117+01       | 1.0744+01       | 8.4170+01       | 1.0741+01       | 8.5563+01        |
| 2.00-01                | 8.0766+01       | 1.2355+01       | 8.1807+01       | 1.2360+01       | 8.3182+01        |
| 2.50-01                | 7.6041+01       | 1.5389+01       | 7.7038+01       | 1.5408+01       | 7.8314+01        |
| 3.00-01                | 7.1555+01       | 1.8189+01       | 7.2458+01       | 1.8248+01       | 7.3624+01        |
| 4.00-01                | 6.3690+01       | 2.3229+01       | 6.4451+01       | 2.3331+01       | 6.5315+01        |
| 5.00-01                | 5.7217+01       | 2.7609+01       | 5.7851+01       | 2.7763+01       | 5.8491+01        |
| 6.00-01                | 5.1701+01       | 3.1662+01       | 5.2248+01       | 3.1857+01       | 5.2753+01        |
| 7.00-01                | 4.6943+01       | 3.5480+01       | 4.7433+01       | 3.5715+01       | 4.7867+01        |
| 8.00-01                | 4.2878+01       | 3.9058+01       | 4.3331+01       | 3.9330+01       | 4.3737+01        |
| 9.00-01                | 3.9421+01       | 4.2384+01       | 3.9851+01       | 4.2690+01       | 4.0253+01        |
| 1.00+00                | 3.6440+01       | 4.5435+01       | 3.6862+01       | 4.5772+01       | 3.7272+01        |
| 1.25+00                | 3.0298+01       | 5.1755+01       | 3.0729+01       | 5.2158+01       | 3.1169+01        |
| 1.50+00                | 2.5221+01       | 5.6572+01       | 2.5664+01       | 5.7033+01       | 2.6111+01        |
| 2.00+00                | 1.7765+01       | 6.4037+01       | 1.8076+01       | 6.4568+01       | 1.8395+01        |
| 2.50+00                | 1.3914+01       | 6.9951+01       | 1.4076+01       | 7.0598+01       | 1.4227+01        |
| 3.00+00                | 1.1966+01       | 7.4697+01       | 1.2110+01       | 7.5304+01       | 1.2253+01        |
| 3.50+00                | 1.0018+01       | 7.8340+01       | 1.0153+01       | 7.8986+01       | 1.0280+01        |
| 4.00+00                | 8.6345+00       | 8.1132+01       | 8.7598+00       | 8.1836+01       | 8.8790+00        |
| 5.00+00                | 5.8682+00       | 8.4998+01       | 5.9730+01       | 8.5700+01       | 6.0794+00        |
| 6.00+00                | 4.5979+00       | 8.7587+01       | 4.6564+00       | 8.8411+01       | 4.7165+00        |
| 7.00+00                | 3.8949+00       | 8.9497+01       | 3.9391+00       | 9.0348+01       | 3.9832+00        |
| 8.00+00                | 3.3861+00       | 9.0944+01       | 3.4314+00       | 9.1825+01       | 3.4762+00        |
| 1.00+01                | 2.3684+00       | 9.2791+01       | 2.4159+00       | 9.3711+01       | 2.4621+00        |
| 1.50+01                | 1.4370+00       | 9.4589+01       | 1.4504+00       | 9.5555+01       | 1.4637+00        |
| 2.00+01                | 1.1637+00       | 9.5294+01       | 1.1808+00       | 9.6272+01       | 1.1977+00        |
| 5.00+01                | 3.0009+01       | 9.5989+01       | 3.1223+01       | 9.6988+01       | 3.2471+01        |
| 8.00+01                | 1.0653-01       | 9.6000+01       | 1.1232-01       | 9.6999+01       | 1.1837-01        |
| 1.00+02                | 6.2546-02       | 9.6000+01       | 6.6320-02       | 9.7000+01       | 7.0300+01        |
| 1.00+03                | 2.0748-04       | 9.6000+01       | 2.2992-04       | 9.7000+01       | 2.8026-04        |
| 1.00+06                | 1.0517-11       | 9.6000+01       | 1.2899-11       | 9.7000+01       | 1.3548-11        |
| 1.00+09                | 5.4975-19       | 9.6000+01       | 7.4515-19       | 9.7000+01       | 1.0146-18        |

TABLE III.  
COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNS/ATOM

| PHOTON ENERGY, EV | 1 H      |          |          | 2 HE     |          |          | 3 LI      |          |          | 4 BE     |     |       | 5 B |
|-------------------|----------|----------|----------|----------|----------|----------|-----------|----------|----------|----------|-----|-------|-----|
|                   | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH       | INCOH    | COH      | INCOH    | COH | INCOH |     |
| 1.0+02            | 6.650-01 | 9.552-04 | 2.660+00 | 1.524-03 | 5.982+00 | 5.741-03 | 1.054+01  | 3.773-03 | 1.662+01 | 3.361-03 |     |       |     |
| 1.5+02            | 6.335-01 | 2.144-03 | 2.658+00 | 2.559-03 | 5.955+00 | 1.255-02 | 1.051+01  | 8.574-03 | 1.659+01 | 7.603-03 |     |       |     |
| 2.0+02            | 6.617-01 | 3.802-03 | 2.655+00 | 3.793-03 | 5.922+00 | 2.260-02 | 1.057+01  | 5.524-02 | 1.644+01 | 1.347-02 |     |       |     |
| 3.0+02            | 6.569-01 | 4.949-03 | 2.648+00 | 5.83-03  | 5.837+00 | 4.944-02 | 1.056+01  | 3.401-02 | 1.641+01 | 3.007-02 |     |       |     |
| 4.0+02            | 6.503-01 | 1.496-02 | 2.637+00 | 1.183-02 | 5.724+00 | 8.622-02 | 1.032+C01 | 5.961-02 | 1.624+01 | 5.283-02 |     |       |     |
| 5.0+02            | 6.421-01 | 2.310-02 | 2.624+00 | 1.796-02 | 5.589+00 | 1.261-01 | 1.015+01  | 9.138-02 | 1.603+01 | 8.133-02 |     |       |     |
| 6.0+02            | 6.323-01 | 3.779-02 | 2.608+00 | 2.543-02 | 5.436+00 | 1.714-01 | 1.028+01  | 9.948+00 | 1.578+01 | 1.150-01 |     |       |     |
| 8.0+02            | 6.087-01 | 5.629-02 | 2.567+00 | 4.426-02 | 5.096+00 | 2.656-01 | 9.474+00  | 2.153-01 | 1.518+01 | 1.955-01 |     |       |     |
| 1.0+03            | 5.006-01 | 8.424-02 | 2.517+00 | 6.767-02 | 4.744+00 | 3.549-01 | 8.935+00  | 3.129-01 | 1.448+01 | 2.893-01 |     |       |     |
| 1.5+03            | 4.384-01 | 1.650-01 | 2.162+00 | 1.419-01 | 3.952+00 | 5.273-01 | 7.514+00  | 5.675-01 | 1.252+01 | 5.537-01 |     |       |     |
| 2.0+03            | 4.142-01 | 2.478-01 | 2.317-00 | 2.317-01 | 3.375+00 | 6.378-01 | 6.247+00  | 7.907-01 | 1.059+01 | 8.201-01 |     |       |     |
| 3.0+03            | 2.764-01 | 3.822-01 | 1.743+00 | 4.230-01 | 2.675+00 | 7.970-01 | 4.070+00  | 1.100-00 | 7.594+00 | 1.264+00 |     |       |     |
| 4.0+03            | 1.831-01 | 4.675-01 | 1.369+00 | 5.948-01 | 2.343+00 | 9.361-01 | 3.524+00  | 1.291+00 | 5.721+00 | 1.568+00 |     |       |     |
| 5.0+03            | 1.341-01 | 5.187-01 | 1.072+00 | 7.328-01 | 1.890+00 | 1.033+00 | 2.918+00  | 1.433+00 | 4.553+00 | 1.773+00 |     |       |     |
| 6.0+03            | 9.987-02 | 5.503-01 | 8.492-01 | 3.385-01 | 1.602+00 | 1.177+00 | 2.493+00  | 1.548+00 | 3.782+00 | 1.924+00 |     |       |     |
| 8.0+03            | 6.126-02 | 5.840-01 | 5.592-01 | 9.785-01 | 1.164+00 | 1.357+00 | 1.891+00  | 1.740+00 | 2.818+00 | 2.146+00 |     |       |     |
| 1.0+04            | 4.121-02 | 5.993-01 | 3.921-01 | 1.059+00 | 6.631-01 | 1.483+00 | 1.458+00  | 1.888+00 | 2.213+00 | 2.312+00 |     |       |     |
| 1.5+04            | 1.943-02 | 6.095-01 | 1.962-01 | 1.415+00 | 4.622-01 | 1.644+00 | 1.644+00  | 1.112+00 | 2.511+00 | 2.511+00 |     |       |     |
| 2.0+04            | 1.119-02 | 6.068-01 | 1.166-01 | 1.168+00 | 2.852-01 | 1.702+00 | 5.347-01  | 2.210+00 | 8.582-01 | 2.714+00 |     |       |     |
| 3.0+04            | 5.662-03 | 5.924-01 | 5.432-02 | 1.163+00 | 1.383-01 | 1.784+00 | 2.671-01  | 2.256+00 | 4.383-01 | 2.790+00 |     |       |     |
| 4.0+04            | 2.666-03 | 5.759-01 | 3.113-02 | 1.139+00 | 8.079-02 | 1.632+00 | 1.591-01  | 2.335+00 | 2.642-01 | 2.774+00 |     |       |     |
| 5.0+04            | 1.840-03 | 5.597-01 | 2.010-02 | 1.651+00 | 5.273-02 | 1.656+00 | 1.050-01  | 2.193+00 | 1.760-01 | 2.727+00 |     |       |     |
| 6.0+04            | 1.280-03 | 5.444-01 | 1.403-02 | 1.083+00 | 3.709-03 | 2.167+00 | 7.430-02  | 1.454+00 | 1.253-01 | 2.671+00 |     |       |     |
| 8.0+04            | 7.211-04 | 5.166-01 | 7.933-13 | 1.030+00 | 2.117-02 | 1.540+00 | 4.262-02  | 2.047+00 | 7.242-02 | 2.553+00 |     |       |     |
| 1.0+05            | 4.619-04 | 4.923-01 | 5.089-03 | 9.825-01 | 1.356-02 | 1.471+00 | 2.755-02  | 1.957+00 | 4.699-02 | 2.442+00 |     |       |     |
| 1.5+05            | 2.054-04 | 4.435-01 | 2.267-03 | 8.860-01 | 6.062-03 | 1.358+00 | 1.237-02  | 1.768+00 | 2.119-02 | 2.209+00 |     |       |     |
| 2.0+05            | 1.156-04 | 4.064-01 | 1.276-03 | 8.124-01 | 3.417-03 | 1.228+00 | 6.980-03  | 1.622+00 | 3.110-03 | 2.024+00 |     |       |     |
| 3.0+05            | 5.138-05 | 5.620-01 | 5.676-04 | 7.068-01 | 1.503+00 | 1.030+00 | 3.113-03  | 1.413+00 | 5.345-03 | 1.765+00 |     |       |     |
| 4.0+05            | 2.590-05 | 3.168-01 | 3.194-04 | 6.334-01 | 8.558-04 | 9.459-01 | 1.751-03  | 1.266+00 | 3.010-03 | 1.583+00 |     |       |     |
| 5.0+05            | 1.450-05 | 2.893-01 | 2.044-04 | 5.785-01 | 5.478-04 | 8.676-01 | 1.121-03  | 1.157+00 | 1.928-03 | 1.446+00 |     |       |     |
| 6.0+05            | 1.255-05 | 2.676-01 | 1.492-04 | 4.702-01 | 3.805-04 | 8.058-01 | 7.788-04  | 1.070+00 | 1.339-03 | 1.338+00 |     |       |     |
| 8.0+05            | 7.226-06 | 2.351-01 | 7.982-05 | 2.141-04 | 7.053-01 | 4.382-04 | 9.403-01  | 7.535-04 | 1.175+00 | 7.535-04 |     |       |     |
| 1.0+06            | 4.625-06 | 2.114-01 | 5.111-05 | 4.228-01 | 1.370-04 | 6.341-01 | 2.805-04  | 8.455-01 | 4.824-04 | 1.057+00 |     |       |     |
| 1.5+06            | 2.056-06 | 1.718-01 | 2.272-05 | 3.436-01 | 6.090-05 | 5.154-01 | 1.237-04  | 6.372-01 | 2.144-04 | 8.589-01 |     |       |     |
| 2.0+06            | 1.156-06 | 1.466-01 | 1.278-05 | 2.932-01 | 3.425-05 | 4.388-01 | 7.011-05  | 5.364-01 | 1.206-04 | 7.330-01 |     |       |     |
| 3.0+06            | 5.139-07 | 1.153-01 | 5.679-06 | 2.307-01 | 1.522-05 | 3.400-01 | 3.116-05  | 5.631-05 | 5.766-01 | 5.361-07 |     |       |     |
| 4.0+06            | 2.651-07 | 9.620-02 | 3.194-06 | 1.924-01 | 6.563-06 | 2.886-01 | 1.753-05  | 3.848-01 | 3.015-05 | 4.810-01 |     |       |     |
| 5.0+06            | 1.506-07 | 8.308-02 | 2.044-06 | 1.662-01 | 5.481-06 | 2.452-01 | 1.122-05  | 3.323-01 | 1.930-05 | 4.154-01 |     |       |     |
| 6.0+06            | 1.285-07 | 7.343-02 | 1.420-06 | 1.469-01 | 3.806-06 | 2.263-01 | 7.791-06  | 2.937-01 | 1.340-05 | 3.671-01 |     |       |     |
| 8.0+06            | 7.227-08 | 6.C07-02 | 7.985-07 | 1.201-01 | 2.141-06 | 1.882-01 | 4.382-06  | 2.403-01 | 7.539-06 | 3.C03-01 |     |       |     |
| 1.0+07            | 4.625-08 | 5.111-07 | 1.023-01 | 1.370-06 | 1.535-01 | 2.805-06 | 2.046-01  | 4.825-06 | 2.558-C1 |          |     |       |     |
| 1.5+07            | 2.056-08 | 3.785-02 | 2.272-07 | 7.573-02 | 1.016-01 | 1.136-01 | 1.247-06  | 1.515-01 | 2.144-06 | 1.893-01 |     |       |     |
| 2.0+07            | 1.156-08 | 3.039-02 | 1.278-07 | 6.078-02 | 3.425-07 | 9.117-02 | 7.013-07  | 1.216-01 | 1.206-06 | 1.519-01 |     |       |     |
| 3.0+07            | 5.139-09 | 2.212-02 | 5.679-06 | 4.425-02 | 1.522-07 | 6.637-02 | 3.117-07  | 8.349-02 | 5.361-07 | 1.126-01 |     |       |     |
| 4.0+07            | 2.650-09 | 1.758-02 | 3.194-08 | 3.516-02 | 8.563-08 | 5.244-02 | 1.733-07  | 7.032-02 | 3.015-07 | 8.790-02 |     |       |     |
| 5.0+07            | 1.650-09 | 1.467-02 | 2.044-08 | 2.935-02 | 5.484-08 | 4.402-02 | 1.122-07  | 5.870-02 | 1.930-07 | 7.337-02 |     |       |     |
| 6.0+07            | 1.284-09 | 1.264-02 | 1.420-08 | 2.529-02 | 3.805-08 | 3.793-02 | 7.788-08  | 5.358-02 | 1.340-07 | 6.322-02 |     |       |     |
| 8.0+07            | 7.222-10 | 9.972-03 | 7.984-09 | 1.994-02 | 2.140-08 | 2.991-02 | 4.382-08  | 3.989-02 | 7.538-08 | 4.986-02 |     |       |     |
| 1.0+08            | 4.620-10 | 8.276-03 | 5.109-09 | 1.655-02 | 1.370-08 | 2.403-02 | 2.803-08  | 3.311-02 | 4.824-08 | 4.138-02 |     |       |     |

TABLE II. CONT.  
COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNS/ATOM

| PHOTON ENERGY, EV | 6 C      |          |          | 7 N      |          |          | 8 O      |          |          | 9 F      |          |          | 10 NE    |          |          |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | COH      | INCOH    | COH      | COH      | INCOH    |          |
| 1.0+02            | 2.394+01 | 3.044+03 | 3.255+01 | 2.698+03 | 4.256+01 | 2.479+03 | 5.387+01 | 1.935+03 | 6.651+01 | 1.835+03 | 6.646+01 | 4.309+03 | 6.646+01 | 4.309+03 |          |
| 1.5+02            | 2.390+01 | 6.469+03 | 3.251+01 | 6.260+03 | 4.252+01 | 5.433+03 | 5.382+01 | 4.736+03 | 6.641+01 | 7.636+03 | 6.641+01 | 7.636+03 | 6.626+01 | 1.751+02 |          |
| 2.0+02            | 2.385+01 | 1.140+02 | 3.247+01 | 1.118+02 | 4.244+01 | 9.695+03 | 5.377+01 | 8.533+03 | 6.632+01 | 1.925+02 | 6.605+01 | 3.067+02 | 6.605+01 | 3.067+02 |          |
| 2.5+02            | 2.372+01 | 2.518+02 | 3.234+01 | 2.508+02 | 4.232+01 | 2.175+02 | 5.362+01 | 1.925+02 | 5.342+01 | 3.410+02 | 5.315+01 | 4.770+02 | 5.315+01 | 4.770+02 |          |
| 3.0+02            | 2.353+01 | 4.448+02 | 3.215+01 | 4.428+02 | 4.214+01 | 3.847+02 | 5.342+01 | 3.847+02 | 5.342+01 | 3.410+02 | 5.285+01 | 6.547+01 | 5.285+01 | 6.825+02 |          |
| 4.0+02            | 2.331+01 | 6.870+02 | 3.191+01 | 6.856+02 | 4.187+01 | 5.970+02 | 5.315+01 | 5.298+02 | 5.315+01 | 5.298+02 | 5.285+01 | 6.547+01 | 5.285+01 | 6.825+02 |          |
| 5.0+02            | 2.311+01 | 9.764+02 | 3.162+01 | 9.770+02 | 4.157+01 | 5.522+02 | 5.285+01 | 5.522+02 | 5.285+01 | 5.522+02 | 5.285+01 | 6.547+01 | 5.285+01 | 6.825+02 |          |
| 6.0+02            | 2.303+01 | 1.680+01 | 3.090+01 | 1.692+01 | 4.082+01 | 1.464+01 | 5.207+01 | 1.325+01 | 5.207+01 | 1.325+01 | 6.467+01 | 1.196+01 | 6.467+01 | 1.196+01 |          |
| 8.0+02            | 2.317+01 | 1.680+01 | 3.090+01 | 1.680+01 | 4.082+01 | 1.464+01 | 5.207+01 | 1.325+01 | 5.207+01 | 1.325+01 | 6.467+01 | 1.196+01 | 6.467+01 | 1.196+01 |          |
| 1.0+03            | 2.157+01 | 2.519+01 | 3.033+01 | 2.560+01 | 3.075+01 | 5.198+01 | 3.099+01 | 2.262+01 | 5.111+01 | 2.029+01 | 6.367+01 | 1.836+01 | 6.367+01 | 1.836+01 |          |
| 1.5+03            | 1.521+01 | 5.001+01 | 1.669+01 | 7.02+01  | 2.433+01 | 8.165+01 | 3.359+01 | 4.697+01 | 4.800+01 | 4.270+01 | 6.042+01 | 3.902+01 | 6.042+01 | 3.902+01 |          |
| 2.0+03            | 1.669+01 | 1.140+02 | 1.669+01 | 7.02+01  | 2.433+01 | 8.165+01 | 3.359+01 | 7.560+01 | 4.256+01 | 5.640+01 | 6.452+01 | 5.640+01 | 6.452+01 | 5.640+01 |          |
| 3.0+03            | 1.530+01 | 1.278+00 | 1.861+01 | 1.392+00 | 2.661+01 | 1.352+00 | 3.622+01 | 1.293+00 | 4.741+01 | 1.224+00 | 4.741+01 | 1.224+00 | 4.741+01 | 1.224+00 |          |
| 4.0+03            | 9.244+00 | 1.685+00 | 9.421+01 | 1.886+00 | 2.079+01 | 1.886+00 | 2.323+00 | 1.861+00 | 3.884+01 | 1.756+00 | 3.884+01 | 1.756+00 | 3.884+01 | 1.756+00 |          |
| 5.0+03            | 7.219+00 | 1.984+00 | 1.110+01 | 2.225+00 | 1.644+01 | 2.323+00 | 2.322+01 | 2.354+00 | 3.163+01 | 2.322+00 | 3.163+01 | 2.322+00 | 3.163+01 | 2.322+00 |          |
| 6.0+03            | 5.568+00 | 2.202+00 | 8.926+00 | 2.194+00 | 1.32+01  | 2.665+00 | 1.883+01 | 2.762+00 | 2.591+01 | 2.774+00 | 2.591+01 | 2.774+00 | 2.591+01 | 2.774+00 |          |
| 8.0+03            | 4.205+00 | 2.497+00 | 6.244+00 | 2.588+00 | 9.145+00 | 3.139+00 | 1.304+01 | 3.353+00 | 1.808+01 | 3.473+00 | 3.473+00 | 3.473+00 | 3.473+00 | 3.473+00 |          |
| 1.0+04            | 3.248+00 | 2.697+00 | 4.722+00 | 3.093+00 | 6.805+00 | 3.439+00 | 6.805+00 | 3.439+00 | 9.630+00 | 3.735+00 | 1.333+01 | 3.949+00 | 1.333+01 | 3.949+00 |          |
| 1.5+04            | 1.958+00 | 3.012+00 | 2.803+00 | 3.449+00 | 3.942+00 | 3.864+00 | 5.459+00 | 5.459+00 | 7.447+00 | 4.633+00 | 4.633+00 | 4.633+00 | 4.633+00 | 4.633+00 |          |
| 2.0+04            | 1.395+00 | 3.182+00 | 1.867+00 | 3.645+00 | 2.632+00 | 4.092+00 | 4.524+00 | 4.524+00 | 4.868+00 | 4.926+00 | 4.868+00 | 4.926+00 | 4.868+00 | 4.926+00 |          |
| 3.0+04            | 6.720+01 | 3.300+00 | 9.811+01 | 3.800+00 | 1.388+00 | 4.286+00 | 1.915+00 | 4.760+00 | 2.583+00 | 5.244+00 | 2.583+00 | 5.244+00 | 2.583+00 | 5.244+00 |          |
| 4.0+04            | 4.032+01 | 3.296+00 | 6.015+01 | 3.811+00 | 8.552+01 | 4.315+00 | 1.182+00 | 4.808+00 | 1.597+00 | 5.237+00 | 1.597+00 | 5.237+00 | 1.597+00 | 5.237+00 |          |
| 5.0+04            | 2.736+01 | 3.250+00 | 4.043+01 | 3.766+00 | 5.761+01 | 4.275+00 | 5.761+01 | 4.275+00 | 7.275+00 | 1.078+00 | 5.264+00 | 1.078+00 | 5.264+00 | 1.078+00 |          |
| 6.0+04            | 1.957+01 | 3.188+00 | 2.903+01 | 3.700+01 | 4.145+01 | 4.207+00 | 5.741+01 | 4.707+00 | 7.768+01 | 1.517+00 | 7.768+01 | 1.517+00 | 7.768+01 | 1.517+00 |          |
| 8.0+04            | 1.139+01 | 3.054+00 | 1.699+01 | 3.551+00 | 2.433+01 | 4.044+00 | 3.375+01 | 4.044+00 | 3.375+01 | 4.569+01 | 5.017+00 | 4.569+01 | 5.017+00 | 4.569+01 | 5.017+00 |
| 1.0+05            | 7.418+02 | 2.924+00 | 1.111+01 | 3.403+00 | 1.595+01 | 3.880+00 | 1.595+01 | 3.880+00 | 2.217+01 | 4.354+00 | 3.005+01 | 4.823+00 | 3.005+01 | 4.823+00 |          |
| 1.5+05            | 3.350+02 | 2.647+00 | 5.057+02 | 3.054+00 | 7.289+02 | 3.521+00 | 1.016+01 | 3.955+00 | 1.380+01 | 4.388+00 | 1.380+01 | 4.388+00 | 1.380+01 | 4.388+00 |          |
| 2.0+05            | 1.903+02 | 2.431+00 | 2.870+02 | 2.834+00 | 4.143+02 | 3.236+00 | 5.784+02 | 3.637+00 | 7.867+02 | 4.035+00 | 7.867+02 | 4.035+00 | 7.867+02 | 4.035+00 |          |
| 3.0+05            | 8.502+03 | 2.118+00 | 8.502+03 | 2.118+00 | 4.645+00 | 4.645+00 | 5.821+02 | 3.821+00 | 5.524+02 | 3.524+00 | 5.524+02 | 3.524+00 | 5.524+02 | 3.524+00 |          |
| 4.0+05            | 4.791+03 | 1.899+00 | 7.239+03 | 2.150+00 | 1.047+02 | 2.530+00 | 1.464+02 | 2.846+00 | 1.994+02 | 3.161+00 | 1.994+02 | 3.161+00 | 1.994+02 | 3.161+00 |          |
| 5.0+05            | 3.059+03 | 1.734+00 | 4.639+03 | 2.023+00 | 6.710+03 | 2.312+00 | 9.356+03 | 2.600+00 | 1.279+02 | 2.889+00 | 1.279+02 | 2.889+00 | 1.279+02 | 2.889+00 |          |
| 6.0+05            | 2.132+03 | 1.605+00 | 3.224+03 | 1.872+00 | 4.664+03 | 2.139+00 | 6.325+03 | 2.406+00 | 8.889+03 | 2.673+00 | 8.889+03 | 2.673+00 | 8.889+03 | 2.673+00 |          |
| 8.0+05            | 1.200+03 | 1.410+00 | 1.814+03 | 1.645+00 | 2.625+03 | 1.880+00 | 3.673+03 | 2.115+00 | 5.005+03 | 2.350+00 | 5.005+03 | 2.350+00 | 5.005+03 | 2.350+00 |          |
| 1.0+06            | 7.681+04 | 1.268+00 | 1.162+03 | 1.479+00 | 1.681+03 | 1.691+00 | 2.352+03 | 1.902+00 | 3.205+03 | 2.113+00 | 3.205+03 | 2.113+00 | 3.205+03 | 2.113+00 |          |
| 1.5+06            | 3.414+04 | 0.301+00 | 5.163+04 | 5.026+00 | 7.471+04 | 5.374+00 | 1.045+04 | 5.374+00 | 1.424+03 | 1.718+00 | 1.424+03 | 1.718+00 | 1.424+03 | 1.718+00 |          |
| 2.0+06            | 1.921+04 | 8.795+01 | 1.291+04 | 1.026+00 | 4.203+04 | 1.173+00 | 5.861+04 | 1.319+00 | 8.014+04 | 1.466+00 | 8.014+04 | 1.466+00 | 8.014+04 | 1.466+00 |          |
| 3.0+06            | 8.537+04 | 6.920+01 | 1.291+04 | 8.073+01 | 1.868+04 | 9.226+01 | 2.614+04 | 1.038+00 | 3.562+04 | 1.155+00 | 3.562+04 | 1.155+00 | 3.562+04 | 1.155+00 |          |
| 4.0+06            | 4.802+05 | 5.772+01 | 7.261+05 | 6.734+01 | 1.051+04 | 7.696+01 | 2.670+04 | 8.658+01 | 1.204+04 | 9.620+01 | 1.204+04 | 9.620+01 | 1.204+04 | 9.620+01 |          |
| 5.0+06            | 3.073+05 | 4.985+01 | 6.647+05 | 5.815+01 | 6.725+05 | 6.646+01 | 9.411+04 | 7.477+01 | 1.272+04 | 8.308+01 | 1.272+04 | 8.308+01 | 1.272+04 | 8.308+01 |          |
| 6.0+06            | 2.134+05 | 4.406+01 | 3.228+05 | 5.140+01 | 4.671+05 | 5.074+01 | 6.537+05 | 6.012+05 | 8.609+01 | 7.343+01 | 8.609+01 | 7.343+01 | 8.609+01 | 7.343+01 |          |
| 8.0+06            | 1.201+05 | 3.604+01 | 1.815+05 | 4.205+01 | 2.627+05 | 4.805+01 | 3.676+05 | 5.406+01 | 5.010+05 | 6.006+01 | 5.010+05 | 6.006+01 | 5.010+05 | 6.006+01 |          |
| 1.0+07            | 7.683+06 | 3.069+01 | 1.162+05 | 3.581+01 | 1.682+05 | 4.093+01 | 2.353+05 | 4.604+01 | 3.207+05 | 5.116+01 | 3.207+05 | 5.116+01 | 3.207+05 | 5.116+01 |          |
| 1.5+07            | 3.415+06 | 2.272+01 | 5.164+06 | 2.650+01 | 7.474+06 | 3.029+01 | 1.046+05 | 3.408+01 | 1.425+05 | 3.786+01 | 1.425+05 | 3.786+01 | 1.425+05 | 3.786+01 |          |
| 2.0+07            | 1.921+06 | 1.823+01 | 2.905+06 | 2.127+01 | 4.204+06 | 2.431+01 | 6.833+06 | 2.735+01 | 8.017+06 | 3.039+01 | 8.017+06 | 3.039+01 | 8.017+06 | 3.039+01 |          |
| 3.0+07            | 8.537+07 | 1.327+01 | 1.549+07 | 1.549+01 | 1.868+06 | 1.770+01 | 2.614+06 | 1.991+01 | 3.563+06 | 2.212+01 | 3.563+06 | 2.212+01 | 3.563+06 | 2.212+01 |          |
| 4.0+07            | 4.802+07 | 1.055+01 | 7.263+07 | 1.231+01 | 1.051+06 | 1.464+01 | 1.471+06 | 1.582+01 | 2.004+06 | 1.758+01 | 2.004+06 | 1.758+01 | 2.004+06 | 1.758+01 |          |
| 5.0+07            | 3.073+07 | 8.805+02 | 4.648+07 | 1.027+01 | 6.725+07 | 1.174+01 | 9.412+07 | 1.321+01 | 1.283+06 | 1.467+01 | 1.283+06 | 1.467+01 | 1.283+06 | 1.467+01 |          |
| 6.0+07            | 2.134+07 | 7.586+02 | 3.227+07 | 8.851+02 | 4.670+07 | 1.012+01 | 6.535+07 | 1.138+01 | 8.905+07 | 1.264+01 | 8.905+07 | 1.264+01 | 8.905+07 | 1.264+01 |          |
| 8.0+07            | 1.200+07 | 5.983+02 | 1.816+07 | 6.980+02 | 2.628+07 | 7.977+02 | 3.677+07 | 8.974+02 | 5.011+07 | 9.972+02 | 5.011+07 | 9.972+02 | 5.011+07 | 9.972+02 |          |
| 1.0+08            | 7.682+08 | 4.966+02 | 1.162+07 | 5.793+02 | 1.681+07 | 6.622+02 | 2.353+07 | 7.449+02 | 3.206+07 | 8.276+02 | 3.206+07 | 8.276+02 | 3.206+07 | 8.276+02 |          |

TABLE III--CONT.

| PHOTON ENERGY, EV | COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARN/ATOM |          |          |          |          |          | 15 P     |          |          |          |       |       |
|-------------------|--------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|-------|
|                   | 11 NA                                                        |          | 12 MG    |          | 13 AL    |          | 14 SI    |          | COH      |          | INCOH |       |
|                   | COH                                                          | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH   | INCOH |
| 1.0+02            | 8.037+01                                                     | 7.817+03 | 9.569+01 | 8.654+03 | 1.124+02 | 8.557+03 | 1.303+02 | 7.674+03 | 1.496+02 | 6.934+03 |       |       |
| 1.5+02            | 8.024+01                                                     | 1.747+02 | 9.553+01 | 1.946+02 | 1.121+02 | 1.902+02 | 1.301+02 | 1.710+02 | 1.494+02 | 1.554+02 |       |       |
| 2.0+02            | 8.010+01                                                     | 3.967+02 | 9.534+01 | 3.450+02 | 1.119+02 | 3.357+02 | 1.298+02 | 1.036+02 | 1.491+02 | 2.744+02 |       |       |
| 3.0+02            | 7.979+02                                                     | 9.479+02 | 7.626+02 | 1.112+02 | 7.427+02 | 1.291+02 | 6.751+02 | 1.101+02 | 1.484+02 | 6.101+02 |       |       |
| 4.0+02            | 7.904+01                                                     | 1.142+01 | 9.404+01 | 1.330+01 | 1.103+02 | 1.290+01 | 1.281+02 | 1.180+01 | 1.474+02 | 1.069+01 |       |       |
| 5.0+02            | 7.828+01                                                     | 1.698+01 | 9.312+01 | 1.994+01 | 1.091+02 | 1.960+01 | 1.265+02 | 1.803+01 | 1.461+02 | 1.640+01 |       |       |
| 6.0+02            | 7.743+01                                                     | 2.308+01 | 9.202+01 | 2.759+01 | 1.078+02 | 2.730+01 | 1.254+02 | 2.531+01 | 1.446+02 | 2.311+01 |       |       |
| 8.0+02            | 7.545+01                                                     | 3.592+01 | 8.946+01 | 4.458+01 | 1.046+02 | 4.485+01 | 1.220+02 | 4.230+01 | 1.409+02 | 3.899+01 |       |       |
| 1.0+03            | 7.327+01                                                     | 4.848+01 | 8.659+01 | 6.228+01 | 1.000+02 | 6.394+01 | 1.179+02 | 6.141+01 | 1.366+02 | 5.723+01 |       |       |
| 1.5+03            | 6.773+01                                                     | 7.613+01 | 7.885+01 | 1.023+00 | 9.135+01 | 1.110+00 | 1.066+02 | 1.116+00 | 1.241+02 | 1.070+01 |       |       |
| 2.0+03            | 6.264+01                                                     | 1.007+00 | 7.170+01 | 1.336+00 | 8.231+01 | 1.512+00 | 9.557+01 | 1.580+00 | 1.113+02 | 1.555+00 |       |       |
| 3.0+03            | 5.355+01                                                     | 1.507+00 | 6.037+01 | 1.841+00 | 6.818+01 | 2.120+00 | 7.782+01 | 2.314+00 | 2.385+00 | 8.965+01 |       |       |
| 4.0+03            | 4.522+01                                                     | 2.017+00 | 5.146+01 | 2.311+00 | 5.798+01 | 2.603+00 | 6.544+01 | 2.851+00 | 7.439+01 | 3.027+00 |       |       |
| 5.0+03            | 3.786+01                                                     | 2.503+00 | 4.391+01 | 2.762+00 | 4.994+01 | 3.044+00 | 5.632+01 | 3.316+00 | 6.356+01 | 3.538+00 |       |       |
| 6.0+03            | 3.167+01                                                     | 2.946+00 | 3.743+01 | 3.183+00 | 4.314+01 | 3.448+00 | 4.895+01 | 3.730+00 | 5.529+01 | 3.970+00 |       |       |
| 8.0+03            | 2.261+01                                                     | 3.674+00 | 2.739+01 | 3.967+00 | 3.234+01 | 4.163+00 | 3.744+01 | 4.434+00 | 4.278+01 | 4.698+00 |       |       |
| 1.0+04            | 1.680+01                                                     | 4.203+00 | 2.058+01 | 4.467+00 | 2.465+01 | 4.740+00 | 2.897+01 | 5.020+00 | 3.356+01 | 5.297+00 |       |       |
| 1.5+04            | 9.412+00                                                     | 4.963+00 | 1.160+01 | 5.668+00 | 1.402+01 | 5.668+00 | 1.969+01 | 6.000+00 | 1.283+01 | 6.342+00 |       |       |
| 2.0+04            | 6.142+00                                                     | 5.335+00 | 7.568+00 | 5.741+00 | 9.146+00 | 6.142+00 | 1.085+01 | 6.538+00 | 1.283+01 | 6.923+00 |       |       |
| 3.0+04            | 3.272+00                                                     | 5.666+00 | 4.043+00 | 6.115+00 | 4.885+00 | 6.561+00 | 5.835+00 | 7.002+00 | 6.875+00 | 7.439+00 |       |       |
| 4.0+04            | 2.033+00                                                     | 5.761+00 | 2.524+00 | 6.230+00 | 3.067+00 | 6.692+00 | 3.666+00 | 7.155+00 | 4.333+00 | 7.611+00 |       |       |
| 5.0+04            | 1.377+00                                                     | 5.749+00 | 1.716+00 | 6.228+00 | 2.094+00 | 6.702+00 | 2.513+00 | 7.172+00 | 2.978+00 | 7.637+00 |       |       |
| 6.0+04            | 9.938+01                                                     | 5.685+00 | 1.241+00 | 6.167+00 | 1.517+00 | 6.645+00 | 1.825+00 | 7.118+00 | 2.168+00 | 7.587+00 |       |       |
| 8.0+04            | 5.856+01                                                     | 5.497+00 | 7.328+01 | 5.974+00 | 8.975+01 | 6.447+00 | 1.082+00 | 6.918+00 | 1.289+00 | 7.384+00 |       |       |
| 1.0+05            | 3.857+01                                                     | 5.291+00 | 4.834+01 | 5.756+00 | 5.218+01 | 6.218+00 | 5.929+01 | 6.218+00 | 7.157+01 | 6.678+00 |       |       |
| 1.5+05            | 1.777+01                                                     | 4.819+00 | 2.232+01 | 5.259+00 | 2.744+01 | 5.678+00 | 3.320+01 | 6.105+00 | 3.320+01 | 6.531+00 |       |       |
| 2.0+05            | 1.014+01                                                     | 4.437+00 | 1.276+01 | 4.336+00 | 1.571+01 | 5.237+00 | 1.604+01 | 6.430+00 | 3.630+01 | 6.026+00 |       |       |
| 3.0+05            | 4.560+02                                                     | 3.873+00 | 5.747+02 | 4.223+00 | 7.054+02 | 4.573+00 | 8.594+02 | 4.922+00 | 1.029+01 | 5.270+00 |       |       |
| 4.0+05            | 2.576+02                                                     | 3.476+00 | 3.248+02 | 3.751+00 | 4.006+02 | 4.105+00 | 4.864+02 | 4.419+00 | 5.828+02 | 4.733+00 |       |       |
| 5.0+05            | 1.652+02                                                     | 3.177+00 | 2.084+02 | 3.465+00 | 2.571+02 | 3.752+00 | 3.122+02 | 4.040+00 | 3.742+02 | 4.328+00 |       |       |
| 6.0+05            | 1.149+02                                                     | 2.940+00 | 1.449+02 | 3.207+00 | 1.788+02 | 3.474+00 | 2.171+02 | 3.740+00 | 2.603+02 | 4.006+00 |       |       |
| 8.0+05            | 6.466+03                                                     | 2.584+00 | 8.161+03 | 2.819+00 | 1.067+02 | 3.053+00 | 1.223+02 | 3.288+00 | 1.467+02 | 3.522+00 |       |       |
| 1.0+06            | 4.142+03                                                     | 2.326+03 | 5.235+03 | 6.450+03 | 6.450+03 | 7.456+03 | 7.835+03 | 7.957+00 | 9.396+03 | 3.168+00 |       |       |
| 1.5+06            | 1.841+03                                                     | 1.889+00 | 2.324+03 | 2.061+00 | 2.868+03 | 2.233+00 | 3.485+03 | 2.404+00 | 4.179+03 | 2.576+00 |       |       |
| 2.0+06            | 1.036+03                                                     | 1.612+00 | 1.307+03 | 1.579+00 | 1.614+03 | 1.905+00 | 1.961+03 | 2.052+00 | 2.351+03 | 2.198+00 |       |       |
| 3.0+06            | 4.605+04                                                     | 1.269+00 | 5.812+04 | 1.384+00 | 7.173+04 | 1.499+00 | 8.715+04 | 1.614+00 | 1.045+03 | 1.730+00 |       |       |
| 4.0+06            | 2.590+04                                                     | 1.058+00 | 3.269+04 | 1.154+00 | 4.035+04 | 1.251+00 | 4.903+04 | 1.347+00 | 5.880+04 | 1.443+00 |       |       |
| 5.0+06            | 1.658+04                                                     | 9.138+01 | 2.092+04 | 9.965+01 | 2.583+04 | 1.080+00 | 3.138+04 | 1.163+00 | 3.764+04 | 1.246+00 |       |       |
| 6.0+06            | 1.151+04                                                     | 8.077+01 | 1.453+04 | 8.811+01 | 1.794+04 | 9.545+01 | 2.179+04 | 1.028+00 | 2.014+04 | 1.101+00 |       |       |
| 8.0+06            | 6.476+05                                                     | 6.607+01 | 8.173+05 | 7.208+01 | 1.009+04 | 7.808+01 | 1.226+04 | 8.409+01 | 1.470+04 | 9.010+01 |       |       |
| 1.0+07            | 4.145+05                                                     | 5.627+01 | 5.232+05 | 6.139+01 | 6.458+05 | 6.650+01 | 7.846+05 | 7.162+01 | 9.410+05 | 7.673+01 |       |       |
| 1.5+07            | 1.842+05                                                     | 4.165+01 | 2.325+05 | 4.53+01  | 2.870+05 | 4.922+01 | 3.487+05 | 4.182+01 | 5.679+01 | 5.679+01 |       |       |
| 2.0+07            | 1.036+05                                                     | 3.343+01 | 1.308+05 | 3.647+01 | 1.614+05 | 3.951+01 | 1.961+05 | 4.254+01 | 2.352+05 | 4.558+01 |       |       |
| 3.0+07            | 4.605+06                                                     | 2.434+01 | 5.812+06 | 2.655+01 | 7.174+06 | 2.876+01 | 8.716+06 | 3.097+01 | 1.045+05 | 3.319+01 |       |       |
| 4.0+07            | 2.591+06                                                     | 1.934+01 | 3.270+06 | 2.110+01 | 4.036+06 | 2.285+01 | 4.903+06 | 2.461+01 | 5.881+06 | 2.637+01 |       |       |
| 5.0+07            | 1.614+06                                                     | 1.614+01 | 2.092+06 | 1.761+01 | 2.583+06 | 1.908+01 | 3.138+06 | 2.054+01 | 3.764+06 | 2.201+01 |       |       |
| 6.0+07            | 1.151+06                                                     | 1.391+01 | 1.453+06 | 1.517+01 | 1.793+06 | 1.644+01 | 2.179+06 | 1.770+01 | 2.613+06 | 1.897+01 |       |       |
| 8.0+07            | 6.477+07                                                     | 1.097+01 | 8.174+07 | 1.197+01 | 1.009+06 | 1.295+01 | 1.226+06 | 1.396+01 | 1.470+06 | 1.496+01 |       |       |
| 1.0+08            | 4.146+07                                                     | 9.104+02 | 5.230+07 | 9.932+02 | 6.456+07 | 1.076+01 | 7.844+07 | 1.159+01 | 9.408+07 | 1.241+01 |       |       |

TABLE II., CONT. COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNS/ATOM

| PHOTON ENERGY, EV | 16 S     |          |          |          |          |            | 17 CL    |          |           |          |           |           | 18 AR    |          |          |          |          |          | 19 K     |          |          |          |          |  |
|-------------------|----------|----------|----------|----------|----------|------------|----------|----------|-----------|----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--|
|                   | COH      | INCOH    | COH      | INCOH    | COH      | INCOH      | COH      | INCOH    | COH       | INCOH    | COH       | INCOH     | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    |          |  |
| 1.0+02            | 1.702+02 | 6.170-03 | 1.922+02 | 5.835-03 | 2.155+02 | 5.185-03   | 2.400+02 | 2.400+02 | 1.366-02  | 2.659+02 | 1.561-02  | 2.654+02  | 3.459-02 | 3.459-02 | 2.647+02 | 2.647+02 | 6.166-02 | 6.166-02 | 1.349-01 | 1.349-01 | 2.630+02 | 2.630+02 |          |  |
| 1.5+02            | 1.700+02 | 1.402-02 | 1.279-02 | 2.268-02 | 2.150+02 | 2.080-02   | 2.395+02 | 2.395+02 | 3.028-02  | 3.028-02 | 5.321+02  | 5.321+02  | 1.154-01 | 1.154-01 | 2.375+02 | 2.375+02 | 1.154-01 | 1.154-01 | 2.606+02 | 2.606+02 | 2.309+01 | 2.309+01 |          |  |
| 2.0+02            | 1.697+02 | 2.485-02 | 1.917-02 | 2.268-02 | 1.909+02 | 5.065-02   | 2.142+02 | 4.655-02 | 2.375+02  | 2.375+02 | 1.154-01  | 1.154-01  | 2.630+02 | 2.630+02 | 1.154-01 | 1.154-01 | 2.630+02 | 2.630+02 | 1.349-01 | 1.349-01 | 2.630+02 | 2.630+02 |          |  |
| 2.0+02            | 1.690+02 | 5.543-02 | 1.909+02 | 5.065-02 | 1.889+02 | 8.920-02   | 2.132+02 | 8.210-02 | 2.375+02  | 2.375+02 | 1.950-01  | 1.950-01  | 2.577+02 | 2.577+02 | 1.950-01 | 1.950-01 | 2.577+02 | 2.577+02 | 3.441-01 | 3.441-01 | 2.577+02 | 2.577+02 |          |  |
| 3.0+02            | 1.680+02 | 9.741-02 | 1.886+02 | 1.886+02 | 1.886+02 | 1.378-01   | 2.119+02 | 1.270-01 | 2.375+02  | 2.375+02 | 1.950-01  | 1.950-01  | 2.577+02 | 2.577+02 | 1.950-01 | 1.950-01 | 2.577+02 | 2.577+02 | 3.441-01 | 3.441-01 | 2.577+02 | 2.577+02 |          |  |
| 4.0+02            | 1.667+02 | 5.000-01 | 1.870+02 | 1.870+02 | 1.870+02 | 1.957-01   | 2.033+02 | 1.806-01 | 2.375+02  | 2.375+02 | 3.855-01  | 3.855-01  | 2.577+02 | 2.577+02 | 3.855-01 | 3.855-01 | 2.577+02 | 2.577+02 | 4.690-01 | 4.690-01 | 2.577+02 | 2.577+02 |          |  |
| 5.0+02            | 1.651+02 | 2.124-01 | 1.863+02 | 3.623-01 | 1.863+02 | 3.362-01   | 2.036+02 | 3.117-01 | 2.241+02  | 2.241+02 | 5.892-01  | 5.892-01  | 2.467+02 | 2.467+02 | 7.336-01 | 7.336-01 | 2.467+02 | 2.467+02 | 7.336-01 | 7.336-01 | 2.467+02 | 2.467+02 |          |  |
| 6.0+02            | 1.641+02 | 1.624-01 | 1.852+02 | 3.623-01 | 1.852+02 | 3.362-01   | 2.036+02 | 3.117-01 | 2.241+02  | 2.241+02 | 5.892-01  | 5.892-01  | 2.467+02 | 2.467+02 | 7.336-01 | 7.336-01 | 2.467+02 | 2.467+02 | 7.336-01 | 7.336-01 | 2.467+02 | 2.467+02 |          |  |
| 8.0+02            | 1.632+02 | 1.616-01 | 1.569+02 | 5.383-01 | 1.786+02 | 5.038-01   | 2.017+02 | 4.696-01 | 2.173+02  | 2.173+02 | 7.892-01  | 7.892-01  | 2.383+02 | 2.383+02 | 9.944-01 | 9.944-01 | 2.383+02 | 2.383+02 | 9.944-01 | 9.944-01 | 2.383+02 | 2.383+02 |          |  |
| 1.0+03            | 1.624+02 | 1.435+02 | 1.039+00 | 1.039+00 | 1.645+02 | 9.056-01   | 1.811+02 | 9.421-01 | 1.271+00  | 1.271+00 | 1.598+02  | 1.598+02  | 1.271+00 | 1.271+00 | 1.598+02 | 1.598+02 | 1.271+00 | 1.271+00 | 1.598+02 | 1.598+02 | 1.271+00 | 1.271+00 |          |  |
| 1.5+03            | 1.291+02 | 1.553+00 | 1.489+02 | 1.553+00 | 1.562+02 | 1.744+02   | 1.744+02 | 1.662+02 | 1.750+02  | 1.750+02 | 1.828+02  | 1.828+02  | 1.750+02 | 1.750+02 | 1.828+02 | 1.828+02 | 1.750+02 | 1.750+02 | 1.828+02 | 1.828+02 | 1.750+02 | 1.750+02 |          |  |
| 2.0+03            | 1.377+02 | 1.969+00 | 1.198+02 | 2.501+00 | 1.304+02 | 1.266+00   | 1.304+02 | 2.466+00 | 1.509+02  | 1.509+02 | 2.702+00  | 2.702+00  | 1.362+02 | 1.362+02 | 3.804+00 | 3.804+00 | 1.362+02 | 1.362+02 | 3.804+00 | 3.804+00 | 1.362+02 | 1.362+02 |          |  |
| 3.0+03            | 8.509+01 | 3.196+00 | 9.769+01 | 3.309+00 | 8.184+01 | 3.950+00   | 9.331+01 | 4.046+00 | 1.036+02  | 1.036+02 | 4.270+00  | 4.270+00  | 9.721+01 | 9.721+01 | 5.139+00 | 5.139+00 | 9.721+01 | 9.721+01 | 5.139+00 | 5.139+00 | 9.721+01 | 9.721+01 |          |  |
| 4.0+03            | 7.198+01 | 3.766+00 | 8.184+01 | 4.231+00 | 7.034+01 | 4.463+00   | 7.958+01 | 4.625+00 | 8.813+01  | 8.813+01 | 4.874+00  | 4.874+00  | 9.721+01 | 9.721+01 | 5.139+00 | 5.139+00 | 9.721+01 | 9.721+01 | 5.139+00 | 5.139+00 | 9.721+01 | 9.721+01 |          |  |
| 5.0+03            | 6.232+01 | 4.231+00 | 4.983+00 | 5.452+01 | 5.260+00 | 6.122+01   | 5.501+00 | 6.122+01 | 6.748+01  | 6.748+01 | 5.759+00  | 5.759+00  | 7.408+01 | 7.408+01 | 6.105+00 | 6.105+00 | 7.408+01 | 7.408+01 | 6.105+00 | 6.105+00 | 7.408+01 | 7.408+01 |          |  |
| 8.0+03            | 4.842+01 | 4.983+00 | 4.842+01 | 4.842+01 | 4.842+01 | 4.842+01   | 4.842+01 | 4.842+01 | 4.842+01  | 4.842+01 | 4.842+01  | 4.842+01  | 4.842+01 | 4.842+01 | 4.842+01 | 4.842+01 | 4.842+01 | 4.842+01 | 4.842+01 | 4.842+01 | 4.842+01 | 4.842+01 |          |  |
| 1.0+04            | 3.841+01 | 5.592+00 | 4.355+01 | 5.887+00 | 4.355+01 | 5.887+00   | 4.905+01 | 6.161+00 | 4.905+01  | 6.161+00 | 6.481+00  | 6.481+00  | 5.940+01 | 5.940+01 | 6.114+00 | 6.114+00 | 5.940+01 | 5.940+01 | 6.114+00 | 6.114+00 | 5.940+01 | 5.940+01 |          |  |
| 1.5+04            | 2.884+01 | 6.677+00 | 2.633+01 | 7.010+00 | 3.734+01 | 7.683+00   | 1.930+01 | 8.048+00 | 2.253+01  | 8.423+00 | 2.253+01  | 8.423+00  | 3.379+01 | 3.379+01 | 7.674+00 | 7.674+00 | 3.755+01 | 3.755+01 | 8.028+00 | 8.028+00 | 3.755+01 | 3.755+01 |          |  |
| 2.0+04            | 1.498+01 | 7.306+00 | 8.124+00 | 7.874+00 | 9.287+00 | 8.304+00   | 1.067+01 | 8.727+00 | 1.209+01  | 9.152+00 | 1.209+01  | 9.152+00  | 1.359+01 | 1.359+01 | 9.576+00 | 9.576+00 | 8.801+00 | 8.801+00 | 9.576+00 | 9.576+00 | 8.801+00 | 8.801+00 |          |  |
| 3.0+04            | 8.509+01 | 3.196+00 | 8.184+01 | 4.046+00 | 5.870+00 | 8.155+00   | 6.751+00 | 8.961+00 | 7.651+00  | 8.615+00 | 8.615+00  | 8.615+00  | 9.853+00 | 9.853+00 | 9.765+00 | 9.765+00 | 9.853+00 | 9.853+00 | 9.765+00 | 9.765+00 | 9.853+00 | 9.853+00 |          |  |
| 4.0+04            | 5.066+00 | 8.055+00 | 5.066+00 | 5.066+00 | 4.955+00 | 8.558+00   | 4.671+00 | 9.013+00 | 5.301+00  | 9.468+00 | 5.301+00  | 9.468+00  | 5.940+00 | 5.940+00 | 4.394+00 | 4.394+00 | 9.889+00 | 9.889+00 | 4.394+00 | 4.394+00 | 9.889+00 | 9.889+00 |          |  |
| 5.0+04            | 3.492+00 | 8.099+00 | 2.494+00 | 2.964+00 | 2.964+00 | 8.164+00   | 3.422+00 | 8.975+00 | 3.891+00  | 9.434+00 | 3.891+00  | 9.434+00  | 2.339+00 | 2.339+00 | 2.339+00 | 2.339+00 | 2.339+00 | 2.339+00 | 2.339+00 | 2.339+00 | 2.339+00 | 2.339+00 | 2.339+00 |  |
| 6.0+04            | 2.448+00 | 8.053+00 | 2.448+00 | 2.448+00 | 1.771+00 | 8.309+00   | 2.050+00 | 8.767+00 | 2.050+00  | 8.767+00 | 2.050+00  | 8.767+00  | 2.050+00 | 2.050+00 | 2.050+00 | 2.050+00 | 2.050+00 | 2.050+00 | 2.050+00 | 2.050+00 | 2.050+00 | 2.050+00 |          |  |
| 8.0+04            | 1.518+00 | 7.848+00 | 1.518+00 | 1.518+00 | 1.749+00 | 7.575+00   | 2.042+00 | 3.991+00 | 2.379+02  | 4.225+00 | 2.379+02  | 4.225+00  | 2.379+02 | 2.379+02 | 4.455+00 | 4.455+00 | 3.119+02 | 3.119+02 | 4.455+00 | 4.455+00 | 3.119+02 | 3.119+02 |          |  |
| 1.0+05            | 1.006+00 | 7.590+00 | 1.176+00 | 7.379+00 | 5.481-01 | 7.379+00   | 1.176+00 | 6.362-01 | 7.801+00  | 1.557+00 | 8.941+00  | 1.557+00  | 8.941+00 | 1.767+00 | 1.767+00 | 9.388+00 | 9.388+00 | 1.767+00 | 1.767+00 | 9.388+00 | 9.388+00 |          |          |  |
| 1.5+05            | 4.685-01 | 6.956+00 | 5.481-01 | 6.216+00 | 3.154-01 | 6.216+00   | 3.662-01 | 7.209+00 | 7.209+00  | 7.231-01 | 7.231-01  | 7.231-01  | 8.280+01 | 8.280+01 | 8.641+00 | 8.641+00 | 7.779+01 | 7.779+01 | 7.994+00 | 7.994+00 |          |          |          |  |
| 2.0+05            | 2.593-01 | 6.421+00 | 1.219+01 | 5.618+00 | 1.430+01 | 5.966+00   | 1.663+01 | 6.314+00 | 1.928+01  | 6.160+00 | 6.160+00  | 6.160+00  | 2.175+01 | 2.175+01 | 7.007+00 | 7.007+00 | 2.175+01 | 2.175+01 | 7.007+00 | 7.007+00 |          |          |          |  |
| 3.0+05            | 6.108-02 | 5.047+00 | 8.106-02 | 5.361+00 | 9.435-02 | 5.361+00   | 9.435-02 | 5.674+00 | 9.083+01  | 5.674+00 | 5.987+00  | 5.987+00  | 1.235+01 | 1.235+01 | 6.299+00 | 6.299+00 | 1.235+01 | 1.235+01 | 6.299+00 | 6.299+00 |          |          |          |  |
| 4.0+05            | 4.436-02 | 4.047+00 | 4.436-02 | 4.615+00 | 5.207-02 | 4.902+00   | 6.063+02 | 5.189+00 | 6.9561-02 | 5.189+00 | 6.9561-02 | 6.9561-02 | 5.942+00 | 5.942+00 | 5.763+00 | 5.763+00 | 5.942+00 | 5.942+00 | 5.763+00 | 5.763+00 |          |          |          |  |
| 5.0+05            | 3.486-02 | 3.293+00 | 3.486-02 | 3.615+00 | 5.243-02 | 4.122+00   | 6.108+00 | 1.945+00 | 7.017+04  | 1.945+00 | 1.578+00  | 1.578+00  | 1.097+05 | 1.097+05 | 3.364+01 | 3.364+01 | 1.097+05 | 1.097+05 | 3.364+01 | 3.364+01 |          |          |          |  |
| 6.0+05            | 3.100+04 | 1.757+00 | 3.100+04 | 1.757+00 | 3.641+04 | 1.248+00   | 3.641+04 | 1.248+00 | 2.322+00  | 1.322+00 | 4.874+04  | 4.874+04  | 1.395+00 | 1.395+00 | 1.468+00 | 1.468+00 | 5.564+04 | 5.564+04 | 1.468+00 | 1.468+00 |          |          |          |  |
| 8.0+05            | 1.744+04 | 9.610-01 | 1.744+04 | 9.610-01 | 2.048+04 | 1.021+00   | 2.048+04 | 1.021+00 | 2.386+04  | 1.081+00 | 2.742+04  | 2.742+04  | 1.141+00 | 1.141+00 | 3.130+04 | 3.130+04 | 1.201+00 | 1.201+00 | 3.130+04 | 3.130+04 |          |          |          |  |
| 1.0+06            | 1.114-02 | 8.185+01 | 1.311-04 | 8.696-01 | 1.522+01 | 8.090+00   | 1.522+01 | 8.090+00 | 2.365+02  | 1.751-02 | 4.011+00  | 4.011+00  | 1.751-02 | 1.751-02 | 1.099+02 | 1.099+02 | 4.222+00 | 4.222+00 | 1.099+02 | 1.099+02 |          |          |          |  |
| 1.5+06            | 4.957-03 | 2.747+00 | 5.821-03 | 2.747+00 | 3.276-03 | 2.345+00   | 3.276-03 | 2.345+00 | 3.816-03  | 2.616-01 | 3.818-05  | 3.818-05  | 8.893-03 | 8.893-03 | 3.931+00 | 3.931+00 | 5.005+03 | 5.005+03 | 2.931+00 | 2.931+00 |          |          |          |  |
| 2.0+06            | 2.797-05 | 4.862+01 | 3.889-03 | 4.862+01 | 1.240-03 | 1.456-02   | 1.240-03 | 1.456-02 | 1.697-03  | 3.761-01 | 1.697-05  | 3.982-01  | 3.982-01 | 2.125+03 | 2.125+03 | 2.306+00 | 2.306+00 | 2.125+03 | 2.125+03 | 2.306+00 | 2.306+00 |          |          |  |
| 3.0+06            | 1.240+05 | 3.540+01 | 1.456-02 | 3.540+01 | 8.191-04 | 1.635+00</ |          |          |           |          |           |           |          |          |          |          |          |          |          |          |          |          |          |  |

TABLE III\*, CONT.

| PHOTON ENERGY, EV | COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNs/ATOM |          |          |          |          |          | INCOH    |          |          |          |
|-------------------|---------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | 21 SC                                                         | 22 TI    | 23 V     | 24 CR    | 25 MN    | INCOH    |          |          |          |          |
| COH               | INCOH                                                         | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    |          |          |          |
| 1.0+02            | 2.932+02                                                      | 1.464-02 | 3.217+02 | 1.379-02 | 3.516+02 | 1.291-02 | 3.828+02 | 1.017-02 | 4.154+02 | 1.125-02 |
| 1.5+02            | 2.926+02                                                      | 3.262-02 | 3.212+02 | 3.064-02 | 3.511+02 | 2.871-02 | 3.226+02 | 2.252-02 | 2.149+02 | 2.330-02 |
| 2.0+02            | 2.920+02                                                      | 5.744-02 | 3.205+02 | 5.049-02 | 3.505+02 | 5.049-02 | 3.819-02 | 3.985-02 | 4.143+02 | 4.487-02 |
| 3.0+02            | 2.003+02                                                      | 1.260-01 | 3.189+02 | 1.181-01 | 3.488+02 | 1.111-01 | 3.804+02 | 8.803-02 | 4.127+02 | 9.352-02 |
| 4.0+02            | 2.879+02                                                      | 2.166-01 | 3.165+02 | 2.036-01 | 3.465+02 | 1.920-01 | 3.784+02 | 1.525-01 | 4.114+02 | 1.724-01 |
| 5.0+02            | 2.859+02                                                      | 3.247-01 | 3.137+02 | 3.064-01 | 3.436+02 | 2.898-01 | 3.759+02 | 2.307-01 | 4.075+02 | 2.615-01 |
| 6.0+02            | 2.817+02                                                      | 4.455-01 | 3.103+02 | 4.222-01 | 3.403+02 | 4.007-01 | 3.729+02 | 3.199-01 | 4.042+02 | 3.355-01 |
| 8.0+02            | 2.738+02                                                      | 7.666-01 | 3.024+02 | 6.767-01 | 3.323+02 | 6.473-01 | 3.658+02 | 5.210-01 | 3.961+02 | 5.943-01 |
| 1.0+03            | 2.650+02                                                      | 9.713-01 | 2.930+02 | 9.397-01 | 3.231+02 | 9.062-01 | 3.573+02 | 7.377-01 | 3.866+02 | 8.426-01 |
| 1.5+03            | 2.419+02                                                      | 1.570+00 | 2.620+02 | 1.550+00 | 2.978+02 | 1.520+00 | 3.334+02 | 1.287+00 | 3.598+02 | 1.451+00 |
| 2.0+03            | 2.202+02                                                      | 2.087+00 | 2.456+02 | 2.082+00 | 2.728+02 | 2.059+00 | 3.083+02 | 1.818+00 | 3.322+02 | 1.998+00 |
| 3.0+03            | 1.831+02                                                      | 3.032+00 | 2.019+02 | 3.051+00 | 2.286+02 | 3.041+00 | 2.603+02 | 2.832+00 | 2.816+02 | 2.889+00 |
| 4.0+03            | 1.527+02                                                      | 3.681+00 | 1.712+02 | 3.928+00 | 1.917+02 | 3.936+00 | 2.183+02 | 3.762+00 | 2.380+02 | 3.904+00 |
| 5.0+03            | 1.281+02                                                      | 4.627+00 | 1.436+02 | 4.702+00 | 1.613+02 | 4.734+00 | 1.834+02 | 4.600+00 | 4.013+02 | 4.736+00 |
| 6.0+03            | 1.089+02                                                      | 5.779+00 | 1.222+02 | 5.382+00 | 1.369+02 | 5.442+00 | 1.554+02 | 5.351+00 | 1.713+02 | 5.486+00 |
| 8.0+03            | 8.239+01                                                      | 6.314+00 | 9.189+01 | 6.486+00 | 1.026+02 | 6.610+00 | 1.158+02 | 6.612+00 | 1.279+02 | 6.764+00 |
| 1.0+04            | 6.574+01                                                      | 7.077+00 | 7.289+01 | 7.309+00 | 8.091+01 | 7.497+00 | 9.067+01 | 7.585+00 | 9.986+01 | 7.775+00 |
| 1.5+04            | 4.175+01                                                      | 8.256+00 | 4.628+01 | 8.664+00 | 5.120+01 | 8.950+00 | 5.691+01 | 9.179+00 | 6.238+01 | 9.655+00 |
| 2.0+04            | 2.833+01                                                      | 9.165+00 | 3.165+01 | 9.512+00 | 3.519+01 | 9.846+00 | 3.920+01 | 1.014+01 | 4.314+01 | 1.047+01 |
| 3.0+04            | 1.527+01                                                      | 9.592+00 | 1.710+01 | 1.040+01 | 1.908+01 | 1.080+01 | 2.131+01 | 1.177+01 | 1.556+01 | 1.556+01 |
| 4.0+04            | 9.679+00                                                      | 1.029+01 | 1.084+01 | 1.073+01 | 1.209+01 | 1.116+01 | 1.350+01 | 1.158+01 | 1.494+01 | 1.213+01 |
| 5.0+04            | 6.116+00                                                      | 1.037+01 | 7.518+00 | 1.082+01 | 8.386+00 | 1.126+01 | 9.349+00 | 1.170+01 | 1.034+01 | 1.680+01 |
| 6.0+04            | 4.945+00                                                      | 1.034+01 | 5.541+00 | 1.079+01 | 6.184+00 | 1.124+01 | 6.895+00 | 1.168+01 | 1.213+01 | 6.629+00 |
| 8.0+04            | 2.991+00                                                      | 1.013+01 | 3.359+00 | 1.059+01 | 3.757+00 | 1.103+01 | 4.195+00 | 1.147+01 | 4.648+00 | 1.191+01 |
| 1.0+05            | 1.997+00                                                      | 9.833+00 | 2.247+00 | 1.028+01 | 2.517+00 | 1.072+01 | 2.814+00 | 1.115+01 | 3.122+00 | 1.159+01 |
| 1.5+05            | 9.776-01                                                      | 5.599+00 | 1.056+01 | 9.476+00 | 9.476+00 | 9.891+00 | 1.030+01 | 1.072+01 | 1.474+00 | 1.072+01 |
| 2.0+05            | 5.416-01                                                      | 8.385+00 | 6.107-01 | 8.775+00 | 6.856-01 | 9.164+00 | 7.679-01 | 9.525+00 | 8.539-01 | 9.940+00 |
| 3.0+05            | 2.667-01                                                      | 7.353+00 | 2.785-01 | 7.699+00 | 3.129-01 | 8.044+00 | 3.508-01 | 8.389+00 | 3.904-01 | 8.733+00 |
| 4.0+05            | 1.402-01                                                      | 6.612+00 | 1.583-01 | 6.924+00 | 1.780-01 | 7.236+00 | 1.586-01 | 7.548+00 | 2.223-01 | 7.889+00 |
| 5.0+05            | 9.019-01                                                      | 6.049+00 | 1.019-01 | 6.335+00 | 1.146-01 | 6.622+00 | 1.285-01 | 6.907+00 | 1.432-01 | 7.19+00  |
| 6.0+05            | 6.281-02                                                      | 5.605+00 | 7.096-02 | 5.868+00 | 7.983-02 | 6.133+00 | 8.957-02 | 6.399+00 | 9.979-02 | 6.664+00 |
| 8.0+05            | 3.544-02                                                      | 4.928+00 | 4.004-02 | 5.161+00 | 4.506-02 | 5.395+00 | 5.056-02 | 5.629+00 | 5.634-02 | 5.863+00 |
| 1.0+06            | 2.271-02                                                      | 4.433+00 | 2.566-02 | 4.644+00 | 2.888-02 | 4.854+00 | 3.241-02 | 5.065+00 | 3.612-02 | 5.275+00 |
| 1.5+06            | 1.010-02                                                      | 3.605+00 | 1.142-02 | 3.778+00 | 1.285-02 | 3.948+00 | 1.442-02 | 4.119+00 | 1.608-02 | 4.291+00 |
| 2.0+06            | 5.637-03                                                      | 3.227+00 | 6.428-03 | 3.227+00 | 7.234-03 | 3.370+00 | 8.120-03 | 3.516+00 | 9.050-03 | 3.633+00 |
| 3.0+06            | 2.529-03                                                      | 2.431+00 | 2.858-03 | 2.537+00 | 3.217-03 | 2.652+00 | 3.610-03 | 2.767+00 | 4.024-03 | 2.882+00 |
| 4.0+06            | 1.422-03                                                      | 2.020+00 | 1.608-03 | 2.116+00 | 1.809-03 | 2.212+00 | 2.031-03 | 2.308+00 | 2.264-03 | 2.404+00 |
| 5.0+06            | 9.103-04                                                      | 1.029+00 | 1.059-04 | 1.082+00 | 1.158-04 | 1.911+00 | 1.300-03 | 1.594+00 | 1.449-03 | 2.077+00 |
| 6.0+06            | 6.323-04                                                      | 1.522+00 | 7.147-04 | 1.615+00 | 8.044-04 | 1.689+00 | 9.029-04 | 1.762+00 | 1.06-03  | 1.836+00 |
| 8.0+06            | 3.556-04                                                      | 1.261+00 | 4.019-04 | 1.321+00 | 4.524-04 | 1.381+00 | 5.078-04 | 1.441+00 | 5.659-04 | 1.502+00 |
| 1.0+07            | 2.276-04                                                      | 1.074+00 | 2.573-04 | 1.125+00 | 2.896-04 | 1.177+00 | 3.250-04 | 1.228+00 | 3.623-04 | 1.279+00 |
| 1.5+07            | 1.012-04                                                      | 7.951-01 | 1.144-04 | 8.329-01 | 1.287-04 | 8.708-01 | 1.445-04 | 9.087-01 | 1.610-04 | 9.465-01 |
| 2.0+07            | 5.692-05                                                      | 6.382-01 | 6.433-05 | 6.686-01 | 7.240-05 | 6.989-01 | 8.127-05 | 7.293-01 | 7.59-01  | 9.058-05 |
| 3.0+07            | 2.529-05                                                      | 4.646-01 | 2.859-05 | 4.867-01 | 3.218-05 | 5.088-01 | 3.612-05 | 5.310-01 | 4.025-05 | 5.531-01 |
| 4.0+07            | 1.423-05                                                      | 3.692-01 | 1.608-05 | 3.868-01 | 1.810-05 | 4.043-01 | 2.032-05 | 4.419-01 | 2.65-05  | 4.355-01 |
| 5.0+07            | 9.106-06                                                      | 3.082-01 | 1.029-05 | 3.228-01 | 1.158-05 | 3.375-01 | 1.300-05 | 3.522-01 | 1.449-05 | 3.669-01 |
| 6.0+07            | 6.322-06                                                      | 2.655-01 | 7.146-06 | 2.782-01 | 8.043-06 | 2.908-01 | 9.028-05 | 3.035-01 | 1.06-05  | 3.161-01 |
| 8.0+07            | 3.557-06                                                      | 2.094-01 | 4.020-06 | 2.194-01 | 4.525-06 | 2.293-01 | 5.079-06 | 2.393-01 | 5.662-06 | 2.493-01 |
| 1.0+08            | 2.276-06                                                      | 1.738-01 | 2.572-06 | 1.821-01 | 2.895-06 | 1.904-01 | 3.250-06 | 1.986-01 | 3.622-06 | 2.069-01 |

TABLE III., CONT.  
COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARN/ATOM

| PHOTON ENERGY, EV | 26 FE    |          |          | 27 CO    |          |          | 28 NI    |          |          | 29 CU    |          |          | 30 ZN    |          |          |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | COH      | INCOH    | COH      |
| 1.0+02            | 4.493+02 | 1.062+02 | 4.845+02 | 1.028+02 | 5.211+02 | 9.633+03 | 5.590+02 | 7.777+03 | 5.982+02 | 8.745+03 | 5.982+02 | 8.745+03 | 5.977+02 | 1.991+02 | 5.977+02 |
| 1.5+02            | 4.488+02 | 2.415+02 | 4.840+02 | 2.293+02 | 5.206+02 | 2.183+02 | 5.586+02 | 1.753+02 | 5.511+02 | 3.120+02 | 5.972+02 | 3.549+02 | 5.972+02 | 3.549+02 | 5.972+02 |
| 2.0+02            | 4.483+02 | 4.270+02 | 4.835+02 | 4.063+02 | 5.201+02 | 3.876+02 | 5.581+02 | 3.120+02 | 5.511+02 | 6.936+02 | 5.957+02 | 7.908+02 | 5.957+02 | 7.908+02 | 5.957+02 |
| 3.0+02            | 4.465+02 | 9.451+02 | 4.819+02 | 9.007+02 | 5.185+02 | 8.697+02 | 5.548+02 | 1.560+01 | 5.548+02 | 1.210+01 | 5.934+02 | 1.382+01 | 5.934+02 | 1.382+01 | 5.934+02 |
| 4.0+02            | 4.444+02 | 1.642+01 | 4.796+02 | 1.586+01 | 5.162+02 | 1.500+01 | 5.548+02 | 1.210+01 | 5.548+02 | 1.210+01 | 5.906+02 | 2.111+01 | 5.906+02 | 2.111+01 | 5.906+02 |
| 5.0+02            | 4.415+02 | 2.496+01 | 4.768+02 | 2.386+01 | 5.134+02 | 2.285+01 | 5.522+02 | 1.847+01 | 5.522+02 | 2.586+01 | 5.871+02 | 2.959+01 | 5.871+02 | 2.959+01 | 5.871+02 |
| 6.0+02            | 4.381+02 | 3.476+01 | 4.734+02 | 3.330+01 | 5.100+02 | 3.197+01 | 5.492+02 | 2.586+01 | 5.492+02 | 2.586+01 | 5.790+02 | 4.932+01 | 5.790+02 | 4.932+01 | 5.790+02 |
| 8.0+02            | 4.300+02 | 5.711+01 | 4.653+02 | 5.495+01 | 5.018+02 | 5.295+01 | 5.440+02 | 4.306+01 | 5.440+02 | 4.306+01 | 5.790+02 | 4.932+01 | 5.790+02 | 4.932+01 | 5.790+02 |
| 1.0+03            | 4.204+02 | 8.139+01 | 4.555+02 | 7.869+01 | 4.920+02 | 7.613+01 | 5.331+02 | 6.241+01 | 5.690+02 | 7.145+01 | 5.397+02 | 7.145+01 | 5.397+02 | 7.145+01 | 5.397+02 |
| 1.5+03            | 3.930+02 | 1.419+00 | 4.276+02 | 1.387+00 | 4.636+02 | 1.356+00 | 5.059+02 | 1.146+00 | 5.394+00 | 1.294+00 | 5.072+02 | 1.846+00 | 5.072+02 | 1.846+00 | 5.072+02 |
| 2.0+03            | 3.642+02 | 1.970+00 | 3.978+02 | 1.941+00 | 4.328+02 | 1.910+00 | 4.772+02 | 1.679+00 | 5.153+02 | 2.730+00 | 4.429+02 | 2.864+00 | 4.429+02 | 2.864+00 | 4.429+02 |
| 3.0+03            | 3.106+02 | 2.973+00 | 3.413+02 | 2.955+00 | 3.736+02 | 2.927+00 | 4.153+02 | 2.730+00 | 4.153+02 | 3.863+02 | 3.838+02 | 3.825+00 | 3.838+02 | 3.825+00 | 3.838+02 |
| 4.0+03            | 2.638+02 | 3.906+00 | 2.913+02 | 3.903+00 | 3.205+02 | 3.863+00 | 3.522+02 | 3.722+00 | 3.522+02 | 4.633+00 | 3.311+02 | 4.728+00 | 3.311+02 | 4.728+00 | 3.311+02 |
| 5.0+03            | 2.239+02 | 4.760+00 | 2.482+02 | 4.777+00 | 2.747+02 | 4.771+00 | 3.071+02 | 4.633+00 | 3.071+02 | 5.647+00 | 2.855+02 | 5.562+00 | 2.855+02 | 5.562+00 | 2.855+02 |
| 6.0+03            | 1.909+02 | 5.533+00 | 2.121+02 | 5.571+00 | 2.350+02 | 5.511+00 | 2.633+02 | 5.467+00 | 2.633+02 | 6.990+00 | 2.151+02 | 7.032+00 | 2.151+02 | 7.032+00 | 2.151+02 |
| 8.0+03            | 1.425+02 | 6.858+00 | 1.585+02 | 6.941+00 | 1.759+02 | 6.990+00 | 1.970+02 | 6.932+00 | 1.970+02 | 7.032+00 | 2.151+02 | 7.032+00 | 2.151+02 | 7.032+00 | 2.151+02 |
| 1.0+04            | 1.109+02 | 7.921+00 | 1.231+02 | 8.052+00 | 1.364+02 | 8.146+00 | 1.524+02 | 8.152+00 | 1.524+02 | 8.152+00 | 1.667+02 | 8.268+00 | 1.667+02 | 8.268+00 | 1.667+02 |
| 1.5+04            | 6.875+01 | 9.708+00 | 7.571+01 | 9.745+00 | 8.333+01 | 1.015+01 | 9.233+01 | 1.030+01 | 9.233+01 | 1.030+01 | 1.007+02 | 1.049+01 | 1.007+02 | 1.049+01 | 1.007+02 |
| 2.0+04            | 4.758+01 | 1.078+01 | 5.237+01 | 1.108+01 | 5.753+01 | 1.135+01 | 6.159+01 | 1.185+01 | 6.159+01 | 1.185+01 | 6.912+01 | 1.233+01 | 6.912+01 | 1.233+01 | 6.912+01 |
| 3.0+04            | 2.611+01 | 1.193+01 | 2.884+01 | 1.230+01 | 3.179+01 | 1.266+01 | 3.512+01 | 1.299+01 | 3.512+01 | 1.299+01 | 3.433+01 | 1.333+01 | 3.433+01 | 1.333+01 | 3.433+01 |
| 4.0+04            | 1.654+01 | 1.241+01 | 1.827+01 | 1.282+01 | 2.014+01 | 1.322+01 | 2.244+01 | 1.360+01 | 2.244+01 | 1.360+01 | 2.433+01 | 1.399+01 | 2.433+01 | 1.399+01 | 2.433+01 |
| 5.0+04            | 1.144+01 | 1.257+01 | 1.262+01 | 1.300+01 | 1.390+01 | 1.342+01 | 1.533+01 | 1.386+01 | 1.533+01 | 1.386+01 | 1.677+01 | 1.424+01 | 1.677+01 | 1.424+01 | 1.677+01 |
| 6.0+04            | 8.438+00 | 9.310+01 | 9.310+01 | 1.300+01 | 1.025+01 | 1.343+01 | 1.129+01 | 1.386+01 | 1.129+01 | 1.386+01 | 1.235+01 | 1.428+01 | 1.235+01 | 1.428+01 | 1.235+01 |
| 8.0+04            | 5.145+00 | 1.235+01 | 5.680+00 | 1.279+01 | 6.253+00 | 1.323+01 | 6.866+00 | 1.366+01 | 6.866+00 | 1.366+01 | 7.525+00 | 1.409+01 | 7.525+00 | 1.409+01 | 7.525+00 |
| 1.0+05            | 3.460+00 | 1.203+01 | 3.823+00 | 1.246+01 | 4.213+00 | 1.289+01 | 4.641+00 | 1.332+01 | 4.641+00 | 1.332+01 | 5.075+00 | 1.374+01 | 5.075+00 | 1.374+01 | 5.075+00 |
| 1.5+05            | 1.630+00 | 1.113+01 | 1.810+00 | 1.154+01 | 1.998+00 | 1.195+01 | 2.036+00 | 1.236+01 | 2.036+00 | 1.236+01 | 2.411+00 | 1.276+01 | 2.411+00 | 1.276+01 | 2.411+00 |
| 2.0+05            | 9.483+01 | 1.033+01 | 1.050+00 | 1.071+01 | 1.159+00 | 1.110+01 | 1.278+00 | 1.148+01 | 1.278+00 | 1.148+01 | 1.400+01 | 1.186+01 | 1.400+01 | 1.186+01 | 1.400+01 |
| 3.0+05            | 4.339+01 | 9.077+00 | 4.805+01 | 9.420+00 | 5.309+01 | 9.763+00 | 5.807+01 | 1.045+01 | 5.807+01 | 1.045+01 | 6.419+01 | 9.411+00 | 6.419+01 | 9.411+00 | 6.419+01 |
| 4.0+05            | 2.472+01 | 8.170+00 | 2.739+01 | 8.481+00 | 3.027+01 | 8.791+00 | 3.340+01 | 9.102+00 | 3.340+01 | 9.102+00 | 3.662+01 | 9.411+00 | 3.662+01 | 9.411+00 | 3.662+01 |
| 5.0+05            | 1.593+01 | 7.479+01 | 1.765+00 | 7.764+00 | 1.951+01 | 8.450+00 | 2.154+01 | 8.355+00 | 2.154+01 | 8.355+00 | 2.362+01 | 8.619+00 | 2.362+01 | 8.619+00 | 2.362+01 |
| 6.0+05            | 1.110+01 | 6.929+00 | 1.230+01 | 7.194+00 | 1.361+01 | 7.459+00 | 1.562+01 | 7.727+00 | 1.562+01 | 7.727+00 | 1.647+01 | 7.988+00 | 1.647+01 | 7.988+00 | 1.647+01 |
| 8.0+05            | 6.270+02 | 6.097+00 | 6.950+02 | 6.330+00 | 7.686+02 | 6.564+00 | 8.497+02 | 6.797+00 | 8.497+02 | 6.797+00 | 9.311+02 | 7.031+00 | 9.311+02 | 7.031+00 | 9.311+02 |
| 1.0+06            | 4.020+02 | 5.486+00 | 4.456+02 | 5.696+00 | 4.929+02 | 5.906+00 | 5.443+02 | 6.117+00 | 5.443+02 | 6.117+00 | 5.975+00 | 6.327+00 | 5.975+00 | 6.327+00 | 5.975+00 |
| 1.5+06            | 1.789+02 | 9.844+01 | 1.984+02 | 1.022+00 | 2.194+02 | 4.015+00 | 4.015+02 | 4.976+02 | 4.976+02 | 4.976+02 | 5.147+00 | 5.659+02 | 5.147+00 | 5.659+02 | 5.147+00 |
| 2.0+06            | 1.007+02 | 8.009+02 | 1.117+02 | 3.955+00 | 1.235+02 | 4.102+00 | 1.344+02 | 4.248+00 | 1.344+02 | 4.248+00 | 4.394+00 | 5.147+00 | 4.394+00 | 5.147+00 | 4.394+00 |
| 3.0+06            | 4.479+02 | 2.997+00 | 4.966+03 | 3.113+00 | 5.493+03 | 3.228+00 | 6.067+03 | 3.343+00 | 6.067+03 | 3.343+00 | 6.657+03 | 3.458+00 | 6.657+03 | 3.458+00 | 6.657+03 |
| 4.0+06            | 2.520+03 | 2.501+00 | 2.160+00 | 1.788+03 | 2.243+00 | 1.978+03 | 2.326+00 | 2.184+03 | 2.326+00 | 2.184+03 | 2.492+00 | 2.397+03 | 2.492+00 | 2.397+03 | 2.492+00 |
| 5.0+06            | 1.612+03 | 1.242+03 | 1.242+03 | 1.982+00 | 1.374+03 | 2.055+00 | 1.517+03 | 2.129+00 | 1.517+03 | 2.129+00 | 1.665+03 | 2.033+00 | 1.665+03 | 2.033+00 | 1.665+03 |
| 6.0+06            | 1.120+05 | 3.287+01 | 1.242+05 | 3.414+01 | 1.374+05 | 3.540+01 | 1.517+05 | 3.657+01 | 1.517+05 | 3.657+01 | 1.665+05 | 3.793+01 | 1.665+05 | 3.793+01 | 1.665+05 |
| 8.0+07            | 6.302+06 | 2.593+01 | 6.987+06 | 2.692+01 | 7.730+06 | 2.792+01 | 8.537+06 | 2.892+01 | 8.537+06 | 2.892+01 | 9.368+06 | 2.991+01 | 9.368+06 | 2.991+01 | 9.368+06 |
| 1.0+08            | 4.032+06 | 2.152+01 | 4.471+06 | 2.235+01 | 4.946+06 | 2.317+01 | 5.462+06 | 2.400+01 | 5.462+06 | 2.400+01 | 5.994+06 | 2.483+01 | 5.994+06 | 2.483+01 | 5.994+06 |

TABLE III. UNITS OF COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS. BARNS/ATOM

| PHOTON ENERGY, EV | 31 GA    |          | 32 GE    |          | 33 AS    |          | 34 SE    |          | 35 BR    |          |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | COH      | INCOH    |
| 1.0+02            | 6.386+02 | 9.528-03 | 6.806+02 | 9.297-03 | 7.240+02 | 8.642-03 | 7.687+02 | 8.432-03 | 8.146+02 | 7.773-03 |
| 1.5+02            | 6.360+02 | 2.058-02 | 6.800+02 | 2.058-02 | 7.23+02  | 1.948-02 | 7.680+02 | 1.663-02 | 8.140+02 | 1.754-02 |
| 2.0+02            | 6.375+02 | 3.781-02 | 6.794+02 | 3.649-02 | 7.225+02 | 3.645-02 | 7.672+02 | 3.305-02 | 8.131+02 | 3.130-02 |
| 3.0+02            | 6.356+02 | 8.385-02 | 6.773+02 | 8.112-02 | 7.205+02 | 7.727+02 | 7.650+02 | 7.364-02 | 8.109+02 | 7.068-02 |
| 4.0+02            | 6.359+02 | 1.462-01 | 6.744+02 | 1.48-01  | 7.175+02 | 1.354-01 | 7.619+02 | 1.223-01 | 8.078+02 | 1.233-01 |
| 5.0+02            | 6.295+02 | 2.229-01 | 6.708+02 | 2.170-01 | 7.137+02 | 2.076-01 | 7.581+02 | 1.988-01 | 8.039+02 | 1.901-01 |
| 6.0+02            | 6.255+02 | 3.119-01 | 6.664+02 | 3.099-01 | 7.092+02 | 2.924-01 | 7.534+02 | 2.810-01 | 7.992+02 | 2.794-01 |
| 8.0+02            | 6.158+02 | 5.185-01 | 6.559+02 | 5.113-01 | 6.982+02 | 4.928-01 | 7.421+02 | 4.776-01 | 7.876+02 | 4.605-01 |
| 1.0+03            | 6.062+02 | 7.498-01 | 6.433+02 | 7.458-01 | 6.849+02 | 7.229-01 | 7.284+02 | 7.069-01 | 7.735+02 | 6.863-01 |
| 1.5+03            | 5.709+02 | 1.362+00 | 6.067+02 | 1.381+00 | 6.455+02 | 1.356+00 | 6.869+02 | 1.355+00 | 7.304+02 | 1.338+00 |
| 2.0+03            | 5.352+02 | 1.953+00 | 5.673+02 | 2.005+00 | 6.02+02  | 1.996+00 | 6.410+02 | 2.024+00 | 6.817+02 | 2.028+00 |
| 3.0+03            | 4.675+02 | 3.013+00 | 4.937+02 | 3.138+00 | 5.224+02 | 3.186+00 | 5.535+02 | 3.279+00 | 5.873+02 | 3.340+00 |
| 4.0+03            | 4.070+02 | 3.971+00 | 4.304+02 | 4.126+00 | 4.544+02 | 4.235+00 | 4.806+02 | 4.381+00 | 5.083+02 | 4.501+00 |
| 5.0+03            | 3.555+02 | 4.865+00 | 3.756+02 | 5.025+C0 | 3.979+02 | 5.165+C0 | 4.207+02 | 5.362+00 | 4.444+02 | 5.505+00 |
| 6.0+03            | 3.059+02 | 5.696+00 | 3.279+02 | 5.855+00 | 3.489+02 | 6.008+00 | 3.699+02 | 6.198+00 | 3.914+02 | 6.384+00 |
| 8.0+03            | 2.331+02 | 7.167+00 | 2.514+02 | 7.328+00 | 2.697+02 | 7.493+00 | 2.883+02 | 7.650+00 | 3.070+02 | 7.892+00 |
| 1.0+04            | 1.813+02 | 8.412+00 | 1.962+02 | 8.579+00 | 2.116+02 | 8.753+00 | 2.274+02 | 8.954+00 | 2.436+02 | 9.163+00 |
| 1.5+04            | 1.093+02 | 1.070+01 | 1.183+02 | 1.091+01 | 1.277+02 | 1.112+02 | 1.472+02 | 1.135+01 | 1.478+02 | 1.158+01 |
| 2.0+04            | 7.493+01 | 1.212+01 | 8.096+01 | 1.238+01 | 8.72+01  | 1.265+01 | 9.376+01 | 1.292+01 | 1.006+02 | 1.319+01 |
| 3.0+04            | 4.176+01 | 1.367+01 | 4.527+01 | 1.400+01 | 4.89+01  | 1.434+01 | 5.276+C1 | 1.467+01 | 5.662+01 | 1.500+01 |
| 4.0+04            | 2.651+C1 | 1.437+01 | 2.879+01 | 1.475+01 | 3.117+01 | 1.512+01 | 3.566+01 | 1.550+01 | 3.625+01 | 1.587+01 |
| 5.0+04            | 1.837+01 | 1.465+01 | 1.984+01 | 1.505+01 | 2.14+01  | 1.545+01 | 2.322+01 | 1.583+01 | 2.503+01 | 1.625+01 |
| 6.0+04            | 1.346+01 | 1.470+01 | 1.460+01 | 1.512+01 | 1.581+01 | 1.554+01 | 1.708+01 | 1.595+01 | 1.841+01 | 1.636+01 |
| 8.0+04            | 8.195+00 | 1.452+01 | 8.896+00 | 1.494+01 | 9.633+00 | 1.537+01 | 1.040+01 | 1.579+01 | 1.120+01 | 1.621+01 |
| 1.0+05            | 5.530+00 | 1.417+01 | 6.007+00 | 1.459+01 | 6.506+00 | 1.501+01 | 7.028+00 | 1.563+01 | 7.572+00 | 1.585+01 |
| 1.5+05            | 2.632+00 | 1.317+01 | 2.863+00 | 1.357+01 | 3.104+00 | 1.397+C1 | 3.457+00 | 1.437+01 | 3.622+00 | 1.478+01 |
| 2.0+05            | 1.528+00 | 1.225+01 | 1.664+00 | 1.263+01 | 1.805+00 | 1.301+01 | 1.953+00 | 1.339+01 | 2.109+00 | 1.376+01 |
| 3.0+05            | 7.011-01 | 1.079+01 | 7.635+01 | 1.113+01 | 8.289+01 | 1.147+01 | 8.974+01 | 1.181+01 | 9.691+01 | 1.215+01 |
| 4.0+05            | 4.001-01 | 9.721+00 | 4.359+01 | 1.003+01 | 4.734+01 | 1.034+01 | 5.127+01 | 1.065+01 | 5.539+01 | 1.096+01 |
| 5.0+05            | 2.531-01 | 8.904+00 | 2.813-01 | 9.188+00 | 3.457+01 | 9.473+00 | 3.813-01 | 9.757+00 | 3.576-01 | 1.004+01 |
| 6.0+05            | 1.801-01 | 8.252+00 | 1.963-01 | 8.517+00 | 2.132+01 | 8.781+00 | 2.310+01 | 9.054+00 | 2.497+01 | 9.309+00 |
| 8.0+05            | 1.018-01 | 7.264+00 | 1.110-01 | 7.497+00 | 1.206-01 | 7.730+00 | 1.307+01 | 7.963+00 | 1.412+01 | 8.196+00 |
| 1.0+06            | 6.529-02 | 6.537+00 | 7.118-02 | 6.747+00 | 7.736-02 | 6.958+00 | 8.384-02 | 7.168+00 | 9.063-02 | 7.378+00 |
| 1.5+06            | 2.907-02 | 5.319+00 | 3.170-02 | 5.490+00 | 3.446-02 | 5.661+00 | 3.735-02 | 5.833+00 | 4.038-02 | 6.004+00 |
| 2.0+06            | 1.637-02 | 4.541+00 | 1.785-02 | 4.687+00 | 1.940-02 | 4.833+00 | 2.103-02 | 4.979+00 | 2.274-02 | 5.126+00 |
| 3.0+06            | 7.380-03 | 4.574+00 | 7.939+03 | 3.659+00 | 8.622+00 | 3.844+00 | 9.519+00 | 3.922+00 | 1.011-02 | 4.034+00 |
| 4.0+06            | 4.095-03 | 2.981+00 | 4.466+03 | 3.077+00 | 4.855+03 | 3.174+00 | 5.263+03 | 3.270+00 | 5.690+03 | 3.366+00 |
| 5.0+06            | 2.621-03 | 2.575+00 | 2.859+03 | 2.558+00 | 3.107-03 | 2.741+00 | 3.369+C3 | 2.824+00 | 3.642+03 | 2.907+00 |
| 6.0+06            | 1.821-03 | 2.276+00 | 1.986-03 | 2.349+00 | 2.158-03 | 2.423+00 | 2.434+03 | 2.496+00 | 2.530+03 | 2.569+00 |
| 8.0+06            | 1.024-03 | 1.862+00 | 1.117-03 | 1.922+00 | 1.214-03 | 1.982+00 | 1.316-03 | 2.042+00 | 1.423+03 | 2.102+00 |
| 1.0+07            | 6.555-04 | 1.586+00 | 7.149-04 | 1.637+00 | 7.771-04 | 1.688+00 | 8.424-04 | 1.739+00 | 9.108-04 | 1.790+00 |
| 1.5+07            | 2.913-04 | 1.174+00 | 3.177-04 | 1.212+00 | 3.453-04 | 1.249+00 | 3.744-04 | 1.287+00 | 4.048-04 | 1.325+00 |
| 2.0+07            | 1.639-C4 | 9.420+01 | 1.787-04 | 9.724+01 | 1.943-04 | 1.033+C0 | 2.106-04 | 1.033+00 | 2.277-04 | 1.064+00 |
| 3.0+07            | 7.283-05 | 6.858-01 | 7.943-05 | 7.079-01 | 8.633-05 | 7.301-C1 | 9.359-05 | 7.522-01 | 1.012-04 | 7.743-01 |
| 4.0+07            | 4.097-05 | 5.450-01 | 4.466-05 | 5.626-01 | 4.857-05 | 5.801-C1 | 5.265-05 | 5.977-01 | 5.693-05 | 6.153-01 |
| 5.0+07            | 2.622-05 | 4.549-01 | 2.860-05 | 4.696-01 | 3.108-05 | 4.843-01 | 3.369-05 | 4.989-01 | 3.643-05 | 5.136-01 |
| 6.0+07            | 1.821-05 | 3.920-01 | 1.985-05 | 4.046-01 | 2.158-05 | 4.172-01 | 2.339-05 | 4.299-01 | 2.529-05 | 4.425-01 |
| 8.0+07            | 1.024-05 | 3.091-01 | 1.117-05 | 3.191-01 | 1.214-05 | 3.291-01 | 1.316-05 | 3.390-01 | 1.423-05 | 3.490-01 |
| 1.0+08            | 6.555-06 | 2.566-01 | 7.148-06 | 2.648-01 | 7.770-06 | 2.731-01 | 8.423-06 | 2.814-01 | 9.107-06 | 2.897-01 |

TABLE II--CONT.  
COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS. BARNS/ATOM

| PHOTON ENERGY, EV | 36 KR    |          | 37 RB    |          | 38 SR    |          | 39 Y     |          | 40 ZR    |          |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | COH      | INCOH    |
| 1.0+02            | 8.619+02 | 7.696-03 | 9.097+02 | 1.716-02 | 9.596+02 | 1.983-02 | 1.011+03 | 1.896-02 | 1.064+03 | 1.811-02 |
| 1.5+02            | 8.612+02 | 1.705-02 | 9.086+02 | 3.801-02 | 9.583+02 | 4.431-02 | 1.010+03 | 4.236-02 | 1.062+03 | 4.039-02 |
| 2.0+02            | 8.504+02 | 3.005-02 | 9.074+02 | 6.653-02 | 9.568+02 | 7.867-02 | 1.008+C3 | 1.473-02 | 1.061+03 | 7.113-02 |
| 3.0+02            | 8.581+02 | 6.694-02 | 9.036+02 | 1.439-01 | 9.525+02 | 1.704-01 | 1.004+03 | 1.638-C1 | 1.056+03 | 1.562-01 |
| 4.0+02            | 8.550+02 | 1.178-01 | 8.983+02 | 2.427-01 | 9.465+02 | 2.964-01 | 9.977+02 | 2.839-01 | 1.050+03 | 2.689-01 |
| 5.0+02            | 8.510+02 | 1.818-01 | 8.922+C2 | 3.564-01 | 9.391+02 | 4.304-01 | 9.303+02 | 4.304-01 | 1.043+03 | 4.038-01 |
| 6.0+02            | 8.465+02 | 2.457-01 | 8.851+02 | 4.788-01 | 9.307+02 | 5.845-01 | 9.818+02 | 5.741-01 | 1.034+03 | 5.552-01 |
| 8.0+02            | 8.346+02 | 4.424-01 | 8.686+02 | 7.332-01 | 9.112+02 | 9.058-01 | 9.16+02  | 9.055-01 | 1.014+03 | 8.866-01 |
| 1.0+03            | 8.202+02 | 6.620-01 | 8.502+02 | 9.885-01 | 8.893+02 | 1.223+00 | 9.387+02 | 1.240+00 | 9.905+02 | 1.227+00 |
| 1.5+03            | 7.757+02 | 1.304+00 | 8.008+02 | 1.631+00 | 8.322+02 | 1.941+00 | 8.774+02 | 2.008+00 | 9.063+02 | 2.024+00 |
| 2.0+03            | 7.247+02 | 1.995+00 | 7.501+02 | 2.291+00 | 7.774+02 | 2.604+00 | 8.178+02 | 2.704+00 | 8.626+02 | 2.748+00 |
| 3.0+03            | 6.236+02 | 3.334+00 | 6.510+02 | 3.581+00 | 6.772+02 | 3.867+00 | 7.102+02 | 3.953+00 | 7.472+02 | 4.077+00 |
| 4.0+03            | 5.381+02 | 4.548+00 | 5.635+02 | 4.769+00 | 5.889+02 | 5.077+00 | 6.174+02 | 5.117+00 | 6.486+02 | 5.274+00 |
| 5.0+03            | 4.659+02 | 5.610+00 | 4.919+02 | 5.835+00 | 5.149+02 | 5.084+00 | 5.399+02 | 5.254+00 | 5.667+02 | 5.372+00 |
| 6.0+03            | 4.136+02 | 6.532+00 | 4.331+02 | 6.770+00 | 4.621+02 | 7.026+00 | 4.763+02 | 7.211+00 | 4.996+02 | 7.353+00 |
| 8.0+03            | 3.259+02 | 8.078+00 | 3.434+02 | 8.330+C0 | 3.608+02 | 8.601+00 | 3.789+02 | 8.929+00 | 3.979+02 | 9.032+00 |
| 1.0+04            | 2.601+02 | 9.364+00 | 2.757+C2 | 9.615+00 | 2.912+02 | 9.884+00 | 3.072+02 | 1.011+01 | 3.336+02 | 1.037+01 |
| 1.5+04            | 1.585+02 | 1.181+01 | 1.692+02 | 1.207+C1 | 1.801+02 | 1.234+01 | 1.915+C0 | 1.261+01 | 2.032+02 | 1.287+01 |
| 2.0+04            | 1.077+02 | 1.346+01 | 1.149+02 | 1.374+01 | 1.223+02 | 1.403+01 | 1.301+02 | 1.432+01 | 1.382+02 | 1.461+01 |
| 3.0+04            | 6.070+01 | 1.533+C1 | 6.492+01 | 1.567+C1 | 6.901+C1 | 1.601+C1 | 7.342+C1 | 1.794+01 | 1.667+01 | 1.667+01 |
| 4.0+04            | 3.894+01 | 1.623+C1 | 4.169+01 | 1.660+C1 | 4.449+C1 | 1.697+C1 | 4.744+C1 | 1.754+01 | 5.045+C1 | 1.770+01 |
| 5.0+04            | 2.693+01 | 1.664+C1 | 2.881+01 | 1.703+01 | 3.086+C1 | 1.742+C1 | 3.296+C1 | 1.781+01 | 3.512+C1 | 1.820+C1 |
| 6.0+04            | 1.980+01 | 1.677+C1 | 2.123+C1 | 1.718+C1 | 2.270+C1 | 1.758+C1 | 2.266+C1 | 1.788+C1 | 2.585+C1 | 1.839+C1 |
| 8.0+04            | 1.204+01 | 1.663+C1 | 1.291+01 | 1.703+C1 | 1.380+C1 | 1.746+C1 | 1.474+C1 | 1.788+C1 | 1.570+C1 | 1.829+C1 |
| 1.0+05            | 8.141+00 | 1.627+C1 | 8.728+C0 | 1.669+C1 | 9.331+C0 | 1.710+C1 | 9.968+C0 | 1.752+C1 | 1.062+C1 | 1.793+C1 |
| 1.5+05            | 3.859+00 | 1.817+C0 | 4.180+C0 | 1.571+C1 | 4.380+C0 | 1.597+C1 | 4.790+C0 | 1.637+C1 | 5.108+C0 | 1.676+C1 |
| 2.0+05            | 2.271+C0 | 1.414+C0 | 2.440+C0 | 1.452+C0 | 2.613+C0 | 1.590+C1 | 2.796+C0 | 1.522+C0 | 2.384+C0 | 1.565+C1 |
| 3.0+05            | 1.044+C0 | 1.249+C0 | 1.122+C0 | 1.283+C0 | 1.203+C0 | 1.316+C1 | 1.350+C0 | 1.350+C1 | 1.375+C0 | 1.374+C1 |
| 4.0+C5            | 5.970+C0 | 1.157+C0 | 6.419+C0 | 1.188+C0 | 6.882+C0 | 1.188+C0 | 7.370+C0 | 1.219+C0 | 7.873+C0 | 1.249+C0 |
| 5.0+05            | 3.855+C0 | 1.032+C0 | 4.146+C0 | 1.061+C0 | 4.446+C0 | 1.089+C0 | 4.662+C0 | 1.117+C0 | 5.088+C0 | 1.146+C0 |
| 6.0+05            | 2.692+C0 | 9.572+C0 | 2.885+C0 | 9.836+C0 | 3.105+C0 | 1.010+C0 | 3.327+C0 | 1.036+C0 | 3.555+C0 | 1.063+C0 |
| 8.0+05            | 1.523+C0 | 8.429+C0 | 1.638+C0 | 8.662+C0 | 1.758+C0 | 8.895+C0 | 1.883+C0 | 9.127+C0 | 2.013+C0 | 9.360+C0 |
| 1.0+C7            | 9.774+C0 | 7.588+C0 | 1.052+C0 | 7.797+C0 | 1.128+C0 | 8.007+C0 | 1.209+C0 | 8.217+C0 | 1.293+C0 | 8.427+C0 |
| 1.5+C7            | 4.356+C0 | 6.177+C0 | 4.094+C0 | 6.346+C0 | 5.030+C0 | 6.517+C0 | 5.597+C0 | 6.688+C0 | 5.911+C0 | 6.859+C0 |
| 2.0+C6            | 2.453+C0 | 5.272+C0 | 2.639+C0 | 5.418+C0 | 2.833+C0 | 5.564+C0 | 3.036+C0 | 5.711+C0 | 3.246+C0 | 5.857+C0 |
| 3.0+C6            | 1.091+C0 | 4.149+C0 | 1.174+C0 | 4.265+C0 | 1.260+C0 | 4.380+C0 | 1.351+C0 | 4.495+C0 | 1.444+C0 | 4.610+C0 |
| 4.0+C6            | 6.139+C0 | 3.465+C0 | 6.606+C0 | 3.554+C0 | 7.089+C0 | 3.654+C0 | 7.599+C0 | 3.750+C0 | 8.125+C0 | 3.844+C0 |
| 5.0+C6            | 3.929+C0 | 2.990+C0 | 4.229+C0 | 3.073+C0 | 4.538+C0 | 3.156+C0 | 4.865+C0 | 3.239+C0 | 5.201+C0 | 3.322+C0 |
| 6.0+C6            | 2.729+C0 | 2.643+C0 | 2.937+C0 | 2.716+C0 | 3.152+C0 | 3.156+C0 | 3.739+C0 | 3.233+C0 | 3.813+C0 | 3.293+C0 |
| 8.0+C6            | 1.535+C0 | 2.162+C0 | 1.632+C0 | 2.222+C0 | 1.773+C0 | 2.282+C0 | 1.800+C0 | 2.342+C0 | 2.032+C0 | 2.402+C0 |
| 1.0+C7            | 9.826+C4 | 1.841+C0 | 1.057+C0 | 1.893+C0 | 1.135+C0 | 1.944+C0 | 1.216+C0 | 1.995+C0 | 1.301+C0 | 2.046+C0 |
| 1.5+C7            | 4.366+C4 | 1.363+C0 | 4.699+C4 | 1.401+C0 | 5.043+C0 | 1.439+C0 | 5.406+C0 | 1.477+C0 | 5.780+C0 | 1.514+C0 |
| 2.0+C7            | 2.456+C4 | 1.094+C0 | 2.638+C4 | 1.124+C0 | 2.837+C0 | 1.155+C0 | 3.041+C0 | 1.185+C0 | 3.251+C0 | 1.216+C0 |
| 3.0+C7            | 1.092+C4 | 7.964+C0 | 1.175+C4 | 8.185+C0 | 1.261+C0 | 8.407+C0 | 1.351+C0 | 8.628+C0 | 1.455+C0 | 8.849+C0 |
| 4.0+C7            | 6.141+C4 | 6.329+C0 | 6.609+C4 | 6.505+C0 | 7.093+C0 | 6.680+C0 | 7.603+C0 | 6.856+C0 | 8.129+C0 | 7.032+C0 |
| 5.0+C7            | 3.930+C4 | 5.238+C0 | 4.627+C4 | 5.430+C0 | 5.576+C0 | 4.665+C0 | 5.723+C0 | 4.865+C0 | 5.202+C0 | 5.876+C0 |
| 6.0+C7            | 2.729+C4 | 4.552+C0 | 2.937+C4 | 4.675+C0 | 3.152+C0 | 4.805+C0 | 3.768+C0 | 4.921+C0 | 3.112+C0 | 5.058+C0 |
| 8.0+C7            | 1.535+C4 | 3.590+C0 | 1.652+C4 | 3.689+C0 | 1.773+C0 | 3.789+C0 | 1.901+C0 | 3.889+C0 | 2.032+C0 | 3.999+C0 |
| 1.0+C8            | 9.825+C6 | 2.979+C0 | 1.057+C6 | 3.062+C1 | 1.135+C5 | 3.145+C0 | 1.216+C5 | 3.228+C0 | 1.301+C5 | 3.311+C1 |

TABLE III--CONT.

| PHOTON ENERGY, EV | COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNS/ATOM |          |          |          |          |          | 45 RH    |          |          |          |          |          |
|-------------------|---------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | 41 NB                                                         |          | 42 MO    |          | 43 TC    |          | 44 RU    |          | COH      |          | INCOH    |          |
| COH               | INCOH                                                         | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    |          |
| 1.0+03            | 1.118+03                                                      | 1.473-02 | 1.173+03 | 1.399-02 | 1.230+03 | 1.561-02 | 1.287+03 | 1.290-02 | 1.347+03 | 1.211-02 | 1.346+03 | 2.726-02 |
| 1.5+02            | 1.117+03                                                      | 3.306-02 | 1.172+03 | 3.149-02 | 1.228+03 | 3.497-02 | 1.286+03 | 2.672-02 | 1.346+03 | 2.726-02 | 1.346+03 | 4.838-02 |
| 2.0+02            | 1.115+03                                                      | 5.841-02 | 1.170+03 | 5.551-02 | 1.227+03 | 6.170-02 | 1.285+03 | 5.065-02 | 1.344+03 | 4.838-02 | 1.344+03 | 1.073-01 |
| 3.0+02            | 1.111+03                                                      | 1.287-01 | 1.166+03 | 1.224-01 | 1.222+03 | 1.362-01 | 1.281+03 | 1.119-01 | 1.340+03 | 1.073-01 | 1.340+03 | 1.868-01 |
| 4.0+02            | 1.106+03                                                      | 1.223-01 | 1.161+03 | 2.119-01 | 1.217+03 | 2.361-01 | 1.276+03 | 1.944-01 | 1.335+03 | 1.868-01 | 1.335+03 | 2.842-01 |
| 4.5+02            | 1.099+03                                                      | 3.354-01 | 1.154+03 | 3.205-01 | 1.209+03 | 3.573-01 | 1.269+03 | 2.957-01 | 1.329+03 | 2.842-01 | 1.329+03 | 3.968-01 |
| 5.0+02            | 1.091+03                                                      | 4.636-01 | 1.147+03 | 4.443-01 | 1.201+03 | 4.959-01 | 1.261+03 | 4.116-01 | 1.321+03 | 3.968-01 | 1.321+03 | 5.652-01 |
| 6.0+02            | 1.072+03                                                      | 7.498-01 | 1.128+03 | 7.233-01 | 1.180+03 | 8.080-01 | 1.242+03 | 6.779-01 | 1.302+03 | 6.562-01 | 1.302+03 | 6.562-01 |
| 8.0+02            | 1.050+03                                                      | 1.055+00 | 1.105+03 | 1.024+00 | 1.156+03 | 1.142+00 | 1.220+03 | 9.720-01 | 1.279+03 | 9.448-01 | 1.279+03 | 9.448-01 |
| 1.0+03            | 9.857+02                                                      | 1.817+00 | 1.041+03 | 1.737+00 | 1.085+03 | 1.966+00 | 1.153+03 | 1.745+00 | 1.212+03 | 1.713+00 | 1.212+03 | 2.484+00 |
| 2.0+03            | 9.203+02                                                      | 2.546+00 | 9.715+02 | 2.553+00 | 1.013+03 | 2.721+00 | 1.080+03 | 2.512+00 | 1.137+03 | 2.502+00 | 1.137+03 | 3.052+00 |
| 3.0+03            | 7.946+02                                                      | 3.917+00 | 8.387+02 | 3.905+00 | 8.766+02 | 4.103+00 | 9.343+02 | 3.961+00 | 9.855+02 | 3.952+00 | 9.855+02 | 8.494+02 |
| 4.0+03            | 6.865+02                                                      | 5.171+00 | 7.236+02 | 5.177+00 | 7.574+02 | 5.361+00 | 8.051+02 | 5.275+00 | 8.284+02 | 5.284+00 | 8.284+02 | 7.353+02 |
| 5.0+03            | 5.977+02                                                      | 6.319+00 | 6.289+02 | 6.319+00 | 6.583+02 | 6.515+00 | 6.977+02 | 6.476+00 | 6.500+02 | 6.500+00 | 6.500+02 | 6.427+02 |
| 6.0+03            | 5.288+02                                                      | 7.363+00 | 5.524+02 | 7.415+00 | 5.785+02 | 7.581+00 | 6.108+02 | 7.584+00 | 6.427+02 | 7.625+00 | 6.427+02 | 7.625+00 |
| 8.0+03            | 4.185+02                                                      | 9.128+00 | 4.391+02 | 9.248+00 | 4.599+02 | 9.435+00 | 4.834+02 | 9.516+00 | 5.072+02 | 9.605+00 | 5.072+02 | 9.605+00 |
| 1.0+04            | 3.412+02                                                      | 1.053+01 | 3.586+02 | 1.070+01 | 3.757+02 | 1.093+01 | 3.952+02 | 1.107+01 | 4.144+02 | 1.122+01 | 4.144+02 | 1.408+01 |
| 1.5+04            | 2.157+02                                                      | 1.310+01 | 2.283+02 | 1.334+01 | 2.404+02 | 1.361+01 | 2.546+02 | 1.384+01 | 2.684+02 | 1.408+01 | 2.684+02 | 1.599+01 |
| 2.0+04            | 1.458+02                                                      | 1.468+01 | 1.556+02 | 1.515+01 | 1.645+02 | 1.544+01 | 1.744+02 | 1.571+01 | 1.844+02 | 1.599+01 | 1.844+02 | 1.844+01 |
| 3.0+04            | 8.209+01                                                      | 8.699+01 | 8.757+01 | 8.732+01 | 9.759+01 | 1.765+01 | 9.791+01 | 1.797+01 | 1.873+01 | 1.829+01 | 1.873+01 | 1.948+01 |
| 4.0+04            | 5.561+01                                                      | 1.806+01 | 5.685+01 | 1.841+01 | 6.014+01 | 1.877+01 | 6.368+01 | 1.913+01 | 6.728+01 | 1.948+01 | 6.728+01 | 2.009+01 |
| 5.0+04            | 3.738+01                                                      | 1.858+01 | 3.971+01 | 1.896+01 | 4.209+01 | 1.934+01 | 4.462+01 | 1.971+01 | 4.722+01 | 2.009+01 | 4.722+01 | 2.035+01 |
| 6.0+04            | 2.753+01                                                      | 1.878+01 | 2.925+01 | 1.918+01 | 3.103+01 | 1.957+01 | 3.292+01 | 1.992+01 | 3.485+01 | 2.035+01 | 3.485+01 | 2.117+01 |
| 8.0+04            | 1.672+01                                                      | 1.870+01 | 1.777+01 | 1.911+01 | 1.884+01 | 1.952+01 | 1.994+01 | 1.992+01 | 2.033+01 | 2.117+01 | 2.033+01 | 2.117+01 |
| 1.0+05            | 1.131+01                                                      | 1.834+01 | 1.201+01 | 1.875+01 | 1.274+01 | 1.916+01 | 1.352+01 | 1.957+01 | 1.431+01 | 1.997+01 | 1.431+01 | 1.997+01 |
| 1.5+05            | 5.442+00                                                      | 1.716+01 | 5.787+00 | 1.755+01 | 6.149+00 | 1.795+01 | 6.519+00 | 1.834+01 | 6.904+00 | 1.873+01 | 6.904+00 | 1.873+01 |
| 2.0+05            | 3.182+00                                                      | 1.602+01 | 3.389+00 | 1.639+01 | 3.597+00 | 1.677+01 | 3.820+00 | 1.714+01 | 4.050+00 | 1.751+01 | 4.050+00 | 1.751+01 |
| 3.0+05            | 1.467+00                                                      | 1.418+01 | 1.562+00 | 1.451+01 | 1.666+00 | 1.485+01 | 1.764+00 | 1.518+01 | 1.871+00 | 1.552+01 | 1.871+00 | 1.552+01 |
| 4.0+05            | 8.440+00                                                      | 1.280+01 | 8.947+01 | 1.311+01 | 9.341+01 | 1.344+01 | 9.741+01 | 1.372+01 | 1.402+01 | 1.402+01 | 1.402+01 | 1.402+01 |
| 5.0+05            | 5.430+00                                                      | 1.174+01 | 5.785+01 | 1.115+01 | 6.151+01 | 1.202+01 | 6.250+01 | 6.541+01 | 6.259+01 | 6.942+01 | 6.942+01 | 6.942+01 |
| 6.0+05            | 3.795+01                                                      | 1.089+01 | 4.043+01 | 1.115+01 | 4.300+01 | 1.142+01 | 4.573+01 | 1.168+01 | 4.854+01 | 1.194+01 | 4.854+01 | 1.194+01 |
| 8.0+05            | 2.149+01                                                      | 9.593+00 | 2.290+01 | 9.825+00 | 2.435+01 | 1.006+01 | 2.591+01 | 1.029+01 | 2.752+01 | 1.052+01 | 2.752+01 | 1.052+01 |
| 1.0+06            | 1.380+01                                                      | 8.637+00 | 1.471+01 | 8.846+00 | 1.565+01 | 9.056+00 | 1.665+01 | 9.266+00 | 1.768+01 | 9.475+00 | 1.768+01 | 9.475+00 |
| 1.5+06            | 6.156+02                                                      | 7.030+00 | 6.562+02 | 7.201+00 | 6.982+02 | 7.372+00 | 7.429+02 | 7.563+00 | 7.890+02 | 7.714+00 | 7.890+02 | 7.714+00 |
| 2.0+06            | 3.467+02                                                      | 6.003+00 | 3.695+02 | 6.149+00 | 3.932+02 | 6.295+00 | 4.048+02 | 6.441+00 | 4.444+02 | 6.587+00 | 4.444+02 | 6.587+00 |
| 3.0+06            | 1.542+02                                                      | 4.725+00 | 1.644+02 | 4.840+00 | 1.750+02 | 4.956+00 | 1.862+02 | 5.071+00 | 1.978+02 | 5.186+00 | 1.978+02 | 5.186+00 |
| 4.0+06            | 8.677+02                                                      | 3.942+00 | 9.251+02 | 4.038+00 | 9.844+02 | 4.135+00 | 1.047+02 | 4.231+00 | 1.113+02 | 4.327+00 | 1.113+02 | 4.327+00 |
| 5.0+06            | 5.555+03                                                      | 4.045+00 | 5.922+03 | 3.488+00 | 6.302+03 | 3.571+00 | 6.706+03 | 3.564+00 | 7.123+03 | 3.737+00 | 7.123+03 | 3.737+00 |
| 6.0+06            | 3.858+03                                                      | 3.014+00 | 4.113+03 | 3.083+00 | 4.378+03 | 3.157+00 | 4.658+03 | 3.230+00 | 4.947+03 | 3.303+00 | 4.947+03 | 3.303+00 |
| 8.0+06            | 2.170+03                                                      | 2.462+00 | 2.314+03 | 2.522+00 | 2.662+03 | 2.582+00 | 2.620+03 | 2.642+00 | 2.793+03 | 2.702+00 | 2.793+03 | 2.702+00 |
| 1.0+07            | 1.389+03                                                      | 2.097+00 | 1.481+03 | 2.148+00 | 1.576+03 | 2.199+00 | 1.677+03 | 2.251+00 | 1.782+03 | 2.302+00 | 1.782+03 | 2.302+00 |
| 1.5+07            | 6.173+04                                                      | 1.552+00 | 6.581+04 | 1.590+00 | 7.004+04 | 1.628+00 | 7.453+04 | 1.666+00 | 7.917+04 | 1.704+00 | 7.917+04 | 1.704+00 |
| 2.0+07            | 3.472+04                                                      | 1.244+00 | 3.702+04 | 1.276+00 | 3.540+04 | 1.307+00 | 4.192+04 | 1.337+00 | 4.454+04 | 1.367+00 | 4.454+04 | 1.367+00 |
| 3.0+07            | 1.543+04                                                      | 9.070+01 | 1.645+04 | 9.292+01 | 1.751+04 | 9.513+01 | 1.863+04 | 9.734+01 | 1.979+04 | 9.955+01 | 1.979+04 | 9.955+01 |
| 4.0+07            | 8.682+05                                                      | 7.208+01 | 9.256+05 | 7.384+01 | 9.850+05 | 7.559+01 | 1.046+04 | 7.735+01 | 1.113+04 | 7.911+01 | 1.113+04 | 7.911+01 |
| 5.0+07            | 5.566+05                                                      | 6.017+01 | 5.923+05 | 6.163+01 | 6.304+05 | 6.310+01 | 6.705+05 | 6.557+01 | 7.126+05 | 6.604+01 | 7.126+05 | 6.604+01 |
| 6.0+07            | 3.858+05                                                      | 5.184+01 | 4.113+05 | 4.310+01 | 4.377+05 | 4.437+01 | 4.657+05 | 5.563+01 | 4.947+05 | 5.690+01 | 4.947+05 | 5.690+01 |
| 8.0+07            | 2.170+05                                                      | 4.058+01 | 2.314+05 | 4.188+01 | 2.462+05 | 4.288+01 | 2.620+05 | 4.387+01 | 2.783+05 | 4.487+01 | 2.783+05 | 4.487+01 |
| 1.0+08            | 1.389+05                                                      | 3.393+01 | 1.481+05 | 3.476+01 | 1.576+05 | 3.559+01 | 1.677+05 | 3.642+01 | 1.781+05 | 3.724+01 | 1.781+05 | 3.724+01 |

TABLE II\*, CONT. \* COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS. BARNS/ATOM

| PHOTON ENERGY, EV | 46 PD      |           |            | 47 AG     |           |           | 48 CD     |           |           | 49 IN     |           |           | 50 SN     |           |           |
|-------------------|------------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                   | COH        | INCOH     | COH        | COH       | INCOH     | COH       | COH       | INCOH     | COH       | INCOH     | COH       | INCOH     | COH       | INCOH     | COH       |
| 1.0+02            | 1.4074e-03 | 8.537-03  | 1.4694e-03 | 1.125e-02 | 1.532e-03 | 1.288e-02 | 1.596e-03 | 1.322e-02 | 1.662e-03 | 1.298e-02 | 1.661e-03 | 2.918e-02 | 1.661e-03 | 2.918e-02 | 1.661e-03 |
| 1.5+02            | 1.406e+03  | 1.105e-02 | 1.468e-03  | 2.529e-02 | 1.531e-03 | 2.875e-02 | 1.595e-03 | 2.598e-02 | 1.661e-03 | 2.918e-02 | 1.661e-03 | 2.918e-02 | 1.661e-03 | 2.918e-02 | 1.661e-03 |
| 2.0+02            | 1.405e+03  | 3.384e-02 | 1.467e-03  | 4.484e-02 | 1.522e-03 | 5.086e-02 | 1.597e-03 | 5.297e-02 | 1.659e-03 | 5.170e-02 | 1.654e-03 | 5.170e-02 | 1.654e-03 | 5.170e-02 | 1.654e-03 |
| 3.0+02            | 1.402e+03  | 7.567-02  | 1.463e-03  | 9.952e-02 | 1.525e-03 | 1.128e-01 | 1.589e-03 | 1.173e-01 | 1.654e-03 | 1.148e-01 | 1.647e-03 | 1.148e-01 | 1.647e-03 | 1.148e-01 | 1.647e-03 |
| 4.0+02            | 1.398e+03  | 1.333e-01 | 1.458e-03  | 1.735e-01 | 1.520e-03 | 1.966e-01 | 1.582e-03 | 2.043e-01 | 1.647e-03 | 2.003e-01 | 1.647e-03 | 2.003e-01 | 1.647e-03 | 2.003e-01 | 1.647e-03 |
| 5.0+02            | 1.392e+03  | 2.059e-01 | 1.451e-03  | 2.646e-01 | 1.513e-03 | 2.998e-01 | 1.584e-03 | 3.111e-01 | 1.647e-03 | 3.060e-01 | 1.647e-03 | 3.060e-01 | 1.647e-03 | 3.060e-01 | 1.647e-03 |
| 6.0+02            | 1.386e+03  | 2.126e-01 | 1.443e-03  | 3.703e-01 | 1.504e-03 | 4.193e-01 | 1.565e-03 | 4.348e-01 | 1.628e-03 | 4.269e-01 | 1.628e-03 | 4.269e-01 | 1.628e-03 | 4.269e-01 | 1.628e-03 |
| 8.0+02            | 1.369e+03  | 5.331e-01 | 1.425e-03  | 6.159e-01 | 1.684e-03 | 6.959e-01 | 1.541e-03 | 7.207e-01 | 1.604e-03 | 7.158e-01 | 1.604e-03 | 7.158e-01 | 1.604e-03 | 7.158e-01 | 1.604e-03 |
| 1.0+03            | 1.349e+03  | 7.546e-01 | 1.402e-03  | 8.922e-01 | 1.459e-03 | 1.004e-00 | 1.514e-03 | 1.040e-00 | 1.574e-03 | 1.039e-00 | 1.574e-03 | 1.039e-00 | 1.574e-03 | 1.039e-00 | 1.574e-03 |
| 1.5+03            | 1.286e+03  | 1.996e+00 | 1.333e-03  | 1.642e-00 | 1.380e-03 | 1.808e+00 | 1.434e-03 | 1.882e+00 | 1.488e-03 | 1.909e+00 | 1.488e-03 | 1.909e+00 | 1.488e-03 | 1.909e+00 | 1.488e-03 |
| 2.0+03            | 1.210e+03  | 2.294e+00 | 1.255e-03  | 2.410e-00 | 1.303e-03 | 2.585e+00 | 1.377e-03 | 2.702e+00 | 1.397e-03 | 2.770e+00 | 1.397e-03 | 2.770e+00 | 1.397e-03 | 2.770e+00 | 1.397e-03 |
| 3.0+03            | 1.050e+03  | 3.084e+00 | 1.094e-03  | 3.892e-00 | 1.137e-03 | 4.044e+00 | 1.177e-03 | 4.202e+00 | 1.219e-03 | 4.341e+00 | 1.219e-03 | 4.341e+00 | 1.219e-03 | 4.341e+00 | 1.219e-03 |
| 4.0+03            | 9.027e+02  | 5.156e+00 | 9.446e+02  | 5.248e+00 | 9.854e+02 | 5.395e+00 | 1.024e+03 | 5.561e+00 | 1.062e+03 | 5.728e+00 | 1.062e+03 | 5.728e+00 | 1.062e+03 | 5.728e+00 | 1.062e+03 |
| 5.0+03            | 7.792e+02  | 6.395e+00 | 8.169e+02  | 6.488e+00 | 8.542e+02 | 6.635e+00 | 8.946e+02 | 6.802e+00 | 8.980e+02 | 6.980e+00 | 8.980e+02 | 6.980e+00 | 8.980e+02 | 6.980e+00 | 8.980e+02 |
| 6.0+03            | 6.792e+02  | 7.553e+00 | 7.122e+02  | 7.643e+00 | 7.654e+02 | 7.783e+00 | 7.783e+02 | 7.947e+00 | 8.115e+02 | 8.126e+00 | 8.115e+02 | 8.126e+00 | 8.115e+02 | 8.126e+00 | 8.115e+02 |
| 8.0+03            | 5.339e+02  | 9.512e+00 | 5.588e+02  | 9.715e+00 | 5.843e+02 | 9.849e+00 | 6.101e+02 | 1.001e+01 | 6.366e+02 | 1.018e+01 | 6.366e+02 | 1.018e+01 | 6.366e+02 | 1.018e+01 | 6.366e+02 |
| 1.0+04            | 4.355e+02  | 1.130e+01 | 4.553e+02  | 1.144e+01 | 4.754e+02 | 1.160e+01 | 4.957e+02 | 1.177e+01 | 5.166e+02 | 1.196e+01 | 5.166e+02 | 1.196e+01 | 5.166e+02 | 1.196e+01 | 5.166e+02 |
| 1.5+04            | 2.830e+02  | 1.428e+01 | 2.970e+02  | 1.451e+01 | 3.110e+02 | 1.475e+01 | 3.251e+02 | 1.499e+01 | 3.392e+02 | 1.523e+01 | 3.392e+02 | 1.523e+01 | 3.392e+02 | 1.523e+01 | 3.392e+02 |
| 2.0+04            | 1.950e+02  | 1.524e+01 | 2.054e+02  | 1.651e+01 | 2.160e+02 | 1.679e+01 | 2.268e+02 | 1.707e+01 | 2.377e+02 | 1.736e+01 | 2.377e+02 | 1.736e+01 | 2.377e+02 | 1.736e+01 | 2.377e+02 |
| 3.0+04            | 1.092e+02  | 1.760e+01 | 1.150e+02  | 1.892e+01 | 1.210e+02 | 1.924e+01 | 1.321e+02 | 1.952e+01 | 1.333e+02 | 1.989e+01 | 1.333e+02 | 1.989e+01 | 1.333e+02 | 1.989e+01 | 1.333e+02 |
| 4.0+04            | 7.107e+01  | 1.983e+01 | 7.488e+01  | 2.017e+01 | 7.787e+01 | 2.052e+01 | 8.277e+01 | 2.087e+01 | 8.686e+01 | 2.123e+01 | 8.686e+01 | 2.123e+01 | 8.686e+01 | 2.123e+01 | 8.686e+01 |
| 5.0+04            | 4.994e+01  | 2.045e+01 | 5.268e+01  | 2.082e+01 | 5.569e+01 | 2.119e+01 | 5.836e+01 | 2.156e+01 | 6.128e+01 | 2.193e+01 | 6.128e+01 | 2.193e+01 | 6.128e+01 | 2.193e+01 | 6.128e+01 |
| 6.0+04            | 3.899e+01  | 2.073e+01 | 3.895e+01  | 2.113e+01 | 4.106e+01 | 2.150e+01 | 4.344e+01 | 2.188e+01 | 4.526e+01 | 2.226e+01 | 4.526e+01 | 2.226e+01 | 4.526e+01 | 2.226e+01 | 4.526e+01 |
| 8.0+04            | 2.242e+01  | 2.073e+01 | 2.366e+01  | 2.113e+01 | 2.498e+01 | 2.153e+01 | 2.631e+01 | 2.193e+01 | 2.769e+01 | 2.232e+01 | 2.769e+01 | 2.232e+01 | 2.769e+01 | 2.232e+01 | 2.769e+01 |
| 1.0+05            | 1.515e+01  | 2.038e+01 | 1.600e+01  | 2.078e+01 | 1.688e+01 | 2.118e+01 | 1.778e+01 | 2.158e+01 | 1.871e+01 | 2.196e+01 | 1.871e+01 | 2.196e+01 | 1.871e+01 | 2.196e+01 | 1.871e+01 |
| 1.5+05            | 7.313e+00  | 1.912e+01 | 7.726e+00  | 1.951e+01 | 8.152e+00 | 1.990e+01 | 8.591e+00 | 2.029e+01 | 9.044e+00 | 2.068e+01 | 9.044e+00 | 2.068e+01 | 9.044e+00 | 2.068e+01 | 9.044e+00 |
| 2.0+05            | 4.291e+00  | 1.768e+01 | 4.537e+00  | 1.825e+01 | 4.791e+00 | 1.862e+01 | 5.052e+00 | 1.899e+01 | 5.322e+00 | 1.936e+01 | 5.322e+00 | 1.936e+01 | 5.322e+00 | 1.936e+01 | 5.322e+00 |
| 3.0+05            | 1.984e+00  | 1.885e+01 | 2.099e+00  | 1.619e+01 | 2.288e+00 | 1.652e+01 | 2.340e+00 | 1.681e+01 | 2.462e+00 | 1.719e+01 | 2.462e+00 | 1.719e+01 | 2.462e+00 | 1.719e+01 | 2.462e+00 |
| 4.0+05            | 1.388e+00  | 1.433e+01 | 1.204e+00  | 1.464e+01 | 1.773e+00 | 1.494e+01 | 1.344e+00 | 1.524e+01 | 1.524e+00 | 1.417e+01 | 1.524e+00 | 1.417e+01 | 1.524e+00 | 1.417e+01 | 1.524e+00 |
| 5.0+05            | 7.364e-01  | 1.151e+01 | 7.794e-01  | 1.343e+01 | 8.240e-01 | 1.371e+01 | 8.70e-01  | 1.399e+01 | 9.175e-01 | 1.428e+01 | 9.175e-01 | 1.428e+01 | 9.175e-01 | 1.428e+01 | 9.175e-01 |
| 6.0+05            | 5.150e-01  | 1.220e+01 | 5.451e-01  | 1.247e+01 | 5.764e-01 | 1.273e+01 | 6.087e-01 | 1.297e+01 | 6.421e-01 | 1.325e+01 | 6.421e-01 | 1.325e+01 | 6.421e-01 | 1.325e+01 | 6.421e-01 |
| 8.0+05            | 2.920e-01  | 1.075e+01 | 3.092e-01  | 1.099e+01 | 3.269e-01 | 1.122e+01 | 3.453e-01 | 1.145e+01 | 3.644e-01 | 1.168e+01 | 3.644e-01 | 1.168e+01 | 3.644e-01 | 1.168e+01 | 3.644e-01 |
| 1.0+06            | 1.876e-01  | 9.685e+00 | 1.987e-01  | 9.894e+00 | 2.101e-01 | 1.010e+01 | 2.119e-01 | 1.020e+01 | 2.134e-01 | 1.052e+01 | 2.134e-01 | 1.052e+01 | 2.134e-01 | 1.052e+01 | 2.134e-01 |
| 1.5+06            | 6.374e-02  | 7.885e+00 | 8.870e-02  | 8.056e+00 | 9.383e-02 | 8.227e+00 | 9.913e-02 | 8.398e+00 | 1.046e-02 | 8.569e+00 | 1.046e-02 | 8.569e+00 | 1.046e-02 | 8.569e+00 | 1.046e-02 |
| 2.0+06            | 4.171e-02  | 6.734e+00 | 4.996e-02  | 6.880e+00 | 5.286e-02 | 7.026e+00 | 5.585e-02 | 7.172e+00 | 5.895e-02 | 7.318e+00 | 5.895e-02 | 7.318e+00 | 5.895e-02 | 7.318e+00 | 5.895e-02 |
| 3.0+06            | 2.099e-02  | 5.210e+00 | 4.516e-02  | 5.124e-02 | 5.351e-02 | 5.631e+00 | 2.496e-02 | 5.674e+00 | 2.496e-02 | 5.761e+00 | 2.496e-02 | 5.761e+00 | 2.496e-02 | 5.761e+00 | 2.496e-02 |
| 4.0+06            | 1.181e-02  | 4.423e+00 | 1.251e-02  | 4.519e-02 | 1.324e-02 | 4.615e+00 | 1.399e-02 | 4.711e+00 | 1.476e-02 | 4.807e+00 | 1.476e-02 | 4.807e+00 | 1.476e-02 | 4.807e+00 | 1.476e-02 |
| 5.0+06            | 7.561e-03  | 3.320e+00 | 8.009e-03  | 3.903e+00 | 8.473e-03 | 3.986e+00 | 8.954e-03 | 4.699e+00 | 9.451e-03 | 4.670e+00 | 9.451e-03 | 4.670e+00 | 9.451e-03 | 4.670e+00 | 9.451e-03 |
| 6.0+06            | 5.252e-03  | 3.777e+00 | 5.564e-03  | 3.450e+00 | 5.886e-03 | 3.282e+00 | 6.220e-03 | 3.499e+00 | 6.566e-03 | 3.670e+00 | 6.566e-03 | 3.670e+00 | 6.566e-03 | 3.670e+00 | 6.566e-03 |
| 8.0+06            | 2.954e-03  | 2.762e+00 | 3.130e-03  | 3.02e-01  | 3.311e-03 | 3.082e+00 | 3.499e-03 | 3.294e-03 | 3.597e+00 | 3.693e-03 | 3.693e-03 | 3.693e-03 | 3.693e-03 | 3.693e-03 | 3.693e-03 |
| 1.0+07            | 1.891e-03  | 2.353e+00 | 2.003e-03  | 2.404e+00 | 2.119e-03 | 2.455e+00 | 2.010e-03 | 2.506e+00 | 2.342e-03 | 2.557e+00 | 2.342e-03 | 2.557e+00 | 2.342e-03 | 2.557e+00 | 2.342e-03 |
| 1.5+07            | 6.404e-04  | 1.742e+00 | 8.902e-04  | 1.779e+00 | 9.419e-04 | 1.817e+00 | 9.953e-04 | 1.855e+00 | 1.051e-03 | 1.893e+00 | 1.051e-03 | 1.893e+00 | 1.051e-03 | 1.893e+00 | 1.051e-03 |
| 2.0+07            | 4.728e-04  | 1.598e+00 | 5.008e-04  | 1.428e+00 | 5.269e-04 | 1.459e+00 | 5.595e-04 | 1.489e+00 | 5.910e-04 | 1.519e+00 | 5.910e-04 | 1.519e+00 | 5.910e-04 | 1.519e+00 | 5.910e-04 |
| 3.0+07            | 2.011e-04  | 1.018e+00 | 2.025e-04  | 1.040e+00 | 2.035e-04 | 1.062e+00 | 2.048e-04 | 1.084e+00 | 2.062e-04 | 1.106e+00 | 2.062e-04 | 1.106e+00 | 2.062e-04 | 1.106e+00 | 2.062e-04 |
| 4.0+07            | 1.182e-04  | 8.087e-04 | 1.252e-04  | 8.263e-04 | 1.325e-04 | 8.325e-04 | 1.399e-04 | 8.438e-04 | 1.400e-04 | 8.614e-04 | 1.478e-04 | 8.790e-04 | 1.478e-04 | 8.790e-04 | 1.478e-04 |
| 5.0+07            | 7.564e-05  | 6.750e-04 | 8.012e-05  | 6.897e-04 | 8.477e-05 | 7.944e-04 | 8.958e-05 | 7.958e-04 | 9.456e-05 | 7.910e-04 | 9.456e-05 | 7.910e-04 | 9.456e-05 | 7.910e-04 | 9.456e-05 |
| 6.0+07            | 5.522e-05  | 5.816e-04 | 5.563e-05  | 5.943e-04 | 5.886e-05 | 6.069e-04 | 6.220e-05 | 6.195e-04 | 6.486e-05 | 6.886e-04 | 6.486e-05 | 6.886e-04 | 6.486e-05 |           |           |

TABLE II. CONT.

| PHOTON ENERGY, EV | COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNS/ATOM |          |          |          |          |          |          |          |          |          |          |          |          |
|-------------------|---------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | 51 SB                                                         | 52 TE    | 53 I     | 54 XE    | 55 CS    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    |
| 1.0+02            | 1.730+03                                                      | 1.278+02 | 1.798+03 | 1.213+02 | 1.868+03 | 1.147+02 | 1.939+03 | 1.126+02 | 2.011+03 | 2.315+02 | 2.011+03 | 2.315+02 | 2.011+03 |
| 1.5+02            | 1.728+03                                                      | 2.832+02 | 1.797+03 | 2.721+02 | 1.867+03 | 2.611+02 | 1.938+03 | 2.527+02 | 2.008+03 | 5.118+02 | 2.008+03 | 5.118+02 | 2.008+03 |
| 2.0+02            | 1.726+03                                                      | 4.999+02 | 1.795+03 | 4.813+02 | 1.865+03 | 4.632+02 | 1.936+03 | 4.472+02 | 2.006+03 | 8.943+02 | 2.006+03 | 8.943+02 | 2.006+03 |
| 3.0+02            | 1.721+03                                                      | 1.109+01 | 1.071+01 | 1.032+01 | 1.032+01 | 1.032+01 | 1.930+03 | 9.970+02 | 1.997+03 | 1.924+01 | 1.997+03 | 1.924+01 | 1.997+03 |
| 4.0+02            | 1.714+03                                                      | 1.938+01 | 1.872+03 | 1.875+01 | 1.852+03 | 1.812+01 | 1.923+03 | 1.751+01 | 1.986+03 | 3.227+01 | 1.986+03 | 3.227+01 | 1.986+03 |
| 5.0+02            | 1.705+03                                                      | 2.964+01 | 1.773+03 | 2.877+01 | 1.843+03 | 2.787+01 | 1.914+03 | 2.695+01 | 1.973+03 | 4.712+01 | 1.973+03 | 4.712+01 | 1.973+03 |
| 6.0+02            | 1.694+03                                                      | 4.122+01 | 1.762+03 | 4.054+01 | 1.831+03 | 3.936+01 | 1.914+03 | 3.812+01 | 1.958+03 | 6.301+01 | 1.958+03 | 6.301+01 | 1.958+03 |
| 8.0+02            | 1.669+03                                                      | 6.970+01 | 1.736+03 | 6.841+01 | 1.804+03 | 6.682+01 | 1.875+03 | 6.491+01 | 1.923+03 | 9.607+01 | 1.923+03 | 9.607+01 | 1.923+03 |
| 1.0+03            | 1.638+03                                                      | 1.116+00 | 1.704+03 | 1.005+00 | 1.673+03 | 9.878+01 | 1.841+03 | 9.659+01 | 1.884+03 | 1.298+00 | 1.884+03 | 1.298+00 | 1.884+03 |
| 1.5+03            | 1.546+03                                                      | 1.885+00 | 1.608+03 | 1.896+00 | 1.563+03 | 1.829+00 | 1.890+00 | 1.858+00 | 1.740+03 | 2.177+00 | 1.666+03 | 2.177+00 | 1.666+03 |
| 2.0+03            | 1.448+03                                                      | 2.733+00 | 1.504+03 | 2.809+00 | 1.355+03 | 4.614+00 | 1.406+03 | 4.28+00  | 1.626+03 | 3.088+00 | 1.448+03 | 3.088+00 | 1.448+03 |
| 3.0+03            | 1.262+03                                                      | 4.411+00 | 1.307+03 | 4.527+00 | 1.178+03 | 6.178+00 | 1.224+03 | 6.265+00 | 1.224+03 | 4.863+00 | 4.863+00 | 4.863+00 | 4.863+00 |
| 4.0+03            | 1.100+03                                                      | 5.850+00 | 1.140+03 | 6.029+00 | 1.035+03 | 7.519+00 | 1.072+03 | 7.664+00 | 1.072+03 | 5.905+00 | 5.905+00 | 5.905+00 | 5.905+00 |
| 5.0+03            | 9.623+02                                                      | 7.40+00  | 9.983+02 | 7.333+00 | 9.118+02 | 8.700+00 | 9.457+02 | 8.876+00 | 9.770+02 | 9.129+00 | 9.770+02 | 9.129+00 | 9.770+02 |
| 6.0+03            | 8.448+02                                                      | 8.297+00 | 8.782+02 | 8.499+00 | 9.118+02 | 8.700+00 | 9.457+02 | 8.876+00 | 9.770+02 | 9.129+00 | 9.770+02 | 9.129+00 | 9.770+02 |
| 8.0+03            | 6.637+02                                                      | 1.035+01 | 6.914+02 | 1.056+01 | 7.196+02 | 1.076+01 | 7.483+02 | 1.096+01 | 7.756+02 | 1.121+01 | 7.756+02 | 1.121+01 | 7.756+02 |
| 1.0+04            | 5.381+02                                                      | 1.214+01 | 5.603+02 | 1.234+01 | 5.831+02 | 1.255+01 | 6.066+02 | 1.275+01 | 6.295+02 | 1.300+01 | 6.295+02 | 1.300+01 | 6.295+02 |
| 1.5+04            | 3.535+02                                                      | 1.548+01 | 3.680+02 | 1.572+01 | 3.826+02 | 1.597+01 | 3.971+02 | 1.621+01 | 4.124+02 | 1.647+01 | 4.124+02 | 1.647+01 | 4.124+02 |
| 2.0+04            | 2.488+02                                                      | 1.784+01 | 2.600+02 | 1.793+01 | 2.713+02 | 1.822+01 | 2.828+02 | 1.850+01 | 2.942+02 | 1.880+01 | 2.942+02 | 1.880+01 | 2.942+02 |
| 3.0+04            | 1.398+02                                                      | 2.922+01 | 1.464+02 | 2.025+01 | 1.532+02 | 2.088+01 | 1.601+02 | 2.121+01 | 1.671+02 | 2.154+01 | 1.671+02 | 2.154+01 | 1.671+02 |
| 4.0+04            | 9.105+01                                                      | 2.158+01 | 9.536+01 | 2.193+01 | 9.978+01 | 2.228+01 | 1.034+02 | 2.264+01 | 1.089+02 | 2.299+01 | 1.089+02 | 2.299+01 | 1.089+02 |
| 5.0+04            | 6.430+01                                                      | 2.267+01 | 6.737+01 | 2.267+01 | 7.053+01 | 2.303+01 | 7.374+01 | 2.340+01 | 7.701+01 | 2.377+01 | 7.701+01 | 2.377+01 | 7.701+01 |
| 6.0+04            | 4.772+01                                                      | 2.265+01 | 5.006+01 | 2.303+01 | 5.249+01 | 2.340+01 | 5.490+01 | 2.378+01 | 5.739+01 | 2.416+01 | 5.739+01 | 2.416+01 | 5.739+01 |
| 8.0+04            | 2.911+01                                                      | 2.272+01 | 3.056+01 | 2.311+01 | 3.209+01 | 2.350+01 | 3.360+01 | 2.390+01 | 3.518+01 | 2.429+01 | 3.518+01 | 2.429+01 | 3.518+01 |
| 1.0+05            | 1.967+01                                                      | 2.238+01 | 2.065+01 | 2.278+01 | 2.169+01 | 2.318+01 | 2.318+01 | 2.379+01 | 2.379+01 | 2.397+01 | 2.397+01 | 2.397+01 | 2.397+01 |
| 1.5+05            | 9.508+00                                                      | 2.106+01 | 9.937+00 | 2.145+01 | 1.049+01 | 2.183+01 | 1.049+01 | 2.224+01 | 1.094+01 | 2.260+01 | 1.151+01 | 2.260+01 | 1.151+01 |
| 2.0+05            | 5.600+00                                                      | 1.973+01 | 5.886+00 | 2.009+01 | 6.189+00 | 2.046+01 | 6.486+00 | 2.083+01 | 6.797+00 | 2.119+01 | 6.797+00 | 2.119+01 | 6.797+00 |
| 3.0+05            | 2.598+00                                                      | 1.752+01 | 2.733+00 | 1.785+01 | 2.876+01 | 1.818+01 | 3.016+00 | 1.832+01 | 3.163+00 | 1.885+01 | 3.163+00 | 1.885+01 | 3.163+00 |
| 4.0+05            | 1.492+00                                                      | 1.385+01 | 1.570+00 | 1.616+01 | 1.653+00 | 1.646+01 | 1.734+00 | 1.676+01 | 1.819+00 | 1.707+01 | 1.819+00 | 1.707+01 | 1.819+00 |
| 5.0+05            | 9.666+01                                                      | 1.456+01 | 1.017+00 | 1.484+01 | 1.071+00 | 1.512+01 | 1.124+00 | 1.520+01 | 1.180+00 | 1.568+01 | 1.180+00 | 1.568+01 | 1.180+00 |
| 6.0+05            | 6.765+01                                                      | 1.320+01 | 1.377+01 | 1.501+01 | 7.501+01 | 1.404+01 | 7.812+01 | 1.420+01 | 8.263+01 | 1.456+01 | 8.263+01 | 1.456+01 | 8.263+01 |
| 8.0+05            | 3.840+01                                                      | 1.191+01 | 4.044+01 | 1.215+01 | 4.260+01 | 1.238+01 | 4.238+01 | 1.261+01 | 4.694+01 | 1.284+01 | 4.694+01 | 1.284+01 | 4.694+01 |
| 1.0+06            | 2.469+01                                                      | 1.673+01 | 2.600+01 | 1.694+01 | 2.740+01 | 1.115+01 | 2.877+01 | 1.157+01 | 3.020+01 | 2.397+01 | 3.020+01 | 2.397+01 | 3.020+01 |
| 1.5+06            | 1.103+01                                                      | 8.739+00 | 1.162+01 | 8.910+00 | 1.224+01 | 5.081+00 | 1.285+01 | 5.352+00 | 1.350+01 | 9.422+00 | 1.350+01 | 9.422+00 | 1.350+01 |
| 2.0+06            | 6.215+02                                                      | 7.664+00 | 6.547+02 | 7.610+00 | 6.900+02 | 7.756+00 | 7.246+02 | 7.902+00 | 7.610+02 | 8.048+00 | 7.610+02 | 8.048+00 | 7.610+02 |
| 3.0+06            | 2.767+02                                                      | 5.876+00 | 2.914+02 | 5.991+00 | 3.071+02 | 6.107+00 | 3.226+02 | 6.224+00 | 3.388+02 | 6.337+00 | 3.388+02 | 6.337+00 | 3.388+02 |
| 4.0+06            | 1.557+02                                                      | 4.903+00 | 1.640+02 | 4.999+00 | 1.728+02 | 5.095+00 | 1.815+02 | 5.191+00 | 1.906+02 | 5.287+00 | 1.906+02 | 5.287+00 | 1.906+02 |
| 5.0+06            | 9.565+02                                                      | 4.235+00 | 1.050+02 | 4.318+00 | 1.106+02 | 4.401+00 | 1.162+02 | 4.484+00 | 1.222+02 | 4.567+00 | 1.222+02 | 4.567+00 | 1.222+02 |
| 6.0+06            | 6.923+03                                                      | 3.744+00 | 7.293+03 | 3.817+00 | 7.687+03 | 3.890+00 | 8.073+03 | 3.964+00 | 8.480+03 | 4.037+00 | 8.480+03 | 4.037+00 | 8.480+03 |
| 8.0+06            | 3.894+03                                                      | 3.063+00 | 4.102+03 | 3.123+00 | 4.323+03 | 3.183+00 | 4.541+03 | 3.233+00 | 4.769+03 | 3.303+00 | 4.769+03 | 3.303+00 | 4.769+03 |
| 1.0+07            | 2.493+03                                                      | 2.609+00 | 2.526+03 | 2.660+00 | 2.768+03 | 2.711+00 | 2.907+03 | 2.762+00 | 3.053+03 | 2.813+00 | 3.053+03 | 2.813+00 | 3.053+03 |
| 1.5+07            | 1.108+03                                                      | 1.931+00 | 1.167+03 | 1.969+00 | 1.230+03 | 2.006+00 | 1.292+03 | 2.044+00 | 1.357+03 | 2.082+00 | 1.357+03 | 2.082+00 | 1.357+03 |
| 2.0+07            | 6.232+04                                                      | 1.550+00 | 6.566+04 | 1.580+00 | 6.920+04 | 1.611+00 | 7.268+04 | 1.641+00 | 7.610+04 | 1.671+00 | 7.610+04 | 1.671+00 | 7.610+04 |
| 3.0+07            | 2.769+04                                                      | 1.128+00 | 2.917+04 | 1.150+00 | 3.075+04 | 1.172+00 | 3.229+04 | 1.195+00 | 3.392+04 | 1.217+00 | 3.392+04 | 1.217+00 | 3.392+04 |
| 4.0+07            | 1.558+04                                                      | 8.966+01 | 1.641+04 | 9.141+01 | 1.730+04 | 5.317+01 | 1.817+04 | 9.493+01 | 1.908+04 | 9.669+01 | 1.908+04 | 9.669+01 | 1.908+04 |
| 5.0+07            | 9.970+05                                                      | 4.848+01 | 1.631+05 | 1.107+01 | 7.777+05 | 1.070+01 | 1.163+05 | 7.924+01 | 1.221+05 | 8.071+01 | 1.221+05 | 8.071+01 | 1.221+05 |
| 6.0+07            | 6.923+05                                                      | 6.448+01 | 7.293+05 | 6.575+01 | 7.687+05 | 6.701+01 | 8.073+05 | 6.888+01 | 8.480+05 | 6.954+01 | 8.480+05 | 6.954+01 | 8.480+05 |
| 8.0+07            | 3.895+05                                                      | 5.085+01 | 4.103+05 | 5.185+01 | 4.325+05 | 5.285+01 | 4.542+05 | 5.365+01 | 4.771+05 | 5.484+01 | 4.771+05 | 5.484+01 | 4.771+05 |
| 1.0+08            | 2.492+05                                                      | 4.221+01 | 2.625+05 | 4.304+01 | 2.767+05 | 4.386+01 | 2.906+05 | 4.469+01 | 2.906+05 | 4.552+01 | 2.906+05 | 4.552+01 | 2.906+05 |

| PHOTON ENERGY, eV | 56 BA    |          |          | 57 LA    |          |          | 58 CE    |          |          | 59 PR    |          |          | 60 ND    |          |          |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | COH      | INCOH    | COH      |
| 1.0+02            | 2.085+03 | 2.694-02 | 2.159+03 | 2.595-02 | 2.036+03 | 2.517-02 | 2.314+03 | 2.516-02 | 2.393+03 | 2.496-02 | 2.390+03 | 5.551-02 | 2.390+03 | 5.551-02 | 2.390+03 |
| 1.1+02            | 2-C82+03 | 6.018-02 | 2.157+03 | 5.783-02 | 2.233+03 | 5.633-02 | 2.311+03 | 5.638-02 | 2.390+03 | 9.920-02 | 2.308+03 | 9.747-02 | 2.308+03 | 9.747-02 | 2.308+03 |
| 1.2+02            | 2-079+03 | 1.504-01 | 1.154+03 | 1.014-01 | 2.230+03 | 9.909-01 | 2.221+03 | 2.159-01 | 2.299+03 | 2.159-01 | 2.286+03 | 3.668-01 | 2.378+03 | 2.121-01 | 2.378+03 |
| 1.3+02            | 2-069+03 | 2.264-01 | 2.144+03 | 2.209-01 | 2.221+03 | 3.779-01 | 2.208+03 | 3.679-01 | 2.286+03 | 3.668-01 | 2.366+03 | 3.606-01 | 2.366+03 | 3.606-01 | 2.366+03 |
| 1.4+02            | 2-057+03 | 3.864-01 | 2.332+03 | 3.779-01 | 2.221+03 | 3.679-01 | 2.193+03 | 5.463-01 | 2.271+03 | 5.425-01 | 2.350+03 | 5.339-01 | 2.350+03 | 5.339-01 | 2.350+03 |
| 1.5+02            | 2-041+03 | 5.689-01 | 2.116+03 | 5.575-01 | 2.193+03 | 5.463-01 | 2.163+03 | 7.416-01 | 2.254+03 | 7.375-01 | 2.333+03 | 7.228-01 | 2.333+03 | 7.228-01 | 2.333+03 |
| 1.6+02            | 2-024+03 | 7.554-01 | 2.099+03 | 7.555-01 | 2.174+C0 | 1.154+00 | 2.134+03 | 1.154+00 | 2.213+03 | 1.133+00 | 2.292+03 | 1.119+00 | 2.292+03 | 1.119+00 | 2.292+03 |
| 1.7+02            | 2-008+03 | 1.170+00 | 2.057+03 | 1.174+C0 | 2.134+03 | 1.154+00 | 2.134+03 | 1.154+00 | 2.213+03 | 1.133+00 | 2.292+03 | 1.119+00 | 2.292+03 | 1.119+00 | 2.292+03 |
| 1.8+02            | 1.983+03 | 1.170+00 | 2.057+03 | 1.174+C0 | 2.134+03 | 1.154+00 | 2.134+03 | 1.154+00 | 2.213+03 | 1.133+00 | 2.292+03 | 1.119+00 | 2.292+03 | 1.119+00 | 2.292+03 |
| 1.9+03            | 1.939+03 | 1.565+00 | 2.011+03 | 1.568+00 | 2.087+03 | 1.568+00 | 2.046+03 | 1.568+00 | 2.167+03 | 1.529+00 | 2.246+03 | 1.513+00 | 2.246+03 | 1.513+00 | 2.246+03 |
| 2.0+03            | 1.822+03 | 2.494+00 | 1.886+03 | 2.561+00 | 1.961+03 | 2.536+00 | 2.046+03 | 2.469+00 | 2.123+03 | 2.452+00 | 2.197+03 | 2.452+00 | 2.197+03 | 2.452+00 | 2.197+03 |
| 2.1+03            | 1.705+03 | 3.96+00  | 1.763+03 | 3.68+B0  | 1.836+03 | 3.465+00 | 1.923+03 | 3.386+00 | 1.999+03 | 3.369+00 | 2.069+03 | 3.141+00 | 2.141+03 | 3.141+00 | 2.141+03 |
| 2.2+03            | 1.489+03 | 5.133+00 | 1.536+03 | 5.234+00 | 1.692+03 | 5.234+00 | 1.683+03 | 5.154+00 | 1.758+03 | 5.141+00 | 1.778+03 | 5.141+00 | 1.778+03 | 5.141+00 | 1.778+03 |
| 2.3+03            | 1.293+03 | 6.738+00 | 1.338+03 | 6.880+00 | 1.398+03 | 6.877+00 | 1.475+03 | 6.786+00 | 1.539+03 | 6.778+00 | 1.529+03 | 6.759+00 | 1.529+03 | 6.759+00 | 1.529+03 |
| 2.4+03            | 1.129+03 | 8.644+00 | 1.175+03 | 8.338+00 | 1.227+03 | 8.355+00 | 1.247+03 | 8.355+00 | 1.295+03 | 8.258+00 | 1.352+03 | 8.196+00 | 1.352+03 | 8.196+00 | 1.352+03 |
| 2.5+03            | 1.008+03 | 9.400+00 | 1.041+03 | 9.568+00 | 1.067+03 | 9.646+00 | 1.145+03 | 9.554+00 | 1.196+03 | 9.571+00 | 1.196+03 | 9.571+00 | 1.196+03 | 9.571+00 | 1.196+03 |
| 2.6+03            | 9.027+02 | 1.148+01 | 8.307+02 | 1.172+01 | 8.671+02 | 1.180+01 | 9.121+02 | 1.174+01 | 9.521+02 | 1.179+01 | 9.521+02 | 1.179+01 | 9.521+02 | 1.179+01 | 9.521+02 |
| 2.7+02            | 6.526+02 | 1.326+01 | 6.765+02 | 1.350+01 | 7.058+02 | 1.366+01 | 7.408+02 | 1.358+01 | 7.730+02 | 1.365+01 | 8.108+02 | 1.375+01 | 8.108+02 | 1.375+01 | 8.108+02 |
| 2.8+02            | 4.274+02 | 1.747+01 | 4.428+02 | 1.700+01 | 4.10+02  | 1.710+01 | 4.819+02 | 1.720+01 | 5.18+02  | 1.735+01 | 5.488+02 | 1.755+01 | 5.488+02 | 1.755+01 | 5.488+02 |
| 2.9+02            | 3.055+02 | 1.940+01 | 3.171+02 | 1.946+01 | 3.30+02  | 1.962+01 | 3.448+02 | 1.977+01 | 3.588+02 | 1.996+01 | 3.696+02 | 2.036+01 | 3.696+02 | 2.036+01 | 3.696+02 |
| 3.0+02            | 1.743+02 | 2.188+01 | 1.816+02 | 2.222+01 | 1.996+02 | 2.255+01 | 1.983+02 | 2.278+01 | 2.069+02 | 2.306+01 | 2.069+02 | 2.306+01 | 2.069+02 | 2.306+01 | 2.069+02 |
| 3.1+02            | 1.336+02 | 2.335+01 | 1.185+02 | 2.371+01 | 1.237+02 | 2.404+01 | 1.293+02 | 2.436+01 | 1.349+02 | 2.468+01 | 1.349+02 | 2.468+01 | 1.349+02 | 2.468+01 | 1.349+02 |
| 3.2+02            | 8.032+01 | 2.434+01 | 8.374+01 | 2.451+01 | 8.374+01 | 2.482+01 | 8.429+01 | 2.482+01 | 9.151+01 | 2.521+01 | 9.519+01 | 2.556+01 | 9.519+01 | 2.556+01 | 9.519+01 |
| 3.3+02            | 6.004+01 | 2.454+01 | 6.252+01 | 2.492+01 | 6.252+01 | 2.529+01 | 6.823+01 | 2.529+01 | 7.519+01 | 2.565+01 | 7.117+01 | 2.601+01 | 7.117+01 | 2.601+01 | 7.117+01 |
| 3.4+02            | 5.992+01 | 2.468+01 | 3.843+01 | 2.507+01 | 4.018+C1 | 2.545+01 | 4.202+01 | 2.583+01 | 4.389+01 | 2.621+01 | 4.389+01 | 2.621+01 | 4.389+01 | 2.621+01 | 4.389+01 |
| 3.5+02            | 2.488+01 | 2.436+01 | 2.600+01 | 2.476+01 | 2.719+01 | 2.515+01 | 2.845+01 | 2.553+01 | 2.972+01 | 2.592+01 | 3.177+01 | 2.643+01 | 3.177+01 | 2.643+01 | 3.177+01 |
| 3.6+02            | 1.204+01 | 2.259+01 | 1.259+01 | 2.337+01 | 1.316+01 | 2.375+01 | 1.375+01 | 2.375+01 | 1.413+01 | 2.413+01 | 1.438+01 | 2.452+01 | 1.438+01 | 2.452+01 | 1.438+01 |
| 3.7+02            | 2.115+01 | 2.156+01 | 2.156+01 | 2.193+01 | 7.68+00  | 2.222+01 | 8.150+00 | 2.265+01 | 8.518+00 | 2.302+01 | 8.979+00 | 2.340+01 | 8.979+00 | 2.340+01 | 8.979+00 |
| 3.8+02            | 3.314+00 | 1.918+01 | 3.470+00 | 1.915+01 | 3.633+00 | 1.984+01 | 3.805+00 | 2.017+01 | 3.979+00 | 2.050+01 | 4.181+00 | 2.293+00 | 4.181+00 | 2.293+00 | 4.181+00 |
| 3.9+02            | 4.00+00  | 1.907+00 | 1.797+00 | 1.767+01 | 2.092+00 | 1.799+01 | 2.194+00 | 1.828+01 | 2.293+00 | 1.858+01 | 2.422+00 | 1.883+00 | 2.422+00 | 1.883+00 | 2.422+00 |
| 4.0+02            | 5.00+00  | 1.237+00 | 1.596+01 | 1.295+00 | 1.624+01 | 1.357+00 | 1.652+01 | 1.422+00 | 1.680+01 | 1.488+00 | 1.708+01 | 1.527+00 | 1.738+00 | 1.527+00 | 1.738+00 |
| 4.1+02            | 6.00+00  | 8.663-01 | 1.442+01 | 9.507-01 | 1.508+01 | 9.512-01 | 1.535+01 | 9.568-01 | 1.560+01 | 9.596-01 | 1.586+01 | 1.586+01 | 1.586+01 | 1.586+01 | 1.586+01 |
| 4.2+02            | 8.00+00  | 4.923-01 | 1.397+01 | 5.160-01 | 1.330+01 | 5.08-01  | 1.355+01 | 5.135+01 | 5.668-01 | 1.376+01 | 5.934-01 | 1.403+01 | 5.934-01 | 1.403+01 | 5.934-01 |
| 4.3+02            | 3.168-01 | 1.178+01 | 3.321-01 | 1.199+01 | 3.481-01 | 1.219+01 | 3.649-01 | 1.240+01 | 3.821-01 | 1.261+01 | 4.038+01 | 1.282+01 | 4.038+01 | 1.282+01 | 4.038+01 |
| 4.4+02            | 1.415-01 | 9.593+00 | 1.485-01 | 9.764+00 | 1.557-01 | 9.934+00 | 1.632-01 | 1.011+01 | 1.709-01 | 1.028+01 | 1.783-01 | 1.041+01 | 1.783-01 | 1.041+01 | 1.783-01 |
| 4.5+02            | 7.984-02 | 8.194+00 | 8.371-02 | 8.304+C0 | 8.778-02 | 8.488+00 | 9.205-02 | 8.632+00 | 9.640-02 | 8.778+00 | 9.640-02 | 9.238+00 | 9.640-02 | 9.238+00 | 9.640-02 |
| 4.6+02            | 5.355-02 | 6.652+00 | 3.927-02 | 6.567+00 | 3.008-02 | 6.682+00 | 4.298-02 | 6.797-00 | 4.298-02 | 6.797-00 | 4.298-02 | 6.912+00 | 4.298-02 | 6.912+00 | 4.298-02 |
| 4.7+02            | 2.003-02 | 5.355+00 | 2.098-02 | 5.549+00 | 2.200-02 | 5.571+00 | 2.307-02 | 5.672+00 | 2.416-02 | 5.768+00 | 2.416-02 | 5.768+00 | 2.416-02 | 5.768+00 | 2.416-02 |
| 4.8+02            | 5.00+00  | 1.281-02 | 4.343-02 | 4.333+00 | 1.08-02  | 4.814+00 | 1.477-02 | 4.899+00 | 1.547-02 | 4.982+00 | 1.547-02 | 4.982+00 | 1.547-02 | 4.982+00 | 1.547-02 |
| 4.9+02            | 8.898-05 | 4.110+00 | 9.330-03 | 4.164+00 | 9.784-03 | 4.257+00 | 1.026-02 | 4.330+00 | 1.075-02 | 4.404+00 | 1.075-02 | 4.404+00 | 1.075-02 | 4.404+00 | 1.075-02 |
| 5.0+02            | 5.205+00 | 5.363+00 | 5.247-03 | 3.423+00 | 5.503-03 | 3.488+00 | 5.771-03 | 3.543+00 | 6.045-03 | 3.603+00 | 6.045-03 | 3.603+00 | 6.045-03 | 3.603+00 | 6.045-03 |
| 5.1+02            | 1.4+C07  | 3.204-03 | 2.864+00 | 3.359-03 | 2.915+00 | 3.523-03 | 2.966+00 | 3.659-03 | 3.018+00 | 3.069+00 | 3.070-03 | 3.069+00 | 3.070-03 | 3.069+00 | 3.070-03 |
| 5.2+02            | 1.5+007  | 1.424-03 | 2.204+00 | 1.493-03 | 2.158+C0 | 1.566-03 | 2.191+00 | 1.642-03 | 2.234+00 | 1.721+00 | 2.271+00 | 1.721+00 | 2.271+00 | 1.721+00 | 2.271+00 |
| 5.3+02            | 3.0+007  | 1.401-04 | 1.722+00 | 8.400-04 | 1.732+00 | 8.809-04 | 1.762+00 | 9.238+00 | 1.793+00 | 9.676+00 | 1.823+00 | 9.676+00 | 1.823+00 | 9.676+00 | 1.823+00 |
| 5.4+02            | 3.0+006  | 3.559-04 | 1.239+00 | 3.372-04 | 1.261+C0 | 3.94-04  | 1.283+00 | 4.105-04 | 1.305+00 | 4.299+00 | 1.327+00 | 4.299+00 | 1.327+00 | 4.299+00 | 1.327+00 |
| 5.5+02            | 4.0+007  | 2.099-04 | 9.845-04 | 2.099-04 | 1.002+00 | 2.020-04 | 1.020+00 | 2.309-04 | 1.037+00 | 2.419+00 | 1.055+00 | 2.419+00 | 1.055+00 | 2.419+00 | 1.055+00 |
| 5.6+02            | 5.0+007  | 1.881-04 | 8.218-04 | 1.344-04 | 8.364-04 | 1.409-04 | 8.511-04 | 1.473-04 | 8.658-04 | 1.548-04 | 8.805-04 | 1.548-04 | 8.805-04 | 1.548-04 | 8.805-04 |
| 5.7+02            | 6.0+007  | 8.898-05 | 7.080-01 | 9.331-05 | 7.207-01 | 9.785-05 | 7.333-01 | 1.026-04 | 7.460-01 | 1.075-04 | 7.586-01 | 1.075-04 | 7.586-01 | 1.075-04 | 7.586-01 |
| 5.8+02            | 5.006+05 | 5.364-01 | 5.250-05 | 5.684-01 | 5.505-05 | 5.783-01 | 5.505-05 | 5.774-05 | 5.883-01 | 6.048-05 | 5.983-01 | 6.048-05 | 5.983-01 | 6.048-05 | 5.983-01 |
| 5.9+02            | 3.203-05 | 4.635-01 | 3.169-05 | 4.717-01 | 3.203-05 | 4.800-01 | 3.203-05 | 4.883-01 | 3.369-05 | 4.966-01 | 3.469-05 | 4.966-01 | 3.469-05 | 4.966-01 | 3.469-05 |

TABLE II. CONT.

| PHOTON ENERGY, EV | COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNS/ATOM |          |          |          |          |          | 65 TB    |          |          |          |          |          |
|-------------------|---------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | 61 PM                                                         | 62 SM    | 63 EU    | 64 GD    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    |
| 1.0+02            | 2.473+03                                                      | 2.430-02 | 2.555+C3 | 2.409-02 | 2.636+03 | 2.343-02 | 2.722+C3 | 2.256-02 | 2.808+03 | 2.234-02 | 2.805+03 | 4.968-02 |
| 1.5+02            | 2.471+03                                                      | 5.440-02 | 2.522+03 | 5.355-02 | 2.634+03 | 5.247-02 | 2.720+03 | 5.050-02 | 2.805+03 | 5.050-02 | 2.805+03 | 8.140-02 |
| 2.0+02            | 2.468+03                                                      | 9.563-02 | 2.549+03 | 9.400-02 | 2.633+03 | 9.227-02 | 2.717+03 | 8.971-02 | 2.803+03 | 8.971-02 | 2.803+03 | 1.913-01 |
| 3.0+02            | 2.459+03                                                      | 2.085-01 | 2.504-01 | 2.047-01 | 2.620+03 | 2.012+01 | 2.708+03 | 1.943-01 | 2.794+03 | 1.943-01 | 2.794+03 | 3.278-01 |
| 4.0+02            | 2.446+03                                                      | 3.545-01 | 2.288+03 | 3.487-01 | 2.611+03 | 3.430-01 | 2.699+03 | 3.327-01 | 2.781+03 | 3.278-01 | 2.766+03 | 4.899-01 |
| 5.0+02            | 2.431+03                                                      | 5.255-01 | 2.513+03 | 5.175-01 | 2.596+03 | 5.094-01 | 2.680+03 | 4.968-01 | 2.768+03 | 4.968-01 | 2.768+03 | 6.699-01 |
| 6.0+02            | 2.413+03                                                      | 7.123-01 | 2.454+03 | 7.020-01 | 2.578+03 | 6.921-01 | 2.663+03 | 6.788-01 | 2.748+03 | 6.788-01 | 2.748+03 | 8.218-01 |
| 8.0+02            | 2.373+03                                                      | 1.106+00 | 2.454+03 | 1.092+00 | 2.537+03 | 1.079+00 | 2.621+03 | 1.070+00 | 2.706+03 | 1.058+00 | 2.706+03 | 1.058+00 |
| 1.0+03            | 2.326+03                                                      | 1.458+00 | 2.408+03 | 1.482+00 | 2.494+03 | 1.466+00 | 2.572+03 | 1.469+00 | 2.658+03 | 1.455+00 | 2.658+03 | 1.455+00 |
| 1.5+03            | 2.202+03                                                      | 2.424+00 | 2.282+03 | 2.415+00 | 2.345+03 | 2.396+00 | 2.423+00 | 2.423+00 | 2.524+03 | 2.406+00 | 2.524+03 | 2.406+00 |
| 2.0+03            | 2.076+03                                                      | 3.350+00 | 2.155+03 | 3.329+00 | 2.235+03 | 3.308+00 | 2.303+00 | 3.304+00 | 2.385+03 | 3.321+00 | 2.385+03 | 3.321+00 |
| 3.0+03            | 1.830+03                                                      | 5.125+00 | 1.904+03 | 5.103+00 | 1.980+03 | 5.085+00 | 2.039+00 | 5.120+00 | 2.117+03 | 5.1C3+00 | 2.117+03 | 5.1C3+00 |
| 4.0+03            | 1.673+03                                                      | 6.766+00 | 1.673+03 | 6.749+00 | 1.742+03 | 6.731+00 | 1.799+00 | 6.780+00 | 1.869+03 | 6.769+00 | 1.869+03 | 6.769+00 |
| 5.0+03            | 1.605+03                                                      | 8.257+00 | 1.672+03 | 8.245+00 | 1.535+03 | 8.234+00 | 1.584+00 | 8.204+00 | 1.650+03 | 8.203+00 | 1.650+03 | 8.203+00 |
| 6.0+03            | 1.248+03                                                      | 9.582+00 | 1.303+03 | 9.580+C0 | 1.355+03 | 9.579+00 | 1.404+00 | 9.576+00 | 1.464+03 | 9.59C+00 | 1.464+03 | 9.59C+00 |
| 8.0+03            | 5.939+02                                                      | 1.183+01 | 1.037+03 | 1.185+01 | 1.083+03 | 1.187+01 | 1.121+03 | 1.201+01 | 1.170+03 | 1.206+01 | 1.170+03 | 1.206+01 |
| 1.0+04            | 8.068+02                                                      | 1.372+01 | 8.419+02 | 1.376+01 | 8.785+02 | 1.381+01 | 9.113+02 | 1.396+01 | 9.506+02 | 1.403+01 | 9.506+02 | 1.403+01 |
| 1.5+04            | 5.225+02                                                      | 5.746+01 | 5.641+02 | 5.756+01 | 5.666+02 | 5.765+01 | 5.878+02 | 5.881+01 | 6.121+02 | 5.794+01 | 6.121+02 | 5.794+01 |
| 2.0+04            | 3.732+02                                                      | 2.013+01 | 3.862+02 | 2.030+01 | 4.037+02 | 2.045+01 | 4.184+02 | 2.065+01 | 4.350+02 | 2.082+01 | 4.350+02 | 2.082+01 |
| 3.0+04            | 2.157+02                                                      | 2.333+01 | 2.248+02 | 2.358+01 | 2.343+02 | 2.383+01 | 2.435+02 | 2.411+01 | 2.535+02 | 2.437+01 | 2.535+02 | 2.437+01 |
| 4.0+04            | 1.407+02                                                      | 2.500+01 | 1.667+02 | 2.531+01 | 1.529+02 | 2.561+01 | 1.593+02 | 2.593+01 | 1.656+02 | 2.624+01 | 1.656+02 | 2.624+01 |
| 5.0+04            | 9.923+01                                                      | 1.500+01 | 1.034+01 | 1.034+01 | 1.077+02 | 2.658+01 | 1.120+02 | 2.692+C1 | 1.165+02 | 2.726+01 | 1.165+02 | 2.726+01 |
| 6.0+04            | 7.421+01                                                      | 2.637+01 | 7.735+01 | 2.674+01 | 8.058+01 | 2.708+01 | 8.380+01 | 2.744+01 | 8.722+01 | 2.779+01 | 8.722+01 | 2.779+01 |
| 8.0+04            | 4.581+01                                                      | 2.659+01 | 4.779+01 | 2.695+01 | 4.982+01 | 2.733+01 | 5.186+01 | 2.771+01 | 5.402+01 | 2.808+01 | 5.402+01 | 2.808+01 |
| 1.0+05            | 3.103+01                                                      | 2.630+01 | 3.238+01 | 2.669+C1 | 3.378+01 | 2.707+01 | 3.518+01 | 2.745+01 | 3.666+01 | 2.783+01 | 3.666+01 | 2.783+01 |
| 1.5+05            | 1.501+01                                                      | 2.489+01 | 1.567+01 | 2.527+01 | 1.633+01 | 2.565+01 | 1.702+01 | 2.602+01 | 1.774+01 | 2.640+01 | 1.774+01 | 2.640+01 |
| 2.0+05            | 8.897+00                                                      | 2.388+01 | 9.289+00 | 2.410+01 | 9.693+00 | 2.410+01 | 1.040+01 | 2.446+01 | 1.053+01 | 2.482+01 | 1.053+01 | 2.482+01 |
| 3.0+05            | 4.159+00                                                      | 2.083+01 | 4.346+00 | 2.116+01 | 4.532+00 | 2.148+01 | 4.732+00 | 2.181+01 | 4.936+01 | 2.214+01 | 4.936+01 | 2.214+01 |
| 4.0+05            | 2.397+00                                                      | 1.888+01 | 2.506+00 | 1.918+01 | 2.618+00 | 1.948+01 | 2.731+00 | 1.978+01 | 2.850+00 | 2.008+01 | 2.850+00 | 2.008+01 |
| 5.0+05            | 1.557+00                                                      | 1.765+01 | 1.767+00 | 1.769+01 | 1.794+00 | 1.794+01 | 1.774+00 | 1.819+01 | 1.852+00 | 1.847+01 | 1.852+00 | 1.847+01 |
| 6.0+05            | 1.091+00                                                      | 1.612+01 | 1.141+00 | 1.638+01 | 1.192+00 | 1.664+01 | 1.245+00 | 1.690+01 | 1.299+00 | 1.716+01 | 1.299+00 | 1.716+01 |
| 8.0+05            | 6.209+01                                                      | 1.423+01 | 6.493+01 | 1.446+01 | 6.787+01 | 1.469+01 | 7.085+01 | 1.492+01 | 7.398+01 | 1.515+01 | 7.398+01 | 1.515+01 |
| 1.0+06            | 3.998+01                                                      | 1.282+01 | 4.182+01 | 1.303+01 | 4.372+01 | 1.324+01 | 4.565+01 | 1.345+01 | 4.767+01 | 1.365+01 | 4.767+01 | 1.365+01 |
| 1.5+06            | 1.789+01                                                      | 1.045+01 | 1.872+01 | 1.062+01 | 1.957+01 | 1.079+01 | 2.044+01 | 1.096+01 | 2.135+01 | 1.113+01 | 2.135+01 | 1.113+01 |
| 2.0+06            | 1.009+01                                                      | 8.923+00 | 1.056+01 | 9.069+00 | 1.104+01 | 9.215+00 | 1.153+01 | 9.361+00 | 1.205+01 | 9.507+00 | 1.205+01 | 9.507+00 |
| 3.0+06            | 4.494+02                                                      | 1.027+00 | 4.702+02 | 4.742+02 | 4.917+02 | 4.757+02 | 5.152+02 | 5.372+02 | 5.366+02 | 5.487+00 | 5.366+02 | 5.487+00 |
| 4.0+06            | 2.530+02                                                      | 5.864+00 | 2.647+02 | 5.960+00 | 2.768+02 | 6.056+00 | 2.892+02 | 6.152+00 | 3.021+02 | 6.484+00 | 3.021+02 | 6.484+00 |
| 5.0+06            | 1.619+02                                                      | 5.065+00 | 1.695+02 | 5.148+00 | 1.772+02 | 5.231+00 | 1.851+02 | 5.314+00 | 1.934+02 | 5.397+00 | 1.934+02 | 5.397+00 |
| 6.0+06            | 1.125+02                                                      | 4.477+00 | 1.177+02 | 4.555+00 | 1.233+02 | 4.624+00 | 1.286+02 | 4.694+00 | 1.344+02 | 4.771+00 | 1.344+02 | 4.771+00 |
| 8.0+06            | 6.328+03                                                      | 3.663+00 | 6.622+03 | 3.723+00 | 6.926+03 | 3.783+00 | 7.235+03 | 3.843+00 | 7.559+03 | 3.903+00 | 7.559+03 | 3.903+00 |
| 1.0+07            | 4.051+03                                                      | 3.120+00 | 4.240+03 | 3.171+00 | 4.434+03 | 3.222+00 | 4.632+03 | 3.273+00 | 4.839+03 | 3.324+00 | 4.839+03 | 3.324+00 |
| 1.5+07            | 1.401+03                                                      | 2.309+00 | 1.884+03 | 2.347+00 | 1.971+03 | 2.385+00 | 2.059+03 | 2.423+00 | 2.151+03 | 2.461+00 | 2.151+03 | 2.461+00 |
| 2.0+07            | 1.013+03                                                      | 1.854+00 | 1.060+03 | 1.884+00 | 1.109+03 | 1.914+00 | 1.158+03 | 1.945+00 | 1.210+03 | 1.975+00 | 1.210+03 | 1.975+00 |
| 3.0+07            | 4.501+04                                                      | 1.369+00 | 4.710+04 | 1.372+00 | 4.926+04 | 1.377+00 | 4.394+04 | 1.466+04 | 5.146+04 | 1.466+04 | 5.146+04 | 1.466+04 |
| 4.0+07            | 2.532+04                                                      | 1.072+00 | 2.650+04 | 1.094+00 | 2.771+04 | 1.108+00 | 2.895+04 | 1.125+00 | 3.024+04 | 1.143+00 | 3.024+04 | 1.143+00 |
| 5.0+07            | 1.620+04                                                      | 8.951+01 | 1.696+04 | 9.098+01 | 1.773+04 | 9.245+01 | 1.853+04 | 9.392+01 | 1.936+04 | 9.538+01 | 1.936+04 | 9.538+01 |
| 6.0+07            | 1.125+04                                                      | 7.713+01 | 1.178+04 | 7.839+01 | 1.232+04 | 7.965+01 | 1.287+04 | 8.092+01 | 1.344+04 | 8.218+01 | 1.344+04 | 8.218+01 |
| 8.0+07            | 6.332+05                                                      | 6.083+01 | 6.626+05 | 6.182+01 | 6.929+05 | 6.282+01 | 7.238+05 | 6.382+01 | 7.563+05 | 6.481+01 | 7.563+05 | 6.481+01 |
| 1.0+08            | 4.051+05                                                      | 5.049+01 | 4.240+05 | 5.131+01 | 4.434+05 | 5.214+01 | 4.632+05 | 5.297+01 | 4.839+05 | 5.380+01 | 4.839+05 | 5.380+01 |

CONTINUOUS SCATTERING SECTIONS. BARNES/ATOM

| Spectral Energy Distribution |          |          |          |          |          |          |          |          |          | 70 YR    |          |          |
|------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| PHOTON ENERGY, EV            |          |          |          |          | 66 DY    |          |          |          |          | 67 HO    |          |          |
|                              | COH      | INCOH    |
| 4.0-4.0+00                   | 2.896+03 | 2.247-02 | 2.984+03 | 2.179-02 | 3.074+03 | 2.157-02 | 3.165+03 | 2.148-02 | 3.257+03 | 2.060-02 | 3.255+03 | 2.068-02 |
| 4.1-4.1+00                   | 2.893+03 | 5.007-02 | 2.981+03 | 4.900-02 | 3.071+03 | 4.81-02  | 3.162+03 | 4.772-02 | 3.255+03 | 4.668-02 | 3.255+03 | 4.668-02 |
| 4.2-4.2+00                   | 2.890+03 | 8.786-02 | 2.978+03 | 8.630-02 | 3.068+03 | 8.499-02 | 3.159+03 | 8.384-02 | 3.242+03 | 8.238-02 | 3.243+03 | 8.238-02 |
| 4.3-4.3+00                   | 2.889+03 | 1.917-01 | 2.977+03 | 1.887-01 | 3.059+03 | 1.859-01 | 3.150+03 | 1.832-01 | 3.231+03 | 1.805-01 | 3.231+03 | 1.805-01 |
| 4.4-4.4+00                   | 2.869+03 | 3.275-01 | 2.957+03 | 3.226-01 | 3.047+03 | 3.178-01 | 3.138+03 | 3.135-01 | 3.215+03 | 3.091-01 | 3.215+03 | 3.091-01 |
| 4.5-4.5+00                   | 2.869+03 | 4.875-01 | 2.942+03 | 4.806-01 | 3.032+03 | 4.749-01 | 3.123+03 | 4.676-01 | 3.215+03 | 4.614-01 | 3.215+03 | 4.614-01 |
| 4.6-4.6+00                   | 2.856+03 | 6.336+02 | 2.942+03 | 6.339-01 | 3.014+03 | 6.466-01 | 3.105+03 | 6.383-01 | 3.198+03 | 6.304-01 | 3.198+03 | 6.304-01 |
| 4.7-4.7+00                   | 2.795+03 | 1.040+00 | 2.883+03 | 1.028+00 | 2.973+03 | 1.017+01 | 3.064+03 | 1.005+00 | 3.156+03 | 9.943-01 | 3.156+03 | 9.943-01 |
| 4.8-4.8+00                   | 2.795+03 | 1.040+00 | 2.883+03 | 1.028+00 | 2.973+03 | 1.017+01 | 3.064+03 | 1.005+00 | 3.156+03 | 9.943-01 | 3.156+03 | 9.943-01 |
| 4.9-4.9+00                   | 2.728+03 | 1.241+00 | 2.836+03 | 1.421+00 | 2.925+03 | 1.794+00 | 3.030+03 | 2.300+00 | 3.016+03 | 1.379+00 | 3.016+03 | 1.379+00 |
| 5.0-5.0+00                   | 2.618+03 | 2.340+00 | 2.705+03 | 2.322+00 | 2.557+03 | 2.320+00 | 2.746+03 | 2.180+00 | 2.884+03 | 2.286+00 | 2.884+03 | 2.286+00 |
| 5.1-5.1+00                   | 2.684+03 | 3.245+00 | 2.570+03 | 3.223+00 | 2.557+03 | 3.200+00 | 2.557+03 | 3.180+00 | 2.836+03 | 3.161+00 | 2.836+03 | 3.161+00 |
| 5.2-5.2+00                   | 2.621+03 | 5.029+00 | 2.298+03 | 5.007+00 | 2.382+03 | 4.986+00 | 2.466+03 | 4.961+00 | 2.553+03 | 4.944+00 | 2.553+03 | 4.944+00 |
| 5.3-5.3+00                   | 2.333+03 | 6.697+00 | 2.383+03 | 6.679+00 | 2.616+03 | 6.666+00 | 2.195+03 | 6.638+00 | 2.277+03 | 6.621+00 | 2.277+03 | 6.621+00 |
| 5.4-5.4+00                   | 2.440+03 | 8.744+00 | 1.804+03 | 8.219+00 | 1.876+03 | 8.219+00 | 1.949+03 | 8.188+00 | 2.024+03 | 8.175+00 | 2.024+03 | 8.175+00 |
| 5.5-5.5+00                   | 1.747+03 | 8.231+00 | 1.602+03 | 9.618+00 | 1.667+03 | 9.611+00 | 1.734+03 | 9.600+00 | 1.803+03 | 9.593+00 | 1.803+03 | 9.593+00 |
| 5.6-5.6+00                   | 1.539+03 | 9.618+00 | 1.602+03 | 9.615+00 | 1.667+03 | 9.611+00 | 1.734+03 | 9.600+00 | 1.803+03 | 9.593+00 | 1.803+03 | 9.593+00 |
| 5.7-5.7+00                   | 1.228+03 | 1.200+01 | 1.280+03 | 1.202+01 | 1.333+03 | 1.204+01 | 1.389+03 | 1.205+01 | 1.445+03 | 1.206+01 | 1.445+03 | 1.206+01 |
| 5.8-5.8+00                   | 5.970+02 | 1.401+01 | 1.039+03 | 1.405+01 | 1.083+03 | 1.408+01 | 1.129+03 | 1.412+01 | 1.176+03 | 1.415+01 | 1.176+03 | 1.415+01 |
| 5.9-5.9+00                   | 6.599+02 | 1.799+01 | 6.663+02 | 1.808+01 | 6.798+02 | 1.810+01 | 7.224+02 | 1.824+01 | 7.518+02 | 1.831+01 | 7.518+02 | 1.831+01 |
| 6.0-6.0+00                   | 4.209+02 | 2.093+01 | 4.716+02 | 2.077+01 | 4.901+02 | 2.120+01 | 5.093+02 | 2.132+01 | 5.292+02 | 2.143+01 | 5.292+02 | 2.143+01 |
| 6.1-6.1+00                   | 2.644+02 | 4.559+01 | 2.550+02 | 4.842+01 | 2.860+02 | 5.050+01 | 2.973+02 | 5.266+01 | 3.089+02 | 5.474+01 | 3.089+02 | 5.474+01 |
| 6.2-6.2+00                   | 1.726+02 | 2.653+01 | 1.797+02 | 2.682+01 | 1.869+02 | 2.710+01 | 1.944+02 | 2.738+01 | 2.021+02 | 2.765+01 | 2.021+02 | 2.765+01 |
| 6.3-6.3+00                   | 1.214+02 | 2.758+01 | 1.263+02 | 2.790+01 | 1.314+02 | 2.822+01 | 1.366+02 | 2.854+01 | 1.419+02 | 2.894+01 | 1.419+02 | 2.894+01 |
| 6.4-6.4+00                   | 9.688+01 | 2.814+01 | 9.452+01 | 2.848+01 | 9.828+01 | 1.022+01 | 1.022+02 | 9.916+01 | 1.061+02 | 2.949+01 | 1.061+02 | 2.949+01 |
| 6.5-6.5+00                   | 9.565+01 | 2.814+01 | 9.452+01 | 2.848+01 | 9.828+01 | 1.022+01 | 1.022+02 | 9.916+01 | 1.061+02 | 2.949+01 | 1.061+02 | 2.949+01 |
| 6.6-6.6+00                   | 5.630+01 | 2.845+01 | 5.859+01 | 2.881+01 | 6.094+01 | 2.911+01 | 6.336+01 | 2.953+01 | 6.584+01 | 2.989+01 | 6.584+01 | 2.989+01 |
| 6.7-6.7+00                   | 3.822+01 | 2.820+01 | 3.979+01 | 2.856+01 | 4.141+01 | 2.895+01 | 4.306+01 | 2.932+01 | 4.477+01 | 2.969+01 | 4.477+01 | 2.969+01 |
| 6.8-6.8+00                   | 1.849+01 | 2.678+01 | 1.925+01 | 2.715+01 | 2.003+01 | 2.755+01 | 2.083+01 | 2.789+01 | 2.166+01 | 2.826+01 | 2.166+01 | 2.826+01 |
| 6.9-6.9+00                   | 1.011+01 | 1.405+01 | 1.143+01 | 2.554+01 | 1.190+01 | 2.599+01 | 1.238+01 | 2.645+01 | 1.337+01 | 2.737+01 | 1.337+01 | 2.737+01 |
| 7.0-7.0+00                   | 5.152+01 | 2.518+01 | 5.366+00 | 2.279+01 | 5.588+00 | 2.312+00 | 5.816+00 | 2.345+01 | 6.050+00 | 3.500+00 | 2.158+01 | 3.500+00 |
| 7.1-7.1+00                   | 2.974+00 | 2.038+01 | 3.100+00 | 2.068+01 | 3.230+00 | 2.094+01 | 3.363+00 | 2.128+01 | 2.187+00 | 1.985+01 | 2.187+00 | 1.985+01 |
| 7.2-7.2+00                   | 1.933+00 | 1.875+01 | 2.015+00 | 1.902+01 | 2.100+00 | 1.933+01 | 2.167+00 | 1.978+01 | 2.182+00 | 1.958+01 | 2.182+00 | 1.958+01 |
| 7.3-7.3+00                   | 1.355+00 | 1.742+01 | 1.414+00 | 1.766+01 | 1.474+00 | 1.797+01 | 1.535+00 | 1.820+01 | 1.598+00 | 1.866+01 | 1.598+00 | 1.866+01 |
| 7.4-7.4+00                   | 7.726+01 | 5.538+01 | 8.058+01 | 1.561+01 | 8.000+01 | 1.588+01 | 8.751+01 | 1.607+01 | 9.113-01 | 1.630+01 | 9.113-01 | 1.630+01 |
| 7.5-7.5+00                   | 4.111+00 | 4.005+00 | 4.111+00 | 4.074+01 | 5.416+01 | 4.074+01 | 5.643+01 | 4.424+01 | 5.877+01 | 4.449+01 | 5.877+01 | 4.449+01 |
| 7.6-7.6+00                   | 2.231+01 | 1.130+01 | 2.327+01 | 1.147+01 | 2.427+01 | 1.166+01 | 2.529+01 | 1.181+01 | 2.635+01 | 1.198+01 | 2.635+01 | 1.198+01 |
| 7.7-7.7+00                   | 1.255+01 | 9.653+00 | 1.313+01 | 9.798+00 | 1.370+01 | 9.944+00 | 1.428+01 | 1.009+01 | 1.487+01 | 1.024+01 | 1.487+01 | 1.024+01 |
| 7.8-7.8+00                   | 5.601+02 | 7.602+00 | 5.851+02 | 7.717+00 | 6.103+02 | 7.835+00 | 6.538+02 | 7.947+00 | 6.629+02 | 7.947+00 | 6.629+02 | 7.947+00 |
| 7.9-7.9+00                   | 3.157+02 | 6.344+02 | 3.294+02 | 6.445+02 | 3.436+02 | 6.538+02 | 3.582+02 | 6.632+02 | 3.732+02 | 6.724+02 | 3.732+02 | 6.724+02 |
| 8.0-8.0+00                   | 2.021+02 | 5.480+00 | 2.109+02 | 5.563+00 | 2.200+02 | 5.645+00 | 2.294+02 | 5.728+00 | 2.390+02 | 5.811+00 | 2.390+02 | 5.811+00 |
| 8.1-8.1+00                   | 1.401+02 | 4.844+00 | 1.466+02 | 4.917+02 | 1.529+02 | 4.999+00 | 1.594+02 | 5.064+00 | 1.661+02 | 5.137+00 | 1.661+02 | 5.137+00 |
| 8.2-8.2+00                   | 7.893+03 | 3.963+00 | 8.243+03 | 4.023+00 | 8.598+03 | 4.083+00 | 8.964+03 | 4.143+00 | 9.340+03 | 4.203+00 | 9.340+03 | 4.203+00 |
| 8.3-8.3+00                   | 5.057-05 | 5.462-01 | 5.278-05 | 5.545-01 | 5.505-05 | 5.622-01 | 5.505-05 | 5.622-01 | 5.739-05 | 5.980-05 | 5.739-05 | 5.980-05 |

TABLE III. CCNT. COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNS/ATOM

| PHOTON ENERGY, EV | 71 LU    |          | 72 HF    |          | 73 TA    |          | 74 W     |          | 75 RE    |          |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | COH      | INCOH    |
| 1.0+02            | 3.351+03 | 2.048+02 | 3.445+03 | 1.974+02 | 3.542+C3 | 1.898+02 | 3.639+03 | 1.807+02 | 3.739+03 | 1.745+02 |
| 1.5+02            | 3.344+03 | 4.541+02 | 3.443+03 | 4.384+02 | 3.539+03 | 4.230+02 | 3.637+03 | 4.044+02 | 3.736+03 | 3.927+02 |
| 2.0+02            | 3.345+03 | 8.002+02 | 3.440+03 | 7.715+02 | 3.637+03 | 7.439+02 | 3.635+03 | 7.156+02 | 3.734+03 | 6.928+02 |
| 3.0+02            | 3.337+03 | 1.757+01 | 3.440+03 | 1.697+01 | 3.528+03 | 1.638+01 | 3.626+03 | 1.581+01 | 3.725+03 | 1.531+01 |
| 4.0+02            | 3.328+03 | 3.022+01 | 3.419+03 | 2.927+01 | 3.168+03 | 2.831+01 | 3.614+03 | 2.740+01 | 3.713+03 | 2.656+01 |
| 5.0+02            | 3.320+03 | 4.535+01 | 3.404+03 | 4.408+01 | 3.501+03 | 4.276+01 | 3.599+03 | 4.147+01 | 3.698+03 | 4.026+01 |
| 6.0+02            | 3.291+03 | 6.229+01 | 3.386+03 | 6.081+01 | 3.483+03 | 5.916+01 | 3.582+03 | 5.752+01 | 3.680+03 | 5.596+01 |
| 8.0+02            | 3.249+03 | 9.936+01 | 3.343+03 | 9.765+01 | 3.439+03 | 9.582+01 | 3.537+03 | 9.366+01 | 3.637+03 | 9.154+01 |
| 1.0+03            | 3.199+03 | 1.378+00 | 3.292+03 | 1.368+00 | 3.388+03 | 1.348+00 | 3.485+03 | 1.325+00 | 3.584+03 | 1.301+00 |
| 1.5+03            | 3.059+03 | 2.311+00 | 3.148+03 | 2.323+00 | 3.240+03 | 2.313+00 | 3.343+03 | 2.294+00 | 3.430+03 | 2.271+00 |
| 2.0+03            | 3.012+03 | 3.209+00 | 3.194+03 | 3.233+00 | 3.080+03 | 3.230+00 | 3.169+03 | 3.213+00 | 3.261+03 | 3.194+00 |
| 3.0+03            | 2.619+03 | 4.979+00 | 2.690+03 | 5.068+00 | 2.765+03 | 5.005+00 | 2.842+03 | 4.983+00 | 2.923+03 | 4.961+00 |
| 4.0+03            | 2.339+03 | 6.656+00 | 2.403+03 | 6.659+00 | 2.470+03 | 6.691+00 | 2.538+03 | 6.755+00 | 2.609+03 | 6.652+00 |
| 5.0+03            | 2.083+03 | 8.219+00 | 2.143+03 | 8.562+00 | 2.203+03 | 8.277+00 | 2.265+03 | 8.276+00 | 2.328+03 | 8.262+00 |
| 6.0+03            | 1.859+03 | 9.654+00 | 1.914+03 | 9.716+00 | 1.970+03 | 9.754+00 | 2.028+03 | 9.777+00 | 2.083+03 | 9.722+00 |
| 8.0+03            | 1.494+03 | 1.215+01 | 1.542+03 | 1.226+01 | 1.590+03 | 1.234+01 | 1.639+03 | 1.242+01 | 1.687+03 | 1.248+01 |
| 1.0+04            | 1.217+03 | 1.426+01 | 1.259+03 | 1.439+01 | 1.301+03 | 1.451+01 | 1.343+03 | 1.463+01 | 1.386+03 | 1.474+01 |
| 1.5+04            | 7.791+02 | 1.844+01 | 8.076+02 | 1.860+01 | 8.362+02 | 1.876+01 | 8.653+02 | 1.892+01 | 8.908+02 | 1.908+01 |
| 2.0+04            | 5.480+02 | 2.159+01 | 5.673+02 | 2.176+01 | 5.869+02 | 2.194+01 | 6.059+02 | 2.212+01 | 6.273+02 | 2.230+01 |
| 3.0+04            | 3.205+02 | 5.570+01 | 3.316+02 | 5.523+01 | 3.383+02 | 5.616+01 | 3.550+02 | 2.639+01 | 3.670+02 | 2.663+01 |
| 4.0+04            | 2.096+02 | 2.793+01 | 2.173+02 | 2.822+01 | 2.252+02 | 2.850+01 | 2.331+02 | 2.878+01 | 2.413+02 | 2.906+01 |
| 5.0+04            | 1.473+02 | 2.916+01 | 1.527+02 | 2.948+01 | 1.584+02 | 2.980+01 | 1.639+02 | 3.011+01 | 1.697+02 | 3.043+01 |
| 6.0+04            | 1.101+02 | 2.983+01 | 1.141+02 | 3.016+01 | 1.183+02 | 3.050+01 | 1.228+02 | 3.083+01 | 1.268+02 | 3.111+01 |
| 8.0+04            | 6.832+01 | 3.025+01 | 7.084+01 | 3.061+01 | 7.341+01 | 3.096+01 | 7.604+01 | 3.132+01 | 7.871+01 | 3.167+01 |
| 1.0+05            | 4.648+01 | 3.005+01 | 4.822+01 | 3.042+01 | 5.000+01 | 3.079+01 | 5.181+01 | 3.115+01 | 5.366+01 | 3.152+01 |
| 1.5+05            | 2.244+01 | 2.863+01 | 2.333+01 | 2.960+01 | 2.420+01 | 2.936+01 | 2.508+01 | 2.973+01 | 2.598+01 | 3.010+01 |
| 2.0+05            | 1.336+01 | 2.697+01 | 1.387+01 | 2.733+01 | 1.438+01 | 2.768+01 | 1.491+01 | 2.834+01 | 2.545+01 | 2.839+01 |
| 3.0+05            | 6.287+00 | 2.410+01 | 6.442+01 | 2.442+01 | 6.755+00 | 2.475+01 | 7.027+01 | 2.507+01 | 7.284+01 | 2.539+01 |
| 4.0+05            | 3.631+00 | 2.188+01 | 3.779+00 | 2.248+01 | 3.923+00 | 2.247+01 | 4.071+00 | 2.277+01 | 4.222+00 | 2.307+01 |
| 5.0+05            | 2.367+00 | 2.013+01 | 2.459+00 | 2.041+01 | 2.554+00 | 2.069+01 | 2.606+00 | 2.096+01 | 2.749+00 | 2.124+01 |
| 6.0+05            | 1.662+00 | 1.872+01 | 1.727+00 | 1.794+01 | 1.923+00 | 1.923+01 | 1.862+00 | 1.949+01 | 1.932+00 | 1.975+01 |
| 8.0+05            | 9.478+01 | 1.653+01 | 9.853+01 | 1.676+01 | 1.024+00 | 1.699+01 | 1.063+00 | 1.722+01 | 1.103+00 | 1.745+01 |
| 1.0+06            | 6.114+01 | 1.490+01 | 6.356+01 | 1.511+01 | 6.605+01 | 1.532+01 | 6.859+01 | 1.552+01 | 7.119+01 | 1.573+01 |
| 1.5+06            | 2.742+01 | 2.851+01 | 1.232+01 | 2.964+01 | 1.249+01 | 3.078+01 | 1.266+01 | 3.196+01 | 1.283+01 | 3.196+01 |
| 2.0+06            | 1.548+01 | 1.038+01 | 1.053+01 | 1.067+01 | 1.067+01 | 1.067+01 | 1.082+01 | 1.082+01 | 1.095+01 | 1.095+01 |
| 3.0+06            | 6.899+02 | 8.176+00 | 7.176+02 | 8.291+00 | 7.460+02 | 8.406+00 | 7.751+02 | 8.521+00 | 8.636+00 | 8.636+00 |
| 4.0+06            | 3.884+02 | 6.824+00 | 4.041+02 | 6.920+00 | 4.201+02 | 7.015+00 | 4.365+02 | 7.111+00 | 4.533+02 | 7.207+00 |
| 5.0+06            | 2.487+02 | 5.894+00 | 2.587+02 | 5.977+00 | 2.690+02 | 6.060+00 | 2.795+02 | 6.143+00 | 2.853+02 | 6.226+00 |
| 6.0+06            | 1.728+02 | 5.211+00 | 1.798+02 | 5.284+00 | 1.869+02 | 5.357+00 | 1.942+02 | 5.431+00 | 2.017+02 | 5.504+00 |
| 8.0+06            | 9.722+03 | 4.263+00 | 1.011+02 | 4.323+00 | 1.051+02 | 4.383+00 | 1.093+02 | 4.443+00 | 1.135+02 | 4.503+00 |
| 1.0+07            | 6.223+03 | 3.631+00 | 6.475+03 | 3.682+C0 | 6.732+03 | 3.733+00 | 6.995+03 | 3.784+00 | 7.265+03 | 3.836+00 |
| 1.5+07            | 2.766+03 | 2.688+00 | 2.878+03 | 2.726+00 | 2.992+03 | 2.763+00 | 3.109+03 | 2.801+00 | 3.229+03 | 2.839+00 |
| 2.0+07            | 1.556+03 | 2.157+00 | 1.619+03 | 2.168+00 | 1.663+03 | 2.218+00 | 1.749+03 | 2.249+00 | 1.816+03 | 2.279+00 |
| 3.0+07            | 6.915+04 | 1.571+00 | 7.193+04 | 1.593+00 | 7.479+04 | 1.615+00 | 7.771+04 | 1.657+00 | 8.071+04 | 1.659+00 |
| 4.0+07            | 3.890+04 | 1.248+00 | 4.046+04 | 1.266+00 | 4.207+04 | 1.283+00 | 4.371+04 | 1.301+00 | 4.540+04 | 1.318+00 |
| 5.0+07            | 2.489+04 | 1.042+00 | 2.590+04 | 1.057+00 | 2.692+04 | 1.071+00 | 2.798+04 | 1.085+00 | 2.906+04 | 1.101+00 |
| 6.0+07            | 1.729+04 | 8.977+01 | 1.799+04 | 9.033+01 | 1.870+04 | 9.230+01 | 1.943+04 | 9.356+01 | 2.018+04 | 9.483+01 |
| 8.0+07            | 9.727+05 | 7.080+01 | 1.012+04 | 7.179+01 | 1.052+04 | 7.279+01 | 1.093+04 | 7.379+01 | 1.135+04 | 7.479+01 |
| 1.0+08            | 6.225+05 | 5.876+01 | 6.475+05 | 5.959+01 | 6.732+05 | 6.042+01 | 6.995+05 | 6.124+01 | 7.265+05 | 6.207+01 |

TABLE III., CONT. COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNS/ATOM

| PHOTON ENERGY, EV | 76 OS    |          |          |          | 77 IR    |          |          |          | 78 PI    |          |          |          | 79 AU    |          |          |          | 8G HG    |          |          |          |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | COH      | INCOH    |
| 1.0+02            | 3.846+03 | 1.712+02 | 3.942+03 | 1.647+02 | 4.045+03 | 1.388+02 | 4.150+03 | 1.356+02 | 4.056+03 | 1.481+02 | 4.253+03 | 1.322+02 | 4.253+03 | 1.322+02 | 4.253+03 | 1.322+02 | 4.253+03 | 1.322+02 | 4.253+03 | 1.322+02 |
| 1.5+02            | 3.837+03 | 3.804+02 | 3.939+03 | 3.691+02 | 4.034+03 | 3.107+03 | 4.148+03 | 3.024+02 | 4.084+03 | 3.024+02 | 4.253+03 | 3.024+02 | 4.253+03 | 3.024+02 | 4.253+03 | 3.024+02 | 4.253+03 | 3.024+02 | 4.253+03 | 3.024+02 |
| 2.0+02            | 3.834+03 | 6.712+02 | 3.936+03 | 6.509+02 | 4.040+03 | 5.477+02 | 4.145+03 | 5.326+02 | 4.250+03 | 5.326+02 | 4.250+03 | 5.326+02 | 4.250+03 | 5.326+02 | 4.250+03 | 5.326+02 | 4.250+03 | 5.326+02 | 4.250+03 | 5.326+02 |
| 3.0+02            | 3.825+03 | 1.484+01 | 3.928+03 | 1.440+01 | 4.033+03 | 1.213+01 | 4.137+03 | 1.179+01 | 4.171+03 | 1.179+01 | 4.126+03 | 2.057+01 | 4.126+03 | 2.057+01 | 4.126+03 | 2.057+01 | 4.126+03 | 2.057+01 | 4.126+03 | 2.057+01 |
| 4.0+02            | 3.814+03 | 2.577+01 | 3.916+03 | 2.505+01 | 4.021+03 | 2.115+01 | 4.126+03 | 2.057+01 | 4.126+03 | 2.057+01 | 4.126+03 | 2.057+01 | 4.126+03 | 2.057+01 | 4.126+03 | 2.057+01 | 4.126+03 | 2.057+01 | 4.126+03 | 2.057+01 |
| 5.0+02            | 3.799+03 | 3.914+01 | 3.901+03 | 3.809+01 | 4.008+03 | 3.426+01 | 4.112+03 | 3.141+01 | 4.154+03 | 3.141+01 | 4.154+03 | 3.141+01 | 4.154+03 | 3.141+01 | 4.154+03 | 3.141+01 | 4.154+03 | 3.141+01 | 4.154+03 | 3.141+01 |
| 6.0+02            | 3.781+03 | 5.451+01 | 3.883+03 | 5.313+01 | 3.991+03 | 4.517+01 | 4.096+03 | 4.402+01 | 4.197+03 | 4.402+01 | 4.197+03 | 4.402+01 | 4.197+03 | 4.402+01 | 4.197+03 | 4.402+01 | 4.197+03 | 4.402+01 | 4.197+03 | 4.402+01 |
| 8.0+02            | 3.737+03 | 8.954+01 | 3.839+03 | 8.761+01 | 3.950+03 | 7.520+01 | 4.055+03 | 7.347+01 | 4.153+03 | 7.347+01 | 4.153+03 | 7.347+01 | 4.153+03 | 7.347+01 | 4.153+03 | 7.347+01 | 4.153+03 | 7.347+01 | 4.153+03 | 7.347+01 |
| 1.0+03            | 3.684+03 | 1.278+00 | 3.786+03 | 1.255+00 | 3.900+03 | 1.091+03 | 3.900+03 | 1.091+03 | 4.005+03 | 1.091+03 | 4.005+03 | 1.091+03 | 4.005+03 | 1.091+03 | 4.005+03 | 1.091+03 | 4.005+03 | 1.091+03 | 4.005+03 | 1.091+03 |
| 1.5+03            | 3.529+03 | 2.524+00 | 3.629+03 | 2.452+00 | 3.181+00 | 3.573+03 | 2.957+00 | 3.401+03 | 3.852+03 | 3.401+03 | 3.852+03 | 3.401+03 | 3.852+03 | 3.401+03 | 3.852+03 | 3.401+03 | 3.852+03 | 3.401+03 | 3.852+03 | 3.401+03 |
| 2.0+03            | 3.355+03 | 3.190+00 | 3.452+03 | 3.093+00 | 4.990+00 | 3.204+03 | 4.796+00 | 3.295+03 | 4.772+00 | 3.295+03 | 4.772+00 | 3.295+03 | 4.772+00 | 3.295+03 | 4.772+00 | 3.295+03 | 4.772+00 | 3.295+03 | 4.772+00 | 3.295+03 |
| 3.0+03            | 3.007+03 | 4.977+00 | 3.093+03 | 4.977+00 | 3.758+03 | 2.711+00 | 2.849+03 | 6.534+00 | 2.930+03 | 6.511+00 | 2.930+03 | 6.511+00 | 2.930+03 | 6.511+00 | 2.930+03 | 6.511+00 | 2.930+03 | 6.511+00 | 2.930+03 | 6.511+00 |
| 4.0+03            | 2.682+03 | 6.682+00 | 2.758+03 | 6.459+00 | 3.424+03 | 8.342+00 | 2.650+03 | 8.195+00 | 2.670+03 | 8.174+00 | 2.670+03 | 8.174+00 | 2.670+03 | 8.174+00 | 2.670+03 | 8.174+00 | 2.670+03 | 8.174+00 | 2.670+03 | 8.174+00 |
| 5.0+03            | 2.392+03 | 8.302+00 | 2.200+03 | 9.835+00 | 2.000+03 | 9.887+00 | 2.266+03 | 9.781+00 | 2.329+03 | 9.770+00 | 2.329+03 | 9.770+00 | 2.329+03 | 9.770+00 | 2.329+03 | 9.770+00 | 2.329+03 | 9.770+00 | 2.329+03 | 9.770+00 |
| 6.0+03            | 2.141+03 | 1.258+01 | 1.786+03 | 1.267+01 | 1.838+03 | 1.265+01 | 1.889+03 | 1.268+01 | 1.889+03 | 1.268+01 | 1.889+03 | 1.268+01 | 1.889+03 | 1.268+01 | 1.889+03 | 1.268+01 | 1.889+03 | 1.268+01 | 1.889+03 | 1.268+01 |
| 8.0+03            | 1.733+03 | 1.258+01 | 1.786+03 | 1.267+01 | 1.847+03 | 1.471+03 | 1.500+01 | 1.517+03 | 1.506+01 | 1.517+03 | 1.506+01 | 1.517+03 | 1.506+01 | 1.517+03 | 1.506+01 | 1.517+03 | 1.506+01 | 1.517+03 | 1.506+01 |          |
| 1.0+04            | 1.428+03 | 1.487+01 | 1.471+03 | 1.471+03 | 1.943+01 | 9.559+02 | 1.958+01 | 9.830+02 | 1.958+01 | 1.958+01 | 1.958+01 | 1.958+01 | 1.958+01 | 1.958+01 | 1.958+01 | 1.958+01 | 1.958+01 | 1.958+01 | 1.958+01 |          |
| 1.5+04            | 9.252+02 | 1.925+01 | 9.252+02 | 1.925+01 | 6.695+02 | 6.695+02 | 6.917+02 | 6.917+02 | 7.287+01 | 7.287+01 | 7.141+02 | 7.141+02 | 7.307+01 | 7.307+01 | 7.383+01 | 7.383+01 | 7.383+01 | 7.383+01 | 7.383+01 |          |
| 2.0+04            | 6.482+02 | 2.49+01  | 6.686+02 | 2.666+01 | 3.916+02 | 2.710+01 | 4.043+02 | 2.733+01 | 4.171+02 | 2.756+01 | 4.171+02 | 2.756+01 | 4.171+02 | 2.756+01 | 4.171+02 | 2.756+01 | 4.171+02 | 2.756+01 | 4.171+02 | 2.756+01 |
| 3.0+04            | 3.792+02 | 2.666+01 | 3.916+02 | 2.710+01 | 2.580+02 | 2.963+01 | 2.666+02 | 2.963+01 | 2.991+02 | 2.754+02 | 3.018+01 | 2.754+02 | 3.018+01 | 2.754+02 | 3.018+01 | 2.754+02 | 3.018+01 | 2.754+02 | 3.018+01 |          |
| 4.0+04            | 2.496+02 | 2.935+01 | 2.580+02 | 2.935+01 | 1.816+02 | 3.105+01 | 1.878+02 | 3.136+01 | 1.878+02 | 3.136+01 | 1.878+02 | 3.136+01 | 1.878+02 | 3.136+01 | 1.878+02 | 3.136+01 | 1.878+02 | 3.136+01 |          |          |
| 5.0+04            | 1.756+02 | 1.756+02 | 1.816+02 | 1.816+02 | 1.507+02 | 3.104+01 | 1.494+02 | 3.121+01 | 1.494+02 | 3.121+01 | 1.494+02 | 3.121+01 | 1.494+02 | 3.121+01 | 1.494+02 | 3.121+01 | 1.494+02 | 3.121+01 |          |          |
| 6.0+04            | 1.312+02 | 3.121+02 | 1.506+02 | 1.506+02 | 1.203+02 | 3.203+01 | 1.442+02 | 3.238+01 | 1.442+02 | 3.238+01 | 1.442+02 | 3.238+01 | 1.442+02 | 3.238+01 | 1.442+02 | 3.238+01 | 1.442+02 | 3.238+01 |          |          |
| 8.0+04            | 8.144+01 | 3.203+01 | 8.144+01 | 3.203+01 | 1.144+00 | 1.768+01 | 1.186+00 | 1.790+01 | 1.186+00 | 1.790+01 | 1.186+00 | 1.790+01 | 1.186+00 | 1.790+01 | 1.186+00 | 1.790+01 | 1.186+00 | 1.790+01 |          |          |
| 9.0+05            | 5.555+01 | 3.188+01 | 5.748+01 | 5.748+01 | 3.224+01 | 5.945+01 | 5.945+01 | 5.945+01 | 5.945+01 | 5.945+01 | 5.945+01 | 5.945+01 | 5.945+01 | 5.945+01 | 5.945+01 | 5.945+01 | 5.945+01 | 5.945+01 |          |          |
| 1.0+05            | 2.690+01 | 3.046+01 | 2.784+01 | 2.784+01 | 3.082+01 | 2.882+01 | 2.882+01 | 2.882+01 | 2.882+01 | 2.882+01 | 2.882+01 | 2.882+01 | 2.882+01 | 2.882+01 | 2.882+01 | 2.882+01 | 2.882+01 | 2.882+01 |          |          |
| 1.5+05            | 1.600+01 | 2.874+01 | 1.656+01 | 1.656+01 | 2.910+01 | 2.910+01 | 1.713+01 | 2.945+01 | 1.713+01 | 2.945+01 | 1.713+01 | 2.945+01 | 1.713+01 | 2.945+01 | 1.713+01 | 2.945+01 | 1.713+01 | 2.945+01 |          |          |
| 2.0+05            | 1.500+01 | 2.574+00 | 1.574+01 | 1.574+01 | 7.816+00 | 2.572+00 | 8.024+00 | 2.636+00 | 8.024+00 | 2.636+00 | 8.024+00 | 2.636+00 | 8.024+00 | 2.636+00 | 8.024+00 | 2.636+00 | 8.024+00 | 2.636+00 |          |          |
| 3.0+05            | 4.376+00 | 2.337+01 | 4.534+00 | 4.534+00 | 2.337+01 | 2.151+01 | 2.954+00 | 2.179+01 | 2.954+00 | 2.179+01 | 2.954+00 | 2.179+01 | 2.954+00 | 2.179+01 | 2.954+00 | 2.179+01 | 2.954+00 | 2.179+01 |          |          |
| 4.0+05            | 2.851+00 | 2.851+00 | 2.151+01 | 2.151+01 | 2.004+00 | 2.027+01 | 2.027+01 | 2.027+01 | 2.027+01 | 2.027+01 | 2.027+01 | 2.027+01 | 2.027+01 | 2.027+01 | 2.027+01 | 2.027+01 | 2.027+01 |          |          |          |
| 5.0+05            | 2.004+00 | 2.004+00 | 1.222+02 | 1.222+02 | 4.563+00 | 4.623+00 | 2.173+02 | 5.650+00 | 2.173+02 | 5.650+00 | 2.173+02 | 5.650+00 | 2.173+02 | 5.650+00 | 2.173+02 | 5.650+00 | 2.173+02 |          |          |          |
| 6.0+05            | 1.466+00 | 4.563+00 | 1.178+02 | 1.178+02 | 4.563+00 | 4.623+00 | 1.222+02 | 5.650+00 | 1.222+02 | 5.650+00 | 1.222+02 | 5.650+00 | 1.222+02 | 5.650+00 | 1.222+02 | 5.650+00 | 1.222+02 |          |          |          |
| 8.0+05            | 1.179+04 | 7.578+01 | 1.223+04 | 1.223+04 | 7.678+01 | 7.678+01 | 1.223+04 | 9.736+01 | 1.223+04 | 9.736+01 | 1.223+04 | 9.736+01 | 1.223+04 | 9.736+01 | 1.223+04 | 9.736+01 | 1.223+04 |          |          |          |
| 1.0+06            | 7.386+01 | 1.594+01 | 3.087+00 | 3.087+00 | 7.826+03 | 3.938+00 | 8.118+03 | 3.938+00 | 8.118+03 | 3.938+00 | 8.118+03 | 3.938+00 | 8.118+03 | 3.938+00 | 8.118+03 | 3.938+00 | 8.118+03 |          |          |          |
| 1.5+06            | 3.317+01 | 1.300+01 | 3.441+01 | 3.441+01 | 1.944+01 | 1.944+01 | 1.111+01 | 1.125+01 | 2.016+01 | 2.016+01 | 1.140+01 | 1.140+01 | 2.016+01 | 1.140+01 | 2.016+01 | 1.140+01 | 2.016+01 |          |          |          |
| 2.0+06            | 1.874+01 | 1.874+01 | 8.751+00 | 8.751+00 | 8.669+02 | 8.666+00 | 8.666+02 | 8.666+00 | 8.666+02 | 8.666+00 | 8.666+02 | 8.666+00 | 8.666+02 | 8.666+00 | 8.666+02 | 8.666+00 | 8.666+02 |          |          |          |
| 3.0+06            | 8.355+00 | 8.355+00 | 4.882+02 | 4.882+02 | 7.303+00 | 6.309+00 | 3.127+02 | 6.392+00 | 3.243+02 | 6.374+00 | 5.054+02 | 7.495+00 | 5.249+02 | 7.591+00 | 5.249+02 | 7.591+00 | 5.249+02 |          |          |          |
| 4.0+06            | 4.705+02 | 4.705+02 | 4.882+02 | 4.882+02 | 7.303+00 | 6.309+00 | 3.127+02 | 6.392+00 | 3.243+02 | 6.374+00 | 5.054+02 | 7.495+00 | 5.249+02 | 7.591+00 | 5.249+02 | 7.591+00 | 5.249+02 |          |          |          |
| 5.0+06            | 3.013+02 | 6.309+00 | 3.127+02 | 3.127+02 | 4.882+02 | 4.882+02 | 4.882+02 | 4.882+02 | 4.882+02 | 4.882+02 | 4.882+02 | 4.882+02 | 4.882+02 | 4.882+02 | 4.882+02 | 4.882+02 | 4.882+02 |          |          |          |
| 6.0+06            | 2.094+02 | 5.577+00 | 2.173+02 | 2.173+02 | 4.563+00 | 4.623+00 | 1.222+02 | 4.623+00 | 1.222+02 | 4.623+00 | 2.254+02 | 5.724+00 | 2.336+02 | 5.797+00 | 2.336+02 | 5.797+00 | 2.336+02 |          |          |          |
| 8.0+06            | 1.178+02 | 4.563+00 | 1.178+02 | 1.178+02 | 4.563+00 | 4.623+00 | 1.222+02 | 4.623+00 | 1.222+02 | 4.623+00 | 1.222+02 | 4.62     |          |          |          |          |          |          |          |          |

TABLE III. CONT. COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNS/ATOM

| PHOTON ENERGY, eV | 81 TL    |          |          |          |          |          | 82 PB    |          |           |          |          |          | 83 BI    |          |          |           |          |           | 84 PO    |           |          |           |          |          |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|----------|
|                   | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH       | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH     | COH      | INCOH     | COH      | INCOH     | COH      | INCOH     |          |          |
| 1.0+02            | 4.363+03 | 1.571-02 | 4.471+03 | 1.561-02 | 4.581+03 | 1.494-02 | 4.693+03 | 1.473-02 | 4.805+03  | 1.478-02 | 4.350+03 | 1.304-02 | 4.689+03 | 1.304-02 | 4.802+03 | 1.234-02  | 4.802+03 | 1.234-02  | 4.802+03 | 1.234-02  | 4.802+03 | 1.234-02  | 4.802+03 | 1.234-02 |
| 1.5+02            | 4.350+03 | 3.538-02 | 4.468+03 | 3.495-02 | 4.578+03 | 3.388-02 | 4.685+03 | 3.304-02 | 4.802+03  | 3.234-02 | 4.646+03 | 5.996-02 | 5.842+03 | 5.996-02 | 4.798+03 | 5.697+03  | 4.798+03 | 5.697+03  | 4.798+03 | 5.697+03  | 4.798+03 | 5.697+03  | 4.798+03 | 5.697+03 |
| 2.0+02            | 4.355+03 | 6.245-02 | 4.465+03 | 6.163-02 | 4.575+03 | 5.996-02 | 4.685+03 | 5.842+03 | 4.675+03  | 1.299-01 | 4.675+03 | 1.299-01 | 4.787+03 | 1.266-01 | 4.787+03 | 1.266-01  | 4.787+03 | 1.266-01  | 4.787+03 | 1.266-01  | 4.787+03 | 1.266-01  | 4.787+03 | 1.266-01 |
| 3.0+02            | 4.347+03 | 1.383-01 | 4.454+03 | 1.366-01 | 4.564+03 | 1.332-01 | 4.664+03 | 1.304-01 | 4.675+03  | 1.299-01 | 4.675+03 | 1.299-01 | 4.787+03 | 1.266-01 | 4.787+03 | 1.266-01  | 4.787+03 | 1.266-01  | 4.787+03 | 1.266-01  | 4.787+03 | 1.266-01  | 4.787+03 | 1.266-01 |
| 4.0+02            | 4.333+03 | 2.407-01 | 4.440+03 | 2.382-01 | 4.545+03 | 2.326-01 | 4.660+03 | 2.272-01 | 4.772+03  | 2.217-01 | 4.641+03 | 3.555-01 | 4.641+03 | 3.555-01 | 4.753+03 | 3.405+01  | 4.753+03 | 3.405+01  | 4.753+03 | 3.405+01  | 4.753+03 | 3.405+01  | 4.753+03 | 3.405+01 |
| 4.0+02            | 4.333+03 | 3.667-01 | 4.422+03 | 3.637-01 | 4.531+03 | 3.555-01 | 4.659+03 | 3.483-01 | 4.753+03  | 3.427-01 | 4.641+03 | 4.987-01 | 4.618+03 | 4.987-01 | 4.730+03 | 4.803+01  | 4.730+03 | 4.803+01  | 4.730+03 | 4.803+01  | 4.730+03 | 4.803+01  | 4.730+03 | 4.803+01 |
| 5.0+02            | 4.297+03 | 5.126-01 | 4.401+03 | 5.037-01 | 4.509+03 | 4.987-01 | 4.618+03 | 4.902-01 | 4.730+03  | 4.902-01 | 4.564+03 | 8.338-01 | 4.564+03 | 8.338-01 | 4.674+03 | 8.127-01  | 4.674+03 | 8.127-01  | 4.674+03 | 8.127-01  | 4.674+03 | 8.127-01  | 4.674+03 | 8.127-01 |
| 8.0+02            | 4.248+03 | 8.503-01 | 4.350+03 | 8.499-01 | 4.456+03 | 8.338-01 | 4.566+03 | 8.252-01 | 4.674+03  | 8.127-01 | 4.564+03 | 8.338-01 | 4.564+03 | 8.338-01 | 4.674+03 | 8.127-01  | 4.674+03 | 8.127-01  | 4.674+03 | 8.127-01  | 4.674+03 | 8.127-01  | 4.674+03 | 8.127-01 |
| 1.0+03            | 4.190+03 | 1.228+00 | 4.289+03 | 1.234+00 | 4.391+03 | 1.214+00 | 4.497+03 | 1.210+00 | 4.606+03  | 1.198+00 | 4.500+03 | 1.204+00 | 4.606+03 | 1.198+00 | 4.606+03 | 1.204+00  | 4.606+03 | 1.204+00  | 4.606+03 | 1.204+00  | 4.606+03 | 1.204+00  | 4.606+03 | 1.204+00 |
| 1.5+03            | 4.018+03 | 2.235+00 | 4.106+03 | 2.217+00 | 4.200+03 | 2.252+00 | 4.299+03 | 2.275+00 | 4.401+03  | 2.280+00 | 4.200+03 | 2.275+00 | 4.401+03 | 2.280+00 | 4.401+03 | 2.280+00  | 4.401+03 | 2.280+00  | 4.401+03 | 2.280+00  | 4.401+03 | 2.280+00  | 4.401+03 | 2.280+00 |
| 2.0+03            | 3.826+03 | 3.230+00 | 3.905+03 | 3.310+00 | 3.990+03 | 3.313+00 | 4.079+03 | 3.374+00 | 4.172+03  | 3.409+00 | 3.905+03 | 3.313+00 | 4.079+03 | 3.374+00 | 4.172+03 | 3.409+00  | 4.172+03 | 3.409+00  | 4.172+03 | 3.409+00  | 4.172+03 | 3.409+00  | 4.172+03 | 3.409+00 |
| 3.0+03            | 3.436+03 | 5.095+00 | 3.505+03 | 5.246+00 | 3.575+03 | 5.335+00 | 3.648+03 | 5.469+00 | 3.724+03  | 5.577+00 | 3.505+03 | 5.246+00 | 3.648+03 | 5.469+00 | 3.724+03 | 5.577+00  | 3.724+03 | 5.577+00  | 3.724+03 | 5.577+00  | 3.724+03 | 5.577+00  | 3.724+03 | 5.577+00 |
| 4.0+03            | 3.067+03 | 6.834+00 | 3.132+03 | 7.006+00 | 3.197+03 | 7.154+00 | 3.262+03 | 7.335+00 | 3.328+03  | 7.504+00 | 3.067+03 | 6.834+00 | 3.197+03 | 7.154+00 | 3.262+03 | 7.335+00  | 3.328+03 | 7.504+00  | 3.328+03 | 7.504+00  | 3.328+03 | 7.504+00  | 3.328+03 | 7.504+00 |
| 5.0+03            | 2.735+03 | 8.479+00 | 2.797+03 | 8.655+00 | 2.859+03 | 8.818+00 | 2.921+03 | 9.014+00 | 2.983+03  | 9.207+00 | 2.735+03 | 8.479+00 | 2.859+03 | 8.818+00 | 2.921+03 | 9.014+00  | 2.983+03 | 9.207+00  | 2.983+03 | 9.207+00  | 2.983+03 | 9.207+00  | 2.983+03 | 9.207+00 |
| 6.0+03            | 2.444+03 | 1.005+01 | 2.505+03 | 1.022+01 | 2.563+03 | 1.038+01 | 2.621+03 | 1.047+01 | 2.680+03  | 1.057+01 | 2.035+03 | 1.032+01 | 2.135+03 | 1.044+01 | 2.185+03 | 1.053+01  | 2.244+03 | 1.063+01  | 2.185+03 | 1.053+01  | 2.185+03 | 1.053+01  | 2.185+03 | 1.053+01 |
| 8.0+03            | 1.981+03 | 1.295+01 | 2.036+03 | 1.310+01 | 2.095+03 | 1.340+01 | 2.151+03 | 1.374+01 | 2.210+03  | 1.404+01 | 1.913+03 | 1.309+01 | 2.082+03 | 1.340+01 | 2.151+03 | 1.374+01  | 2.210+03 | 1.404+01  | 2.210+03 | 1.404+01  | 2.210+03 | 1.404+01  | 2.210+03 | 1.404+01 |
| 1.0+04            | 1.645+03 | 1.545+01 | 1.686+03 | 1.562+01 | 1.726+03 | 1.579+01 | 1.776+03 | 1.598+01 | 1.814+03  | 1.617+01 | 1.455+03 | 1.509+01 | 1.776+03 | 1.598+01 | 1.814+03 | 1.617+01  | 1.814+03 | 1.617+01  | 1.814+03 | 1.617+01  | 1.814+03 | 1.617+01  | 1.814+03 | 1.617+01 |
| 1.5+04            | 1.082+03 | 2.015+01 | 1.113+03 | 2.037+01 | 1.145+03 | 2.059+01 | 1.176+03 | 2.082+01 | 1.208+03  | 2.105+01 | 7.816+02 | 2.074+01 | 1.176+03 | 2.082+01 | 1.208+03 | 2.105+01  | 1.208+03 | 2.105+01  | 1.208+03 | 2.105+01  | 1.208+03 | 2.105+01  | 1.208+03 | 2.105+01 |
| 2.0+04            | 7.588+02 | 2.350+01 | 7.816+02 | 2.373+01 | 8.047+02 | 2.397+01 | 8.281+02 | 2.421+01 | 8.518+02  | 2.446+01 | 5.159+01 | 2.397+01 | 8.281+02 | 2.421+01 | 8.518+02 | 2.446+01  | 8.518+02 | 2.446+01  | 8.518+02 | 2.446+01  | 8.518+02 | 2.446+01  | 8.518+02 | 2.446+01 |
| 3.0+04            | 4.428+02 | 2.806+01 | 4.558+02 | 2.831+01 | 4.690+02 | 2.856+01 | 4.824+02 | 2.882+01 | 4.959+02  | 2.908+01 | 2.018+01 | 2.831+01 | 4.824+02 | 2.882+01 | 4.959+02 | 2.908+01  | 4.959+02 | 2.908+01  | 4.959+02 | 2.908+01  | 4.959+02 | 2.908+01  | 4.959+02 | 2.908+01 |
| 4.0+04            | 2.929+02 | 3.018+02 | 3.018+02 | 3.103+01 | 3.108+02 | 3.132+01 | 3.120+02 | 3.152+01 | 3.191+02  | 3.190+01 | 2.075+01 | 3.108+02 | 3.132+01 | 3.120+02 | 3.152+01 | 3.191+02  | 3.190+01 | 3.191+02  | 3.190+01 | 3.191+02  | 3.190+01 | 3.191+02  | 3.190+01 |          |
| 5.0+04            | 2.058+02 | 3.229+02 | 3.029+02 | 3.133+01 | 3.213+02 | 3.261+01 | 3.199+02 | 3.266+01 | 3.233+02  | 3.233+01 | 2.082+01 | 3.133+01 | 3.261+01 | 3.233+01 | 3.233+02 | 3.233+01  | 3.233+02 | 3.233+01  | 3.233+02 | 3.233+01  | 3.233+02 | 3.233+01  | 3.233+02 | 3.233+01 |
| 6.0+04            | 1.544+02 | 3.166+01 | 1.592+02 | 3.179+01 | 1.641+02 | 3.216+01 | 1.691+02 | 3.244+01 | 1.734+02  | 3.271+01 | 1.554+01 | 1.691+02 | 3.244+01 | 1.691+02 | 3.271+01 | 1.734+02  | 3.271+01 | 1.734+02  | 3.271+01 | 1.734+02  | 3.271+01 | 1.734+02  | 3.271+01 |          |
| 8.0+04            | 9.581+01 | 3.378+01 | 9.880+01 | 3.414+01 | 1.013+02 | 3.449+01 | 1.049+02 | 3.449+01 | 1.080+02  | 3.484+01 | 1.013+02 | 3.449+01 | 1.049+02 | 1.080+02 | 3.484+01 | 1.080+02  | 3.519+01 | 1.080+02  | 3.519+01 | 1.080+02  | 3.519+01 | 1.080+02  | 3.519+01 |          |
| 1.0+05            | 6.550+01 | 3.368+01 | 6.757+01 | 3.404+01 | 6.967+01 | 3.440+01 | 7.180+01 | 3.475+01 | 7.397+01  | 3.511+01 | 3.177+01 | 6.967+01 | 3.440+01 | 7.180+01 | 3.475+01 | 7.397+01  | 3.511+01 | 7.397+01  | 3.511+01 | 7.397+01  | 3.511+01 | 7.397+01  | 3.511+01 |          |
| 1.5+05            | 3.179+01 | 3.227+01 | 3.281+01 | 3.263+01 | 3.385+01 | 3.299+01 | 3.490+01 | 3.335+01 | 3.597+01  | 3.617+01 | 2.130+01 | 3.263+01 | 3.385+01 | 3.299+01 | 3.490+01 | 3.597+01  | 3.617+01 | 3.597+01  | 3.617+01 | 3.597+01  | 3.617+01 | 3.597+01  | 3.617+01 |          |
| 2.0+05            | 1.890+01 | 2.050+01 | 1.951+01 | 2.055+01 | 2.052+01 | 2.076+01 | 2.052+01 | 2.076+01 | 2.076+01  | 2.076+01 | 1.204+01 | 2.055+01 | 2.076+01 | 2.052+01 | 2.076+01 | 2.076+01  | 2.076+01 | 2.076+01  | 2.076+01 | 2.076+01  | 2.076+01 | 2.076+01  | 2.076+01 |          |
| 3.0+05            | 8.941+00 | 2.733+01 | 9.232+00 | 2.732+01 | 9.528+00 | 2.797+01 | 9.828+00 | 2.829+01 | 10.139+00 | 3.029+01 | 1.204+01 | 9.528+00 | 2.797+01 | 9.828+00 | 2.829+01 | 10.139+00 | 3.029+01 | 10.139+00 | 3.029+01 | 10.139+00 | 3.029+01 | 10.139+00 | 3.029+01 |          |
| 4.0+05            | 5.956+00 | 2.485+01 | 5.956+00 | 2.568+01 | 5.368+00 | 2.515+01 | 5.542+00 | 2.544+01 | 5.719+00  | 2.574+01 | 1.204+01 | 5.542+00 | 2.515+01 | 5.542+00 | 2.544+01 | 5.719+00  | 2.574+01 | 5.719+00  | 2.574+01 | 5.719+00  | 2.574+01 | 5.719+00  | 2.574+01 |          |
| 5.0+05            | 3.359+00 | 2.289+01 | 3.029+00 | 2.289+01 | 3.502+00 | 2.316+01 | 3.611+00 | 2.344+01 | 3.734+00  | 2.371+01 | 1.204+01 | 3.502+00 | 2.316+01 | 3.611+00 | 2.344+01 | 3.734+00  | 2.371+01 | 3.734+00  | 2.371+01 | 3.734+00  | 2.371+01 | 3.734+00  | 2.371+01 |          |
| 6.0+05            | 2.355+00 | 2.155+01 | 2.465+00 | 2.155+01 | 2.465+00 | 2.155+01 | 2.465+00 | 2.155+01 | 2.465+00  | 2.155+01 | 1.204+01 | 2.155+00 | 2.465+00 | 2.155+01 | 2.465+00 | 2.155+01  | 2.465+00 | 2.155+01  | 2.465+00 | 2.155+01  | 2.465+00 | 2.155+01  |          |          |
| 8.0+05            | 1.363+00 | 1.882+01 | 1.882+01 | 1.410+00 | 1.905+01 | 1.945+01 | 1.911+01 | 1.739+01 | 1.739+01  | 1.739+01 | 1.204+01 | 1.905+01 | 1.945+01 | 1.911+01 | 1.739+01 | 1.739+01  | 1.739+01 | 1.204+01  | 1.739+01 | 1.739+01  | 1.204+01 | 1.739+01  |          |          |
| 1.0+06            | 8.811-01 | 1.698+01 | 9.341-01 | 1.711+01 | 9.409+01 |          |          |          |           |          |          |          |          |          |          |           |          |           |          |           |          |           |          |          |

TABLE III. CONT. COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNs/ATOM

| PHOTON ENERGY, EV | 86 RN    |          |          | 87 FR    |          |          | 88 RA    |          |          | 89 AC    |          |          | 90 TH    |          |          |          |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | COH      | INCOH    | COH      |          |
| 1.0+02            | 4.919+03 | 1.384-02 | 5.033+03 | 2.672-02 | 5.150+03 | 3.127-02 | 5.267+03 | 3.040-02 | 5.385+03 | 2.940-02 | 5.374+03 | 2.940-02 | 5.385+03 | 2.940-02 | 5.374+03 | 2.940-02 |
| 1.5+02            | 4.916+03 | 3.112-02 | 5.028+03 | 5.939-02 | 5.144+03 | 6.992-02 | 5.261+03 | 6.797-02 | 5.374+03 | 6.564-02 | 5.374+03 | 6.564-02 | 5.374+03 | 6.564-02 | 5.374+03 | 6.564-02 |
| 2.0+02            | 4.912+03 | 2.526-02 | 5.022+03 | 1.046+01 | 5.137+03 | 1.226+01 | 5.255+03 | 1.192+01 | 5.374+03 | 1.154+01 | 5.374+03 | 1.154+01 | 5.374+03 | 1.154+01 | 5.374+03 | 1.154+01 |
| 2.0+02            | 4.912+03 | 1.231-01 | 5.067+03 | 2.235-01 | 5.119+03 | 2.654-01 | 5.237+03 | 2.592+01 | 5.356+03 | 2.517-01 | 5.356+03 | 2.517-01 | 5.356+03 | 2.517-01 | 5.356+03 | 2.517-01 |
| 3.0+02            | 4.901+03 | 1.60-01  | 5.014+03 | 4.985+03 | 5.745+03 | 4.478-01 | 5.213+03 | 4.401+01 | 5.332+03 | 4.295-01 | 5.332+03 | 4.295-01 | 5.332+03 | 4.295-01 | 5.332+03 | 4.295-01 |
| 4.0+02            | 4.895+03 | 2.160-01 | 5.014+03 | 4.959+03 | 5.643+03 | 6.577+01 | 5.213+03 | 6.507+01 | 5.302+03 | 6.383+01 | 5.302+03 | 6.383+01 | 5.302+03 | 6.383+01 | 5.302+03 | 6.383+01 |
| 5.0+02            | 4.866+03 | 3.320-01 | 5.014+03 | 4.959+03 | 5.643+03 | 6.577+01 | 5.183+03 | 6.507+01 | 5.149+03 | 6.383+01 | 5.149+03 | 6.383+01 | 5.149+03 | 6.383+01 | 5.149+03 | 6.383+01 |
| 6.0+02            | 4.843+03 | 4.690-01 | 4.929+03 | 7.302+01 | 5.032+03 | 8.820+01 | 5.149+03 | 8.799+01 | 5.149+03 | 8.664+01 | 5.149+03 | 8.664+01 | 5.149+03 | 8.664+01 | 5.149+03 | 8.664+01 |
| 8.0+02            | 4.786+03 | 7.958-01 | 4.860+03 | 1.116+00 | 4.954+03 | 1.344+00 | 5.059+03 | 1.360+00 | 5.186+03 | 1.355+00 | 5.186+03 | 1.355+00 | 5.186+03 | 1.355+00 | 5.186+03 | 1.355+00 |
| 1.0+03            | 4.717+03 | 1.176+00 | 4.783+03 | 1.516+00 | 4.867+03 | 1.799+00 | 4.978+03 | 1.837+00 | 5.093+03 | 1.852+00 | 5.093+03 | 1.852+00 | 5.093+03 | 1.852+00 | 5.093+03 | 1.852+00 |
| 1.5+03            | 4.506+03 | 2.254+00 | 4.567+03 | 2.574+00 | 4.635+03 | 2.899+00 | 4.733+03 | 2.982+00 | 4.838+03 | 3.038+00 | 4.838+03 | 3.038+00 | 4.838+03 | 3.038+00 | 4.838+03 | 3.038+00 |
| 2.0+03            | 4.269+03 | 3.389+00 | 4.335+03 | 3.678+00 | 4.399+03 | 3.988+00 | 4.485+03 | 4.101+00 | 4.578+03 | 4.184+00 | 4.578+03 | 4.184+00 | 4.578+03 | 4.184+00 | 4.578+03 | 4.184+00 |
| 3.0+03            | 3.804+03 | 5.613+00 | 3.871+03 | 5.852+00 | 3.951+03 | 6.122+00 | 4.085+03 | 6.264+00 | 4.186+03 | 6.386+00 | 4.186+03 | 6.386+00 | 4.186+03 | 6.386+00 | 4.186+03 | 6.386+00 |
| 4.0+03            | 3.396+03 | 7.615+00 | 3.457+03 | 7.857+00 | 3.519+03 | 8.116+00 | 3.583+03 | 8.281+00 | 3.649+03 | 8.421+00 | 3.649+03 | 8.421+00 | 3.649+03 | 8.421+00 | 3.649+03 | 8.421+00 |
| 5.0+03            | 3.044+03 | 9.368+00 | 3.101+03 | 9.620+00 | 3.158+03 | 9.888+00 | 3.217+03 | 1.009+01 | 3.277+03 | 1.027+01 | 3.277+03 | 1.027+01 | 3.277+03 | 1.027+01 | 3.277+03 | 1.027+01 |
| 6.0+03            | 2.738+03 | 1.092+01 | 2.792+03 | 1.120+01 | 2.846+03 | 1.147+01 | 2.901+03 | 1.170+01 | 2.957+03 | 1.190+01 | 2.957+03 | 1.190+01 | 2.957+03 | 1.190+01 | 2.957+03 | 1.190+01 |
| 8.0+03            | 2.236+03 | 1.382+01 | 2.285+03 | 1.405+01 | 2.334+03 | 1.430+01 | 2.383+03 | 1.453+01 | 2.433+03 | 1.476+01 | 2.433+03 | 1.476+01 | 2.433+03 | 1.476+01 | 2.433+03 | 1.476+01 |
| 1.0+04            | 1.857+03 | 1.636+01 | 1.899+03 | 1.658+01 | 1.942+03 | 1.682+01 | 1.985+03 | 1.705+01 | 2.028+03 | 1.727+01 | 2.028+03 | 1.727+01 | 2.028+03 | 1.727+01 | 2.028+03 | 1.727+01 |
| 1.5+04            | 1.259+03 | 2.128+01 | 1.270+03 | 2.130+01 | 1.302+03 | 2.178+01 | 1.333+03 | 2.228+01 | 1.365+03 | 2.228+01 | 1.365+03 | 2.228+01 | 1.365+03 | 2.228+01 | 1.365+03 | 2.228+01 |
| 2.0+04            | 8.758+02 | 2.471+01 | 8.998+02 | 2.498+01 | 9.238+02 | 2.524+01 | 9.482+02 | 2.551+01 | 9.728+02 | 2.578+01 | 9.728+02 | 2.578+01 | 9.728+02 | 2.578+01 | 9.728+02 | 2.578+01 |
| 3.0+04            | 5.096+02 | 2.935+01 | 5.234+02 | 2.962+01 | 5.373+02 | 2.990+01 | 5.515+02 | 3.018+01 | 5.659+02 | 3.046+01 | 5.659+02 | 3.046+01 | 5.659+02 | 3.046+01 | 5.659+02 | 3.046+01 |
| 4.0+04            | 3.364+02 | 3.218+01 | 3.478+02 | 3.247+01 | 3.573+02 | 3.277+01 | 3.669+02 | 3.306+01 | 3.766+02 | 3.335+01 | 3.766+02 | 3.335+01 | 3.766+02 | 3.335+01 | 3.766+02 | 3.335+01 |
| 5.0+04            | 2.402+02 | 3.386+01 | 2.472+02 | 3.417+01 | 2.542+02 | 3.449+01 | 2.613+02 | 3.480+01 | 2.685+02 | 3.512+01 | 2.685+02 | 3.512+01 | 2.685+02 | 3.512+01 | 2.685+02 | 3.512+01 |
| 6.0+04            | 1.794+02 | 3.481+01 | 1.846+02 | 3.514+01 | 1.898+02 | 3.54+01  | 1.952+02 | 3.581+01 | 2.006+02 | 3.614+01 | 2.006+02 | 3.614+01 | 2.006+02 | 3.614+01 | 2.006+02 | 3.614+01 |
| 8.0+04            | 1.112+02 | 3.554+01 | 1.144+02 | 3.588+01 | 1.177+02 | 3.623+01 | 1.210+02 | 3.658+01 | 1.244+02 | 3.693+01 | 1.244+02 | 3.693+01 | 1.244+02 | 3.693+01 | 1.244+02 | 3.693+01 |
| 1.0+05            | 7.617+01 | 3.547+01 | 7.839+01 | 3.582+01 | 8.064+01 | 3.618+01 | 8.293+01 | 3.654+01 | 8.525+01 | 3.689+01 | 8.525+01 | 3.689+01 | 8.525+01 | 3.689+01 | 8.525+01 | 3.689+01 |
| 1.5+05            | 3.706+01 | 3.407+01 | 3.816+01 | 3.442+01 | 3.927+01 | 3.478+01 | 4.042+01 | 3.514+01 | 4.158+01 | 3.549+01 | 4.158+01 | 3.549+01 | 4.158+01 | 3.549+01 | 4.158+01 | 3.549+01 |
| 2.0+05            | 2.233+01 | 3.224+01 | 2.269+01 | 3.259+01 | 2.329+01 | 3.294+01 | 2.410+01 | 3.294+01 | 2.471+01 | 3.353+01 | 2.471+01 | 3.353+01 | 2.471+01 | 3.353+01 | 2.471+01 | 3.353+01 |
| 3.0+05            | 1.044+01 | 2.893+01 | 1.076+01 | 2.925+01 | 1.108+01 | 2.957+01 | 1.140+01 | 2.989+01 | 1.173+01 | 3.021+01 | 1.194+01 | 3.021+01 | 1.194+01 | 3.021+01 | 1.194+01 | 3.021+01 |
| 4.0+05            | 6.032+00 | 2.633+01 | 6.267+00 | 2.662+01 | 6.456+00 | 2.69+01  | 6.644+00 | 2.721+01 | 6.844+00 | 2.751+01 | 6.844+00 | 2.751+01 | 6.844+00 | 2.751+01 | 6.844+00 | 2.751+01 |
| 5.0+05            | 3.973+00 | 2.426+01 | 4.096+00 | 2.454+01 | 4.220+00 | 2.481+01 | 4.388+00 | 2.508+01 | 4.477+00 | 2.536+01 | 4.477+00 | 2.536+01 | 4.477+00 | 2.536+01 | 4.477+00 | 2.536+01 |
| 6.0+05            | 2.798+00 | 2.426+01 | 3.283+01 | 2.497+00 | 3.374+00 | 2.509+01 | 3.458+00 | 2.535+01 | 3.535+00 | 2.563+01 | 3.535+00 | 2.563+01 | 3.535+00 | 2.563+01 | 3.535+00 | 2.563+01 |
| 8.0+05            | 1.503+00 | 1.996+01 | 1.653+00 | 2.019+01 | 1.704+00 | 2.042+01 | 1.757+00 | 2.065+01 | 1.807+00 | 2.120+01 | 1.807+00 | 2.120+01 | 1.807+00 | 2.120+01 | 1.807+00 | 2.120+01 |
| 1.0+06            | 1.037+00 | 1.801+01 | 1.822+00 | 1.847+01 | 1.872+01 | 1.897+01 | 1.904+01 | 1.922+01 | 1.931+01 | 1.941+01 | 1.941+01 | 1.941+01 | 1.941+01 | 1.941+01 | 1.941+01 | 1.941+01 |
| 1.5+06            | 4.670+00 | 1.470+01 | 4.819+00 | 1.487+01 | 4.927+00 | 1.504+01 | 5.042+00 | 1.521+01 | 5.228+00 | 1.541+01 | 5.228+00 | 1.541+01 | 5.228+00 | 1.541+01 | 5.228+00 | 1.541+01 |
| 2.0+06            | 2.642+00 | 1.256+01 | 2.727+00 | 1.271+01 | 2.814+00 | 1.288+01 | 2.903+00 | 1.300+01 | 2.993+00 | 1.315+01 | 2.993+00 | 1.315+01 | 2.993+00 | 1.315+01 | 2.993+00 | 1.315+01 |
| 3.0+06            | 1.180+00 | 9.899+00 | 1.218+00 | 1.001+01 | 1.257+00 | 1.011+01 | 1.297+00 | 1.031+01 | 1.338+00 | 1.056+01 | 1.338+00 | 1.056+01 | 1.338+00 | 1.056+01 | 1.338+00 | 1.056+01 |
| 4.0+06            | 6.647+00 | 8.263+00 | 6.359+00 | 7.083+00 | 6.454+00 | 7.154+00 | 6.481+00 | 7.211+00 | 6.550+00 | 7.310+00 | 6.550+00 | 7.310+00 | 6.550+00 | 7.310+00 | 6.550+00 | 7.310+00 |
| 5.0+06            | 4.259+00 | 7.138+00 | 4.397+00 | 5.038+00 | 4.538+00 | 5.304+00 | 4.684+00 | 5.304+00 | 4.832+00 | 5.387+00 | 4.832+00 | 5.387+00 | 4.832+00 | 5.387+00 | 4.832+00 | 5.387+00 |
| 6.0+06            | 2.990+00 | 6.310+00 | 3.056+00 | 6.384+00 | 3.154+00 | 6.457+00 | 3.252+00 | 6.530+00 | 3.325+00 | 6.633+00 | 3.325+00 | 6.633+00 | 3.325+00 | 6.633+00 | 3.325+00 | 6.633+00 |
| 8.0+06            | 1.666+00 | 5.163+00 | 1.720+00 | 5.223+00 | 1.775+00 | 5.283+00 | 1.833+00 | 5.343+00 | 1.889+00 | 5.403+00 | 1.889+00 | 5.403+00 | 1.889+00 | 5.403+00 | 1.889+00 | 5.403+00 |
| 1.0+07            | 1.065+00 | 4.398+00 | 1.101+00 | 4.449+00 | 1.137+00 | 4.500+00 | 1.173+00 | 4.551+00 | 1.210+00 | 4.602+00 | 1.210+00 | 4.602+00 | 1.210+00 | 4.602+00 | 1.210+00 | 4.602+00 |
| 1.5+07            | 4.759+00 | 3.255+00 | 4.894+00 | 3.293+00 | 5.051+00 | 3.330+00 | 5.121+00 | 3.369+00 | 5.213+00 | 3.407+00 | 5.213+00 | 3.407+00 | 5.213+00 | 3.407+00 | 5.213+00 | 3.407+00 |
| 2.0+07            | 2.666+00 | 2.613+00 | 2.753+00 | 2.643+00 | 2.842+00 | 2.674+00 | 2.933+00 | 2.704+00 | 3.026+00 | 2.735+00 | 3.026+00 | 2.735+00 | 3.026+00 | 2.735+00 | 3.026+00 | 2.735+00 |
| 3.0+07            | 1.185+00 | 1.902+00 | 1.223+00 | 1.921+00 | 1.271+00 | 1.947+00 | 1.320+00 | 1.969+00 | 1.350+00 | 1.994+00 | 1.350+00 | 1.994+00 | 1.350+00 | 1.994+00 | 1.350+00 | 1.994+00 |
| 4.0+07            | 6.655+00 | 1.512+00 | 6.883+00 | 1.529+00 | 7.105+00 | 1.544+00 | 7.310+00 | 1.565+00 | 7.533+00 | 1.584+00 | 7.533+00 | 1.584+00 | 7.533+00 | 1.584+00 | 7.533+00 | 1.584+00 |
| 5.0+07            | 4.266+00 | 4.262+00 | 4.405+00 | 4.277+00 | 4.547+00 | 4.291+00 | 4.654+00 | 4.310+00 | 4.832+00 | 4.330+00 | 4.832+00 | 4.330+00 | 4.832+00 | 4.330+00 | 4.832+00 | 4.330+00 |
| 6.0+07            | 2.922+00 | 1.087+00 | 3.058+00 | 1.100+0  |          |          |          |          |          |          |          |          |          |          |          |          |

TABLE III. CONT.

| PHOTON ENERGY, EV | 91 PA    |          |          | 92 U     |          |          | 93 NP    |          |          | 94 PU    |          |          | 95 AM    |          |  |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--|
|                   | COH      | INCOH    | COH      | COH      | INCOH    |  |
| 1.0+02            | 5.506+03 | 2.930-02 | 5.627+03 | 2.866-02 | 5.750+03 | 2.844-02 | 5.875+03 | 2.852-02 | 6.001+03 | 2.831-02 | 5.995+03 | 6.373-02 | 5.989+03 | 6.288-02 |  |
| 1.1+02            | 5.500+03 | 6.521-02 | 5.622+03 | 6.405-02 | 5.745+03 | 6.325-02 | 5.870+03 | 6.312-02 | 5.989+03 | 6.105-01 | 5.984+03 | 6.121-01 | 5.972+03 | 2.407-01 |  |
| 2.0+02            | 5.494+03 | 1.145-01 | 5.616+03 | 1.125-01 | 5.738+03 | 1.110-01 | 5.864+03 | 1.121-01 | 5.984+03 | 2.422-01 | 5.982+03 | 2.442-01 | 5.972+03 | 2.407-01 |  |
| 3.0+02            | 5.477+03 | 2.493-01 | 5.598+03 | 2.455-01 | 5.722+03 | 2.422-01 | 5.823+03 | 2.417-01 | 5.972+03 | 4.153-01 | 5.949+03 | 4.096-01 | 5.920+03 | 6.073-01 |  |
| 4.0+02            | 5.453+03 | 4.244-01 | 5.575+03 | 4.177-01 | 5.698+03 | 4.127-01 | 5.823+03 | 4.157-01 | 5.972+03 | 6.133-01 | 5.794+03 | 6.152-01 | 5.920+03 | 6.073-01 |  |
| 5.0+02            | 5.423+03 | 6.292-01 | 5.545+03 | 6.200-01 | 5.669+03 | 6.133-01 | 5.823+03 | 6.152-01 | 5.972+03 | 8.338-01 | 5.760+03 | 8.337-01 | 5.886+03 | 8.238-01 |  |
| 6.0+02            | 5.359+03 | 8.355-01 | 5.351+03 | 8.421-01 | 5.635+03 | 8.338-01 | 5.823+03 | 8.337-01 | 5.972+03 | 1.313+00 | 5.555+03 | 1.303+00 | 5.682+03 | 1.282+00 |  |
| 8.0+02            | 5.309+03 | 1.328+00 | 5.431+03 | 1.313+00 | 5.555+03 | 1.303+00 | 5.682+03 | 1.296+00 | 5.808+03 | 1.282+00 | 5.808+03 | 1.282+00 | 5.808+03 | 1.282+00 |  |
| 1.0+03            | 5.218+03 | 1.804+00 | 5.340+03 | 1.799+00 | 5.466+03 | 1.779+00 | 5.593+03 | 1.772+00 | 5.719+03 | 1.747+00 | 5.719+03 | 1.747+00 | 5.719+03 | 1.747+00 |  |
| 1.5+03            | 4.988+03 | 2.960+00 | 5.088+03 | 2.946+00 | 5.209+03 | 2.940+00 | 5.346+03 | 2.909+00 | 5.471+03 | 2.891+00 | 5.471+03 | 2.891+00 | 5.471+03 | 2.891+00 |  |
| 2.0+03            | 4.711+03 | 4.099+00 | 4.827+03 | 4.085+00 | 4.94+03  | 4.065+00 | 5.087+03 | 4.054+00 | 5.209+03 | 4.037+00 | 5.209+03 | 4.037+00 | 5.209+03 | 4.037+00 |  |
| 3.0+03            | 4.212+03 | 6.306+00 | 4.318+03 | 6.305+00 | 4.425+03 | 6.309+00 | 4.563+03 | 6.259+00 | 4.677+03 | 6.247+00 | 4.677+03 | 6.247+00 | 4.677+03 | 6.247+00 |  |
| 4.0+03            | 3.759+03 | 8.355+00 | 3.853+03 | 8.364+00 | 3.949+03 | 8.370+00 | 4.082+03 | 8.290+00 | 4.173+03 | 8.280+00 | 4.173+03 | 8.280+00 | 4.173+03 | 8.280+00 |  |
| 5.0+03            | 3.370+03 | 1.020+01 | 3.451+03 | 1.023+01 | 3.538+03 | 1.024+01 | 3.639+03 | 1.014+01 | 3.730+03 | 1.014+01 | 3.730+03 | 1.014+01 | 3.730+03 | 1.014+01 |  |
| 6.0+03            | 3.056+03 | 1.185+01 | 3.108+03 | 1.189+01 | 3.182+03 | 1.192+01 | 3.270+03 | 1.182+01 | 3.350+03 | 1.182+01 | 3.350+03 | 1.182+01 | 3.350+03 | 1.182+01 |  |
| 8.0+03            | 2.494+03 | 1.474+01 | 2.552+03 | 1.481+01 | 2.611+03 | 1.487+01 | 2.679+03 | 1.480+01 | 2.742+03 | 1.482+01 | 2.742+03 | 1.482+01 | 2.742+03 | 1.482+01 |  |
| 1.0+04            | 2.079+03 | 1.729+01 | 2.127+03 | 1.738+01 | 2.17+03  | 1.747+01 | 2.232+03 | 1.742+01 | 2.284+03 | 1.747+01 | 2.284+03 | 1.747+01 | 2.284+03 | 1.747+01 |  |
| 1.5+04            | 1.401+03 | 2.240+01 | 1.435+03 | 2.255+01 | 1.47+03  | 2.270+01 | 1.508+03 | 2.276+01 | 1.544+03 | 2.286+01 | 1.544+03 | 2.286+01 | 1.544+03 | 2.286+01 |  |
| 2.0+04            | 9.999+02 | 2.619+01 | 2.619+03 | 2.619+01 | 1.053+03 | 2.64+01  | 1.082+03 | 2.655+01 | 1.110+03 | 2.673+01 | 1.110+03 | 2.673+01 | 1.110+03 | 2.673+01 |  |
| 3.0+04            | 5.814+02 | 3.070+01 | 5.969+02 | 3.056+01 | 6.122+02 | 3.121+01 | 6.292+02 | 3.164+01 | 6.457+02 | 3.168+01 | 6.457+02 | 3.168+01 | 6.457+02 | 3.168+01 |  |
| 4.0+04            | 3.870+02 | 3.362+01 | 3.973+02 | 3.390+01 | 4.078+02 | 3.418+01 | 4.188+02 | 3.444+01 | 4.298+02 | 3.471+01 | 4.298+02 | 3.471+01 | 4.298+02 | 3.471+01 |  |
| 5.0+04            | 2.751+02 | 3.541+01 | 2.837+02 | 3.571+01 | 2.911+02 | 3.60+01  | 2.994+02 | 3.650+01 | 3.660+02 | 3.660+01 | 3.660+02 | 3.660+01 | 3.660+02 | 3.660+01 |  |
| 6.0+04            | 2.054+02 | 3.646+01 | 2.121+02 | 3.678+01 | 2.179+02 | 3.710+01 | 2.240+02 | 3.741+01 | 2.311+02 | 3.772+01 | 2.311+02 | 3.772+01 | 2.311+02 | 3.772+01 |  |
| 8.0+04            | 1.279+02 | 3.727+01 | 1.315+02 | 3.762+01 | 1.351+02 | 3.796+01 | 1.388+02 | 3.830+01 | 1.426+02 | 3.863+01 | 1.426+02 | 3.863+01 | 1.426+02 | 3.863+01 |  |
| 1.0+05            | 8.768+01 | 3.724+01 | 9.012+01 | 3.759+01 | 9.261+01 | 3.795+01 | 9.518+01 | 3.829+01 | 9.776+01 | 3.864+01 | 9.776+01 | 3.864+01 | 9.776+01 | 3.864+01 |  |
| 1.5+05            | 4.279+01 | 3.584+01 | 4.401+01 | 3.620+01 | 4.522+01 | 3.655+01 | 4.653+01 | 3.690+01 | 4.783+01 | 3.725+01 | 4.783+01 | 3.725+01 | 4.783+01 | 3.725+01 |  |
| 2.0+05            | 2.533+01 | 3.398+01 | 2.615+01 | 3.432+01 | 2.688+01 | 3.466+01 | 2.764+01 | 3.501+01 | 3.535+01 | 3.535+01 | 3.535+01 | 3.535+01 | 3.535+01 | 3.535+01 |  |
| 3.0+05            | 1.207+01 | 1.053+01 | 1.242+01 | 1.285+01 | 1.277+01 | 1.314+01 | 1.48+01  | 1.514+01 | 1.580+01 | 1.580+01 | 1.580+01 | 1.580+01 | 1.580+01 | 1.580+01 |  |
| 4.0+05            | 7.047+00 | 2.780+01 | 7.253+00 | 2.809+01 | 7.462+00 | 2.839+01 | 7.677+00 | 2.897+01 | 7.894+00 | 2.897+01 | 7.894+00 | 2.897+01 | 7.894+00 | 2.897+01 |  |
| 5.0+C5            | 4.612+00 | 2.563+01 | 4.748+00 | 2.590+01 | 4.884+00 | 2.618+01 | 5.030+00 | 2.645+01 | 5.174+00 | 2.672+01 | 5.174+00 | 2.672+01 | 5.174+00 | 2.672+01 |  |
| 6.0+C5            | 3.253+00 | 2.386+01 | 3.349+00 | 2.411+01 | 3.444+00 | 2.437+01 | 3.555+00 | 2.462+01 | 3.653+00 | 2.488+01 | 3.653+00 | 2.488+01 | 3.653+00 | 2.488+01 |  |
| 8.0+C5            | 1.866+00 | 2.110+01 | 1.922+00 | 2.133+01 | 1.988+00 | 2.156+01 | 2.179+00 | 2.199+01 | 2.201+00 | 2.201+01 | 2.201+00 | 2.201+01 | 2.201+00 | 2.201+01 |  |
| 1.0+06            | 1.298+00 | 1.905+01 | 1.245+00 | 1.925+01 | 1.283+00 | 1.946+01 | 1.321+00 | 1.966+01 | 1.361+00 | 1.987+01 | 1.361+00 | 1.987+01 | 1.361+00 | 1.987+01 |  |
| 1.5+06            | 5.433-01 | 5.555+01 | 5.621-01 | 5.572+01 | 5.793-01 | 5.848+01 | 5.971-01 | 6.106+01 | 6.173+01 | 6.243+01 | 6.157+01 | 6.243+01 | 6.157+01 | 6.243+01 |  |
| 2.0+06            | 3.088-01 | 1.329+01 | 3.184-01 | 1.364+01 | 3.282+01 | 1.358+01 | 3.384+01 | 1.373+01 | 3.486+01 | 1.387+01 | 3.486+01 | 1.387+01 | 3.486+01 | 1.387+01 |  |
| 3.0+06            | 1.331-01 | 1.047+01 | 1.424-01 | 1.059+01 | 1.463-01 | 1.070+01 | 1.514-01 | 1.082+01 | 1.560-01 | 1.093+01 | 1.560-01 | 1.093+01 | 1.560-01 | 1.093+01 |  |
| 4.0+06            | 7.782-02 | 8.742+00 | 8.026-02 | 8.838+00 | 8.276-02 | 8.934+00 | 8.535-02 | 9.030+00 | 8.798-02 | 9.126+00 | 8.798-02 | 9.126+00 | 8.798-02 | 9.126+00 |  |
| 5.0+06            | 4.936-02 | 7.552+00 | 5.143-02 | 7.635+00 | 5.304-02 | 7.718+00 | 5.477-02 | 7.801+00 | 5.639-02 | 7.884+00 | 5.639-02 | 7.884+00 | 5.639-02 | 7.884+00 |  |
| 6.0+06            | 3.466-02 | 6.677+00 | 3.575-02 | 6.750+00 | 3.681-02 | 6.823+00 | 3.802-02 | 6.897+00 | 3.920-02 | 6.970+00 | 3.920-02 | 6.970+00 | 3.920-02 | 6.970+00 |  |
| 8.0+06            | 1.951-02 | 5.463+00 | 2.012-02 | 5.523+00 | 2.075-02 | 5.583+00 | 2.140-02 | 5.643+00 | 2.206-02 | 5.703+00 | 2.206-02 | 5.703+00 | 2.206-02 | 5.703+00 |  |
| 1.0+07            | 1.249-02 | 4.653+00 | 1.288-02 | 4.705+00 | 1.329-02 | 4.756+00 | 1.370-02 | 4.807+00 | 1.413-02 | 4.858+00 | 1.413-02 | 4.858+00 | 1.413-02 | 4.858+00 |  |
| 1.5+07            | 5.531-03 | 3.445+00 | 5.727-03 | 3.582+00 | 5.906-03 | 3.520+00 | 6.092-03 | 3.558+00 | 6.281-03 | 3.596+00 | 6.281-03 | 3.596+00 | 6.281-03 | 3.596+00 |  |
| 2.0+07            | 3.123-03 | 2.765+00 | 3.222-03 | 2.795+00 | 3.323-03 | 2.826+00 | 3.427-03 | 2.856+00 | 3.534-03 | 2.886+00 | 3.534-03 | 2.886+00 | 3.534-03 | 2.886+00 |  |
| 3.0+07            | 1.358-03 | 2.013+00 | 1.432-03 | 2.035+00 | 1.447-03 | 2.057+00 | 1.523-03 | 2.079+00 | 1.570-03 | 2.102+00 | 1.570-03 | 2.102+00 | 1.570-03 | 2.102+00 |  |
| 4.0+07            | 7.809-04 | 1.600+00 | 8.056-04 | 1.617+00 | 8.30-04  | 1.635+00 | 8.570-04 | 1.654+00 | 8.835-04 | 1.670+00 | 8.835-04 | 1.670+00 | 8.835-04 | 1.670+00 |  |
| 5.0+07            | 4.997-04 | 1.335+00 | 5.155-04 | 1.350+00 | 5.317-04 | 1.365+00 | 5.484-04 | 1.379+00 | 5.654-04 | 1.394+00 | 5.654-04 | 1.394+00 | 5.654-04 | 1.394+00 |  |
| 6.0+07            | 3.410-04 | 1.161+00 | 3.579-04 | 1.163+00 | 3.69-04  | 1.176+00 | 3.808-04 | 1.188+00 | 3.926-04 | 1.201+00 | 3.926-04 | 1.201+00 | 3.926-04 | 1.201+00 |  |
| 8.0+07            | 1.952-04 | 9.074-01 | 2.014-04 | 9.174-01 | 2.077-04 | 9.273-01 | 2.142-04 | 9.373-01 | 2.209-04 | 9.473-01 | 2.209-04 | 9.473-01 | 2.209-04 | 9.473-01 |  |
| 1.0+08            | 1.249-04 | 7.531-01 | 1.289-04 | 7.614-01 | 1.322-04 | 7.697-01 | 1.371-04 | 7.780-01 | 1.413-04 | 7.862-01 | 1.413-04 | 7.862-01 | 1.413-04 | 7.862-01 |  |

TABLE II--CONT.

| PHOTON ENERGY, EV | COHERENT AND INCOHERENT SCATTERING CROSS SECTIONS, BARNS/ATOM |          |          |          |          |          | 100 FM   |          |          |          |          |          |
|-------------------|---------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                   | 96 CM                                                         | 97 BK    | 98 CF    | 99 ES    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    | COH      | INCOH    |
| 1.0+02            | 6.127+03                                                      | 2.728-02 | 6.255+03 | 2.692-02 | 6.386+03 | 2.711-02 | 6.516+03 | 2.675-02 | 6.649+03 | 2.635-02 | 6.644+03 | 5.853-02 |
| 1.5+02            | 6.122+03                                                      | 6.058-02 | 6.250+03 | 5.976-02 | 6.380+03 | 6.020-02 | 6.511+03 | 5.937-02 | 6.644+03 | 5.853-02 | 6.638+03 | 1.029-01 |
| 2.0+02            | 6.116+03                                                      | 1.065-01 | 6.244+03 | 1.051-01 | 6.375+03 | 1.058-01 | 6.506+03 | 1.043-01 | 6.621+03 | 2.245-01 | 6.621+03 | 1.029-01 |
| 3.0+02            | 6.099+03                                                      | 2.356-01 | 6.222+03 | 2.296-01 | 6.358+03 | 2.307-01 | 6.489+03 | 2.276-01 | 6.621+03 | 2.245-01 | 6.598+03 | 3.832-01 |
| 4.0+02            | 6.076+03                                                      | 3.975-01 | 6.204+03 | 3.926-01 | 6.334+03 | 3.934-01 | 6.666+03 | 3.882-01 | 6.598+03 | 3.832-01 | 6.598+03 | 3.832-01 |
| 5.0+02            | 6.047+03                                                      | 5.923-01 | 6.175+03 | 5.854-01 | 6.305+03 | 5.845-01 | 6.437+03 | 5.772-01 | 6.570+03 | 5.701-01 | 6.537+03 | 7.769-01 |
| 6.0+02            | 6.013+03                                                      | 8.054-01 | 6.14+03  | 7.999-01 | 6.273+03 | 7.952-01 | 6.404+03 | 7.859-01 | 6.537+03 | 7.769-01 | 6.537+03 | 7.769-01 |
| 8.0+02            | 5.933+03                                                      | 1.272+00 | 6.062+03 | 1.261+00 | 6.194+03 | 1.244+00 | 6.326+03 | 1.232+00 | 6.458+03 | 1.219+00 | 6.458+03 | 1.219+00 |
| 1.0+03            | 5.841+03                                                      | 1.744+00 | 5.969+03 | 1.731+00 | 6.104+03 | 1.701+00 | 6.236+03 | 1.686+00 | 6.368+03 | 1.670+00 | 6.368+03 | 1.670+00 |
| 1.5+03            | 5.583+03                                                      | 2.902+00 | 5.710+03 | 2.888+00 | 5.853+03 | 2.835+00 | 5.983+03 | 2.814+00 | 6.115+03 | 2.793+00 | 6.115+03 | 2.793+00 |
| 2.0+03            | 5.311+03                                                      | 4.055+00 | 5.43+03  | 4.042+00 | 5.583+03 | 3.982+00 | 5.713+03 | 3.963+00 | 5.843+03 | 3.936+00 | 5.843+03 | 3.936+00 |
| 3.0+03            | 4.766+03                                                      | 6.286+00 | 4.833+03 | 6.283+00 | 5.031+03 | 6.221+00 | 5.153+03 | 6.201+00 | 5.276+03 | 6.178+00 | 5.276+03 | 6.178+00 |
| 4.0+03            | 4.255+03                                                      | 8.344+00 | 4.36+03  | 8.355+00 | 4.495+03 | 8.299+00 | 4.608+03 | 8.289+00 | 4.722+03 | 8.276+00 | 4.722+03 | 8.276+00 |
| 5.0+03            | 3.805+03                                                      | 1.022+01 | 3.900+03 | 1.025+01 | 4.017+03 | 1.020+01 | 4.118+03 | 1.021+01 | 4.221+03 | 1.021+01 | 4.221+03 | 1.021+01 |
| 6.0+03            | 3.419+03                                                      | 1.192+01 | 3.503+03 | 1.196+01 | 3.655+03 | 1.194+01 | 3.694+03 | 1.196+01 | 3.785+03 | 1.197+01 | 3.785+03 | 1.197+01 |
| 8.0+03            | 2.801+03                                                      | 1.504+01 | 2.860+03 | 1.502+01 | 2.944+03 | 1.503+01 | 3.015+03 | 1.501+01 | 3.088+03 | 1.511+01 | 3.088+03 | 1.511+01 |
| 1.0+04            | 2.333+03                                                      | 1.761+01 | 2.388+03 | 1.771+01 | 2.449+03 | 1.775+01 | 2.506+03 | 1.783+01 | 2.566+03 | 1.789+01 | 2.566+03 | 1.789+01 |
| 1.5+04            | 1.579+03                                                      | 2.305+01 | 1.617+03 | 2.322+01 | 1.657+03 | 2.332+01 | 1.696+03 | 2.34+01  | 1.735+03 | 2.357+01 | 1.735+03 | 2.357+01 |
| 2.0+04            | 1.137+03                                                      | 2.655+01 | 1.166+03 | 2.715+01 | 1.196+03 | 2.731+01 | 1.226+03 | 2.749+01 | 1.256+03 | 2.765+01 | 1.256+03 | 2.765+01 |
| 3.0+04            | 6.619+02                                                      | 3.194+01 | 6.791+02 | 3.220+01 | 6.971+02 | 3.244+01 | 7.150+02 | 3.266+01 | 7.332+02 | 3.292+01 | 7.332+02 | 3.292+01 |
| 4.0+04            | 4.406+02                                                      | 3.500+01 | 4.520+02 | 3.528+01 | 4.633+02 | 3.555+01 | 4.757+02 | 3.582+01 | 4.877+02 | 3.609+01 | 4.877+02 | 3.609+01 |
| 5.0+04            | 3.154+02                                                      | 3.650+01 | 3.236+02 | 3.720+01 | 3.322+02 | 3.749+01 | 3.407+02 | 3.778+01 | 3.494+02 | 3.807+01 | 3.494+02 | 3.807+01 |
| 6.0+04            | 2.361+02                                                      | 3.804+01 | 2.424+02 | 3.836+01 | 2.489+02 | 3.867+01 | 2.554+02 | 3.899+01 | 2.620+02 | 3.929+01 | 2.620+02 | 3.929+01 |
| 8.0+04            | 1.464+02                                                      | 3.857+01 | 1.503+02 | 3.931+01 | 1.543+02 | 3.956+01 | 1.584+02 | 3.998+01 | 1.625+02 | 4.032+01 | 1.625+02 | 4.032+01 |
| 1.0+05            | 1.003+02                                                      | 3.899+01 | 1.030+02 | 3.934+01 | 1.058+02 | 3.969+01 | 1.086+02 | 4.003+01 | 1.114+02 | 4.037+01 | 1.114+02 | 4.037+01 |
| 1.5+05            | 4.912+01                                                      | 3.760+01 | 5.046+01 | 3.795+01 | 5.184+01 | 3.822+01 | 5.385+01 | 3.850+01 | 5.463+01 | 3.900+01 | 5.463+01 | 3.900+01 |
| 2.0+05            | 2.917+01                                                      | 3.569+01 | 2.96+01  | 3.603+01 | 3.077+01 | 3.636+01 | 3.158+01 | 3.672+01 | 3.241+01 | 3.705+01 | 3.241+01 | 3.705+01 |
| 3.0+05            | 1.387+01                                                      | 3.212+01 | 1.425+01 | 3.243+01 | 1.464+01 | 3.274+01 | 1.503+01 | 3.307+01 | 1.543+01 | 3.338+01 | 1.543+01 | 3.338+01 |
| 4.0+05            | 8.113+00                                                      | 2.927+01 | 8.38+00  | 2.956+01 | 8.563+00 | 2.984+01 | 8.777+00 | 3.01+01  | 9.037+01 | 3.044+01 | 9.037+01 | 3.044+01 |
| 5.0+05            | 5.319+00                                                      | 2.699+01 | 5.469+00 | 2.727+01 | 5.622+00 | 2.753+01 | 5.777+00 | 2.781+01 | 5.934+00 | 2.808+01 | 5.934+00 | 2.808+01 |
| 6.0+05            | 3.757+00                                                      | 2.513+01 | 3.863+00 | 2.539+01 | 3.973+00 | 2.564+01 | 4.084+00 | 2.590+01 | 4.196+00 | 2.615+01 | 4.196+00 | 2.615+01 |
| 8.0+05            | 2.159+00                                                      | 2.224+01 | 2.222+00 | 2.247+01 | 2.285+00 | 2.269+01 | 2.350+00 | 2.292+01 | 2.416+00 | 2.315+01 | 2.416+00 | 2.315+01 |
| 1.0+06            | 1.400+00                                                      | 2.008+01 | 1.441+00 | 2.028+01 | 1.483+00 | 2.049+01 | 1.526+00 | 2.070+01 | 1.569+00 | 2.090+01 | 1.569+00 | 2.090+01 |
| 1.5+06            | 6.333+01                                                      | 1.639+01 | 6.521+01 | 1.656+01 | 6.713+01 | 1.673+01 | 6.909+01 | 1.690+01 | 7.109+01 | 1.707+01 | 7.109+01 | 1.707+01 |
| 2.0+06            | 3.591+01                                                      | 1.402+01 | 3.698+01 | 1.416+01 | 3.809+01 | 1.431+01 | 4.036+01 | 1.446+01 | 4.036+01 | 1.460+01 | 4.036+01 | 1.460+01 |
| 3.0+06            | 1.607+01                                                      | 1.105+01 | 1.656+01 | 1.116+01 | 1.705+01 | 1.128+01 | 1.757+01 | 1.139+01 | 1.809+01 | 1.151+01 | 1.809+01 | 1.151+01 |
| 4.0+06            | 9.064+02                                                      | 9.222+00 | 9.340+02 | 9.317+00 | 9.624+02 | 9.413+00 | 9.912+02 | 9.509+00 | 1.021+01 | 9.605+00 | 1.021+01 | 9.605+00 |
| 5.0+06            | 5.810+02                                                      | 7.967+00 | 5.981+02 | 8.050+00 | 6.169+02 | 8.132+00 | 6.354+02 | 8.298+00 | 6.544+02 | 8.298+00 | 6.544+02 | 8.298+00 |
| 6.0+06            | 4.039+02                                                      | 7.033+00 | 4.162+02 | 7.116+00 | 4.281+02 | 7.190+00 | 4.418+02 | 7.265+00 | 4.550+02 | 7.336+00 | 4.550+02 | 7.336+00 |
| 8.0+06            | 2.274+02                                                      | 5.763+00 | 2.343+02 | 5.823+00 | 2.415+02 | 5.883+00 | 2.487+02 | 5.943+00 | 2.562+02 | 6.003+00 | 2.562+02 | 6.003+00 |
| 1.0+07            | 1.456+02                                                      | 4.909+00 | 1.500+02 | 4.966+00 | 1.546+02 | 5.011+00 | 1.593+02 | 5.062+00 | 1.640+02 | 5.113+00 | 1.640+02 | 5.113+00 |
| 1.5+07            | 6.472+02                                                      | 3.334+00 | 6.670+02 | 3.672+00 | 6.874+02 | 3.710+00 | 7.082+02 | 3.747+00 | 7.295+02 | 3.785+00 | 7.295+02 | 3.785+00 |
| 2.0+07            | 3.641+02                                                      | 2.917+00 | 3.755+02 | 2.947+00 | 3.868+02 | 3.978+00 | 3.985+02 | 3.988+00 | 4.104+02 | 3.038+00 | 4.104+02 | 3.038+00 |
| 3.0+07            | 1.618+02                                                      | 2.124+00 | 1.668+02 | 2.145+00 | 1.719+02 | 2.163+00 | 1.771+02 | 2.190+00 | 2.122+02 | 2.122+00 | 2.122+02 | 2.122+00 |
| 4.0+07            | 9.105+02                                                      | 1.688+00 | 9.384+02 | 1.705+00 | 9.671+02 | 1.723+00 | 9.964+02 | 1.740+00 | 1.026+03 | 1.758+00 | 1.026+03 | 1.758+00 |
| 5.0+07            | 5.827+02                                                      | 1.409+00 | 6.053+02 | 1.423+00 | 6.189+02 | 1.438+00 | 6.376+02 | 1.453+00 | 6.568+02 | 1.467+00 | 6.568+02 | 1.467+00 |
| 6.0+07            | 4.045+02                                                      | 1.214+00 | 4.169+02 | 1.226+00 | 4.297+02 | 1.239+00 | 4.427+02 | 1.252+00 | 4.560+02 | 1.264+00 | 4.560+02 | 1.264+00 |
| 8.0+07            | 2.276+02                                                      | 9.572+01 | 2.346+02 | 9.672+01 | 2.418+02 | 9.772+01 | 2.491+02 | 9.872+01 | 2.566+02 | 9.971+01 | 2.566+02 | 9.971+01 |
| 1.0+08            | 1.457+04                                                      | 7.945+01 | 1.501+04 | 8.028+01 | 1.547+04 | 8.111+01 | 1.594+04 | 8.193+01 | 1.642+04 | 8.276+01 | 1.642+04 | 8.276+01 |

TABLE III. Mork radiative and double-Compton corrections

| Photon<br>energy,<br>eV | Mork<br>correction<br>factor | Photon<br>energy,<br>eV | Mork<br>correction<br>factor |
|-------------------------|------------------------------|-------------------------|------------------------------|
| 1.0 + 04                | (1.00001)                    | 1.0 + 06                | 1.00095                      |
| 1.5 + 04                | (1.00002)                    | 1.5 + 06                | 1.00134                      |
| 2.0 + 04                | (1.00002)                    | 2.0 + 06                | 1.00166                      |
| 3.0 + 04                | (1.00003)                    | 3.0 + 06                | 1.00211                      |
| 4.0 + 04                | (1.00004)                    | 4.0 + 06                | 1.00239                      |
| 5.0 + 04                | (1.00005)                    | 5.0 + 06                | 1.00259                      |
| 6.0 + 04                | (1.00006)                    | 6.0 + 06                | 1.00275                      |
| 8.0 + 04                | (1.00008)                    | 8.0 + 06                | 1.00305                      |
| 1.0 + 05                | (1.00010)                    | 1.0 + 07                | 1.00332                      |
| 1.5 + 05                | (1.00015)                    | 1.5 + 07                | 1.00400                      |
| 2.0 + 05                | (1.00020)                    | 2.0 + 07                | 1.00462                      |
| 3.0 + 05                | (1.00030)                    | 3.0 + 07                | 1.00571                      |
| 4.0 + 05                | 1.00040                      | 4.0 + 07                | 1.00665                      |
| 5.0 + 05                | 1.00050                      | 5.0 + 07                | 1.00742                      |
| 6.0 + 05                | 1.00059                      | 6.0 + 07                | 1.00810                      |
| 8.0 + 05                | 1.00077                      | 8.0 + 07                | 1.00910                      |
|                         |                              | 1.0 + 08                | 1.00950                      |

TABLE IV. ATOMIC FORM FACTOR, F, AND INCOHERENT SCATTERING FUNCTION, S,  
VS. X IN INVERSE ANGSTROMS, FOR ATOMIC AND BONDED HYDROGEN

| X,<br>SIN(THETA/2) | H-ATOM, PIRENNE,<br>FROM TABLE I. | BONDED H, FLATTED SPHERE,<br>STEWART, ET AL (1965) | H IN H <sub>2</sub> MOLECULE,<br>BENTLEY AND STEWART (1973) |                           |
|--------------------|-----------------------------------|----------------------------------------------------|-------------------------------------------------------------|---------------------------|
| /LAMBDA            | F(X,H)                            | S(X,H)                                             | F(X,(1/2)H <sub>2</sub> )                                   | S(X,(1/2)H <sub>2</sub> ) |
| 0.00               | 1.0000+00                         | 0.0000                                             | 1.0000+00                                                   | (0.0000 )                 |
| 5.00-03            | 9.9945-01                         | 1.1047-03                                          | 9.9959-01                                                   | (8.2851-04)               |
| 1.00-02            | 9.9779-01                         | 4.4098-03                                          | 9.9835-01                                                   | (3.3072-03)               |
| 1.50-02            | 9.9504-01                         | 9.8880-03                                          | 9.9628-01                                                   | (7.4157-03)               |
| 2.00-02            | 9.9121-01                         | 1.7494-02                                          | 9.9342-01                                                   | (1.3120-02)               |
| 2.50-02            | 9.8632-01                         | 2.7167-02                                          | 9.8976-01                                                   | (2.0374-02)               |
| 3.00-02            | 9.8039-01                         | 3.8828-02                                          | 9.8533-01                                                   | (2.9116-02)               |
| 4.00-02            | 9.6554-01                         | 6.7731-02                                          | 9.7419-01                                                   | (5.0960-02)               |
| 5.00-02            | 9.4693-01                         | 1.0332-01                                          | 9.6012-01                                                   | (7.8173-02)               |
| 7.00-02            | 8.9987-01                         | 1.9024-01                                          | 9.2417-01                                                   | (1.4591-01)               |
| 9.00-02            | 8.4238-01                         | 2.9039-01                                          | 8.7938-01                                                   | (2.2670-01)               |
| 1.00-01            | 8.1082-01                         | 3.4257-01                                          | 8.5424-01                                                   | (2.7028-01)               |
| 1.25-01            | 7.2711-01                         | 4.7131-01                                          | 7.8605-01                                                   | (3.8213-01)               |
| 1.50-01            | 6.4129-01                         | 5.8874-01                                          | 7.1338-01                                                   | (4.9108-01)               |
| 1.75-01            | 5.5811-01                         | 6.2851-01                                          | 6.3981-01                                                   | (5.9065-01)               |
| 2.00-01            | 4.8078-01                         | 7.6685-01                                          | 5.6794-01                                                   | (6.7744-01)               |
| 2.50-01            | 3.4974-01                         | 8.7768-01                                          | 4.3794-01                                                   | (8.0821-01)               |
| 3.00-01            | 2.5127-01                         | 9.3687-01                                          | 3.3123-01                                                   | (8.9028-01)               |
| 4.00-01            | 1.3044-01                         | 9.8298-01                                          | 1.8443-01                                                   | (9.6599-01)               |
| 5.00-01            | 7.0592-02                         | 9.9502-01                                          | 1.0306-01                                                   | (9.8938-01)               |
| 6.00-01            | 4.0325-02                         | 9.9837-01                                          | 5.9542-02                                                   | (9.9645-01)               |
| 7.00-01            | 2.4285-02                         | 9.9941-01                                          | 3.5945-02                                                   | (9.9871-01)               |
| 8.00-01            | 1.5335-02                         | 9.9977-01                                          | 2.2377-02                                                   | (9.9950-01)               |
| 9.00-01            | 1.0091-02                         | 9.9990-01                                          | 1.4109-02                                                   | (9.9980-01)               |
| 1.00+00            | 6.8811-03                         | 9.9995-01                                          | 9.1052-03                                                   | (9.9992-01)               |
| 1.25+00            | 2.9947-03                         | 9.9999-01                                          | 3.4502-03                                                   | (9.9999-01)               |
| 1.50+00            | 1.4937-03                         | 1.0000+00                                          | 1.8306-03                                                   | (1.0000+00)               |
| 2.00+00            | 4.8903-04                         | 1.0000+00                                          | 4.5462-04                                                   | (1.0000+00)               |
| 2.50+00            | 2.0353-04                         | 1.0000+00                                          | 1.4897-04                                                   | (1.0000+00)               |
| 3.00+00            | 9.9016-05                         | 1.0000+00                                          | 5.9868-05                                                   | (1.0000+00)               |
| 3.50+00            | 5.3730-05                         | 1.0000+00                                          | 2.7698-05                                                   | (1.0000+00)               |
| 4.00+00            | 3.1604-05                         | 1.0000+00                                          | 1.4207-05                                                   | (1.0000+00)               |
| 5.00+00            | 1.2997-05                         | 1.0000+00                                          | 4.6554-06                                                   | (1.0000+00)               |
| 6.00+00            | 6.2819-06                         | 1.0000+00                                          | 1.8709-06                                                   | (1.0000+00)               |
| 7.00+00            | 3.3953-06                         | 1.0000+00                                          | 8.6559-07                                                   | (1.0000+00)               |
| 8.00+00            | 1.9920-06                         | 1.0000+00                                          | 4.4397-07                                                   | (1.0000+00)               |
| 1.00+01            | 8.1675-07                         | 1.0000+00                                          | 1.4548-07                                                   | (1.0000+00)               |
| 1.50+01            | 1.6150-07                         | 1.0000+00                                          | 1.9158-08                                                   | (1.0000+00)               |
| 2.00+01            | 5.1116-08                         | 1.0000+00                                          | 4.5462-09                                                   | (1.0000+00)               |
| 5.00+01            | 1.3091-09                         | 1.0000+00                                          | 4.6554-11                                                   | (1.0000+00)               |
| 8.00+01            | 1.9976-10                         | 1.0000+00                                          | 4.4397-12                                                   | (1.0000+00)               |
| 1.00+02            | 8.1822-11                         | 1.0000+00                                          | 1.4548-12                                                   | (1.0000+00)               |
| 1.00+03            | 8.1823-15                         | 1.0000+00                                          | 1.4548-17                                                   | (1.0000+00)               |
| 1.00+06            | 8.1823-27                         | 1.0000+00                                          | 1.4548-32                                                   | (1.0000+00)               |
| 1.00+09            | 8.1823-39                         | 1.0000+00                                          | 0.0000                                                      | (1.0000+00)               |

TABLE V. CROSS SECTIONS (BARNs/ATOM) FOR COHERENT AND INCOHERENT SCATTERING OF PHOTONS BY ATOMIC AND BONDED HYDROGEN, ALSO THE FREE-ELECTRON COMPTON SCATTERING CROSS SECTION (BARNs/ELECTRON)

| PHOTON ENERGY EV | H-ATOM, PIRENNE,<br>FROM TABLE II. |          | BONDED-H, FLOATING SPHERE,<br>STEWART, ET AL (1965) |       | H IN H <sub>2</sub> MOLECULE,<br>BENTLEY AND STEWART (1973) |          | FREE ELECTRON,<br>KLEIN-NISHINA |
|------------------|------------------------------------|----------|-----------------------------------------------------|-------|-------------------------------------------------------------|----------|---------------------------------|
|                  | COH                                | INCOH    | COH                                                 | INCOH | COH                                                         | INCOH    | COMPTON                         |
| 1.0+02           | 6.650-01                           | 9.552-04 | 6.650-01 (7.163-04)                                 |       | 1.330+00                                                    | 8.558-04 | 6.650-01                        |
| 1.5+02           | 6.635-01                           | 2.144-03 | 6.639-01 (1.608-03)                                 |       | 1.327+00                                                    | 1.802-03 | 6.649-01                        |
| 2.0+02           | 6.617-01                           | 3.802-03 | 6.626-01 (2.851-03)                                 |       | 1.324+00                                                    | 3.088-03 | 6.647-01                        |
| 3.0+02           | 6.569-01                           | 8.494-03 | 6.590-01 (6.370-03)                                 |       | 1.316+00                                                    | 6.685-03 | 6.645-01                        |
| 4.0+02           | 6.503-01                           | 1.496-02 | 6.540-01 (1.122-02)                                 |       | 1.305+00                                                    | 1.163-02 | 6.642-01                        |
| 5.0+02           | 6.421-01                           | 2.310-02 | 6.479-01 (1.734-02)                                 |       | 1.291+00                                                    | 1.787-02 | 6.639-01                        |
| 6.0+02           | 6.323-01                           | 3.279-02 | 6.405-01 (2.469-02)                                 |       | 1.274+00                                                    | 2.533-02 | 6.637-01                        |
| 8.0+02           | 6.087-01                           | 6.629-02 | 6.224-01 (4.268-02)                                 |       | 1.233+00                                                    | 4.357-02 | 6.632-01                        |
| 1.0+03           | 5.806-01                           | 8.424-02 | 6.005-01 (6.445-02)                                 |       | 1.183+00                                                    | 6.557-02 | 6.627-01                        |
| 1.5+03           | 4.984-01                           | 1.650-01 | 5.338-01 (1.300-01)                                 |       | 1.035+00                                                    | 1.313-01 | 6.614-01                        |
| 2.0+03           | 4.142-01                           | 2.478-01 | 4.606-01 (2.018-01)                                 |       | 8.750-01                                                    | 2.024-01 | 6.601-01                        |
| 3.0+03           | 2.764-01                           | 3.822-01 | 3.278-01 (3.313-01)                                 |       | 5.968-01                                                    | 3.295-01 | 6.576-01                        |
| 4.0+03           | 1.881-01                           | 4.675-01 | 2.320-01 (4.239-01)                                 |       | 4.083-01                                                    | 4.206-01 | 6.550-01                        |
| 5.0+03           | 1.341-01                           | 5.187-01 | 1.687-01 (4.842-01)                                 |       | 2.905-01                                                    | 4.809-01 | 6.526-01                        |
| 6.0+03           | 9.987-02                           | 5.503-01 | 1.271-01 (5.231-01)                                 |       | 2.160-01                                                    | 5.202-01 | 6.501-01                        |
| 8.0+03           | 6.126-02                           | 5.840-01 | 7.899-02 (5.663-01)                                 |       | 1.327-01                                                    | 5.643-01 | 6.452-01                        |
| 1.0+04           | 4.121-02                           | 5.993-01 | 5.362-02 (5.868-01)                                 |       | 8.934-02                                                    | 5.855-01 | 6.405-01                        |
| 1.5+04           | 1.943-02                           | 6.095-01 | 2.561-02 (6.033-01)                                 |       | 4.211-02                                                    | 6.026-01 | 6.290-01                        |
| 2.0+04           | 1.119-02                           | 6.068-01 | 1.484-02 (6.031-01)                                 |       | 2.423-02                                                    | 6.027-01 | 6.180-01                        |
| 3.0+04           | 5.062-03                           | 5.924-01 | 6.745-03 (5.908-01)                                 |       | 1.096-02                                                    | 5.905-01 | 5.975-01                        |
| 4.0+04           | 2.866-03                           | 5.759-01 | 3.826-03 (5.749-01)                                 |       | 6.202-03                                                    | 5.748-01 | 5.788-01                        |
| 5.0+04           | 1.840-03                           | 5.597-01 | 2.458-03 (5.591-01)                                 |       | 3.981-03                                                    | 5.590-01 | 5.615-01                        |
| 6.0+04           | 1.280-03                           | 5.444-01 | 1.711-03 (5.439-01)                                 |       | 2.769-03                                                    | 5.439-01 | 5.457-01                        |
| 8.0+04           | 7.211-04                           | 5.166-01 | 9.643-04 (5.164-01)                                 |       | 1.560-03                                                    | 5.163-01 | 5.173-01                        |
| 1.0+05           | 4.619-04                           | 4.923-01 | 6.178-04 (4.922-01)                                 |       | 9.993-04                                                    | 4.922-01 | 4.928-01                        |
| 1.5+05           | 2.054-04                           | 4.433-01 | 2.748-04 (4.434-01)                                 |       | 4.444-04                                                    | 4.434-01 | 4.437-01                        |
| 2.0+05           | 1.156-04                           | 4.064-01 | 1.546-04 (4.064-01)                                 |       | 2.501-04                                                    | 4.064-01 | 4.066-01                        |
| 3.0+05           | 5.138-05                           | 3.535-01 | 6.875-05 (3.535-01)                                 |       | 1.112-04                                                    | 3.535-01 | 3.536-01                        |
| 4.0+05           | 2.890-05                           | 3.168-01 | 3.867-05 (3.168-01)                                 |       | 6.253-05                                                    | 3.168-01 | 3.168-01                        |
| 5.0+05           | 1.850-05                           | 2.893-01 | 2.475-05 (2.893-01)                                 |       | 4.002-05                                                    | 2.893-01 | 2.893-01                        |
| 6.0+05           | 1.285-05                           | 2.676-01 | 1.719-05 (2.676-01)                                 |       | 2.779-05                                                    | 2.676-01 | 2.677-01                        |
| 8.0+05           | 7.226-06                           | 2.351-01 | 9.669-06 (2.351-01)                                 |       | 1.563-05                                                    | 2.351-01 | 2.351-01                        |
| 1.0+06           | 4.625-06                           | 2.114-01 | 6.186-06 (2.114-01)                                 |       | 1.001-05                                                    | 2.114-01 | 2.114-01                        |
| 1.5+06           | 2.056-06                           | 1.718-01 | 2.750-06 (1.718-01)                                 |       | 4.447-06                                                    | 1.718-01 | 1.718-01                        |
| 2.0+06           | 1.156-06                           | 1.466-01 | 1.547-06 (1.466-01)                                 |       | 2.501-06                                                    | 1.466-01 | 1.466-01                        |
| 3.0+06           | 5.139-07                           | 1.153-01 | 6.876-07 (1.153-01)                                 |       | 1.112-06                                                    | 1.153-01 | 1.153-01                        |
| 4.0+06           | 2.891-07                           | 9.620-02 | 3.868-07 (9.620-02)                                 |       | 6.254-07                                                    | 9.620-02 | 9.620-02                        |
| 5.0+06           | 1.850-07                           | 8.308-02 | 2.475-07 (8.308-02)                                 |       | 4.002-07                                                    | 8.308-02 | 8.308-02                        |
| 6.0+06           | 1.285-07                           | 7.343-02 | 1.719-07 (7.343-02)                                 |       | 2.780-07                                                    | 7.343-02 | 7.343-02                        |
| 8.0+06           | 7.227-08                           | 6.007-02 | 9.670-08 (6.007-02)                                 |       | 1.564-07                                                    | 6.007-02 | 6.007-02                        |
| 1.0+07           | 4.625-08                           | 5.116-02 | 6.188-08 (5.116-02)                                 |       | 1.001-07                                                    | 5.116-02 | 5.116-02                        |
| 1.5+07           | 2.056-08                           | 3.786-02 | 2.750-08 (3.786-02)                                 |       | 4.447-08                                                    | 3.786-02 | 3.786-02                        |
| 2.0+07           | 1.156-08                           | 3.039-02 | 1.547-08 (3.039-02)                                 |       | 2.501-08                                                    | 3.039-02 | 3.039-02                        |
| 3.0+07           | 5.139-09                           | 2.212-02 | 6.876-09 (2.212-02)                                 |       | 1.112-08                                                    | 2.212-02 | 2.212-02                        |
| 4.0+07           | 2.890-09                           | 1.758-02 | 3.867-09 (1.758-02)                                 |       | 6.253-09                                                    | 1.758-02 | 1.758-02                        |
| 5.0+07           | 1.850-09                           | 1.467-02 | 2.475-09 (1.467-02)                                 |       | 4.001-09                                                    | 1.467-02 | 1.467-02                        |
| 6.0+07           | 1.284-09                           | 1.264-02 | 1.719-09 (1.264-02)                                 |       | 2.779-09                                                    | 1.264-02 | 1.264-02                        |
| 8.0+07           | 7.222-10                           | 9.972-03 | 9.664-10 (9.972-03)                                 |       | 1.562-09                                                    | 9.972-03 | 9.972-03                        |
| 1.0+08           | 4.620-10                           | 8.276-03 | 6.183-10 (8.276-03)                                 |       | 9.996-10                                                    | 8.276-03 | 8.276-03                        |

TABLE VI. Abbreviated table of Cromer-Waber relativistic Hartree-Fock (RHF) atomic form factors  $F(x, Z)$  abstracted from the extensive tabulation (all elements  $Z=1$  to 98, 112 ions, valence-state C and Si;  $x=0$  to  $2.0 \text{ \AA}^{-1}$ ) in the International Tables for X-Ray Crystallography (reference [14], table 2.2A).

| $x \setminus Z$   | $_2\text{He}$          | $_3\text{Li}$ | $_4\text{Be}$ | $_5\text{B}$ | $_6\text{C}$ | $_7\text{N}$ | $_8\text{O}$ | $^{13}\text{Al}$ | $^{29}\text{Cu}$ | $^{50}\text{Sn}$ | $^{74}\text{W}$ | $^{82}\text{Pb}$ | $^{92}\text{U}$ | $^{98}\text{Cf}$ |
|-------------------|------------------------|---------------|---------------|--------------|--------------|--------------|--------------|------------------|------------------|------------------|-----------------|------------------|-----------------|------------------|
| $\text{\AA}^{-1}$ | $F(x, Z)_{\text{RHF}}$ |               |               |              |              |              |              |                  |                  |                  |                 |                  |                 |                  |
| 0.0               | 2.000                  | 3.000         | 4.000         | 5.000        | 6.000        | 7.000        | 8.000        | 13.000           | 29.000           | 50.000           | 74.000          | 82.000           | 92.000          | 98.000           |
| 0.01              | 1.988                  | 2.986         | 3.987         | 4.988        | 5.990        | 6.991        | 7.992        | 12.976           | 28.977           | 49.955           | 73.948          | 81.949           | 91.922          | 97.929           |
| .02               | 1.993                  | 2.947         | 3.950         | 4.954        | 5.958        | 6.963        | 7.967        | 12.903           | 28.908           | 49.821           | 73.793          | 81.792           | 91.687          | 97.718           |
| .05               | 1.957                  | 2.708         | 3.707         | 4.724        | 5.749        | 6.776        | 7.798        | 12.439           | 28.448           | 48.934           | 72.767          | 80.750           | 90.180          | 96.344           |
| .10               | 1.837                  | 2.215         | 3.065         | 4.060        | 5.107        | 6.180        | 7.245        | 11.230           | 27.084           | 46.361           | 69.778          | 77.607           | 86.130          | 92.486           |
| .2                | 1.460                  | 1.742         | 2.060         | 2.699        | 3.560        | 4.563        | 5.623        | 9.158            | 23.540           | 40.302           | 62.519          | 69.530           | 77.080          | 83.210           |
| .5                | .509                   | 1.033         | 1.362         | 1.526        | 1.685        | 1.942        | 2.338        | 5.692            | 13.707           | 26.096           | 43.691          | 48.969           | 55.410          | 59.078           |
| 1.0               | .095                   | .320          | .622          | .900         | 1.114        | 1.265        | 1.377        | 2.330            | 7.166            | 16.384           | 25.576          | 30.252           | 35.458          | 38.361           |
| 2.0               | .010                   | .044          | .120          | .233         | .373         | .525         | .674         | 1.195            | 3.855            | 7.367            | 13.871          | 15.317           | 17.713          | 19.655           |

TABLE VII. Percent deviations of present (table I)  $F(x, Z)$  values [configuration-interaction (CI) for  $Z=2$  to 6, non-relativistic Hartree-Fock (HF) for  $Z=7$  to 100] from Cromer-Waber [14] relativistic Hartree-Fock (RHF)  $F(x, Z)$  values listed in table VI.

[Percent]

| $x \setminus Z$   | $_2\text{He}$                                                   | $_3\text{Li}$ | $_4\text{Be}$ | $_5\text{B}$ | $_6\text{C}$ | $_7\text{N}$ | $_8\text{O}$                                                    | $^{13}\text{Al}$ | $^{29}\text{Cu}$ | $^{50}\text{Sn}$ | $^{74}\text{W}$ | $^{82}\text{Pb}$ | $^{92}\text{U}$ | $^{98}\text{Cf}$ |
|-------------------|-----------------------------------------------------------------|---------------|---------------|--------------|--------------|--------------|-----------------------------------------------------------------|------------------|------------------|------------------|-----------------|------------------|-----------------|------------------|
| $\text{\AA}^{-1}$ | $[F(x, Z)_{\text{CI}}/F(x, Z)_{\text{RHF}} - 1.0] \times 100\%$ |               |               |              |              |              | $[F(x, Z)_{\text{HF}}/F(x, Z)_{\text{RHF}} - 1.0] \times 100\%$ |                  |                  |                  |                 |                  |                 |                  |
| 0.0               |                                                                 |               |               |              |              |              |                                                                 |                  |                  |                  |                 |                  |                 |                  |
| 0.01              | 0                                                               | +0.02         | +0.03         | 0            | 0            | -0.17        | -0.01                                                           | -0.02            | -0.03            | -0.02            | -0.04           | -0.02            | -0.03           | -0.03            |
| 0.02              | 0                                                               | 0             | +0.06         | 0            | +0.02        | 0            | 0                                                               | 0                | -0.01            | -0.01            | -0.02           | -0.03            | -0.05           | -0.05            |
| 0.05              | 0                                                               | +0.10         | +0.39         | +0.06        | +0.09        | 0            | -0.01                                                           | 0                | 0                | -0.06            | -0.10           | -0.15            | -0.20           | -0.18            |
| 0.10              | -0.03                                                           | +0.18         | +1.06         | +0.20        | +0.30        | +0.07        | -0.01                                                           | -0.04            | -0.01            | -0.19            | -0.25           | -0.42            | -0.40           | -0.23            |
| 0.2               | -0.10                                                           | +0.03         | +0.83         | +0.46        | +0.49        | +0.06        | -0.06                                                           | -0.03            | -0.01            | -0.22            | -0.32           | -0.44            | -0.49           | -0.03            |
| 0.5               | +0.10                                                           | -0.16         | -0.10         | 0            | +0.04        | -0.22        | -0.12                                                           | -0.10            | -0.29            | -0.63            | -0.61           | -1.04            | -1.03           | -0.99            |
| 1.0               | +1.18                                                           | 0             | -0.23         | -0.14        | -0.17        | -0.24        | -0.05                                                           | -0.22            | -0.59            | -1.09            | -1.93           | -1.69            | -2.26           | -2.84            |
| 2.0               | 0                                                               | +1.84         | 0             | 0            | -0.26        | 0.25         | -0.30                                                           | -0.22            | -1.60            | -2.86            | -4.01           | -4.73            | -6.10           | -6.41            |