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CROSS SECTIONS FOR ELECTRON CAPTURE IN RELATIVISTIC ATOMIC COLLISIONS

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Cross sections for the capture of electrons from single-electron targets into bare projectiles moving at relativistic velocities are calculated using the relativistic eikonal approximation. The calculations are performed for projectile energies between 0.2 and 10^4 GeV/u and for projectile–target combinations that presumably are of interest for future experiments, namely Au and U colliding with C, Al, Cu, Ag, Au, and U and *vice versa*. State-to-state cross sections are given for initial and final $1s_{1/2}$, $2s_{1/2}$, $2p_{1/2}$, and $2p_{3/2}$ states.

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CONTENTS

INTRODUCTION

With the currently developing possibilities to accelerate highly stripped high-Z ions to relativistic velocities, new frontiers are opened up in atomic structure as well as in atomic collision physics. The basic atomic processes, namely excitation, ionization, electron capture, and electron–positron pair production, are being studied both experimentally and theoretically. For a recent review see Ref. 1.

Atomic structure studies of high-Z few-electron atoms such as hydrogen-like or helium-like gold and uranium atoms[2] may serve as a testing ground for quantum electrodynamics (QED) in the nonperturbative domain of strong fields. The starting point for experimental investigations of one- or two-electron systems will always be the production of this species in a specific quantum state. One way to achieve this is by electron capture into the bare or one-electron ion, respectively.[2] Similar requirements arise in other types of studies. In order to design and analyze the experiments, it is important to have realistic estimates for state-to-state cross sections between the lowest few hydrogenic levels of target and projectile.

It should be mentioned that there are two distinct additional processes which lead to the same final projectile state, namely an ion with a bound electron. The first one is radiative electron capture (REC), in which a photon is emitted simultaneously with electron capture. Since the photon carries away energy and momentum, the behavior of the REC cross section is different from that of direct capture. In particular, for high-Z projectiles and low-Z targets, the REC cross section exceeds the cross section for direct capture.[1] The second process is bound–free pair production. In this case, for sufficiently high projectile energies, a free positron may be created along with an electron in a bound projectile (or target) state. Since this cannot be treated as a two-step process of pair creation and subsequent capture, the estimates given in this paper are not applicable. In fact, at projectile energies greater than a few tens of GeV/u, bound–free pair production by far exceeds direct capture, at 10^4 GeV/u by as much as several orders of magnitude.[1] Nevertheless, as the two processes discussed here are theoretically distinct and, in principle, distinguishable experimentally, it will be useful to have estimates for direct capture, even in an energy range where it is no longer dominant.

For collisions between high-Z ions in the energy range of up to 1 GeV/u, the theoretically most satisfactory treatment is provided by two-center coupled-channel calculations[3]; however, these calculations are extremely time-consuming and must be repeated for each projectile–target combination. Moreover, the convergence of the expansion is difficult to assess. In the present paper, we have adopted the relativistic eikonal approximation,[4] which is less satisfactory from the theoretical point of view but has the advantage of being easily and accurately implemented and yielding reasonable agreement with a large body of experimental data[1,5,6] and with calculations for the relativistic boundary-corrected Born approximation.[7] For a critical discussion of other capture theories, see Ref. 1. As a further approximation to the eikonal approach, a simple analytical formula for $1s_{1/2}$–$1s_{1/2}$ transitions has been derived[4] and scaled to higher principal shells.[6] In the absence of anything better, this formula has been widely used for cross section estimates.[8]

It is the purpose of the present tables to provide accurately evaluated eikonal cross sections for projectile–target combinations which are likely to be of interest for future experiments[8] and for an energy range extending from about the lower limit of applicability of the theory to 10^4 GeV/u.

For a collision system consisting of a hydrogenic target (charge Z_T) and a bare projectile (charge Z_P), moving with a constant velocity **v** at impact parameter **b** with respect to the target, the capture cross section averaged over the initial and summed over the final projections μ, μ' of the electron angular momentum j, j' is given by

$$\sigma_{fi} = \frac{1}{2j+1} \sum_{\mu,\mu'} \int |A_{fi}^{\mu'\mu}(\mathbf{b}, v)|^2 d^2b. \qquad (1)$$

Here and in the following, we use atomic units unless explicitly stated otherwise. The transition amplitude between any pair of specified states i, f is written as[4]

$$A_{fi} = i \int dt \int d^3r [\psi'_f(\mathbf{r}'_P, t')]^\dagger S \frac{Z_P}{r'_P} \psi_i(\mathbf{r}_T, t). \quad (2)$$

Here, the space–time coordinates of the electron are denoted by $\mathbf{r}_T$, t in the target frame and by $\mathbf{r}'_P$, t' in the projectile frame. The spinor transformation which Lorentz transforms a Dirac eigenfunction from the target to the projectile frame is defined by

$$\begin{aligned}\psi'(\mathbf{r}'_P, t') &= S\psi(\mathbf{r}_T, t) \\ &= \sqrt{\tfrac{1}{2}(\gamma+1)}(1-\delta\alpha_z)\psi(\mathbf{r}_T, t), \quad (3)\end{aligned}$$

where $\gamma = (1 - v^2/c^2)^{-1/2}$ is the Lorentz factor, $\delta = [(\gamma - 1)/(\gamma + 1)]^{1/2}$, and α_z is the component of the Dirac α matrix in the beam direction. In the *prior* form of the eikonal approach, appropriate for $Z_P \leqslant Z_T$, the initial and final wave functions

$$\psi_i(\mathbf{r}_T, t) = \phi_i(\mathbf{r}_T)e^{-iE_it} \qquad (4)$$

and

$$\psi'_f(\mathbf{r}'_P, t') = \phi'_f(\mathbf{r}'_P)e^{-iE_ft'}e^{i(Z_T/v)\ln(r_T+z_T)} \qquad (5)$$

are expressed by the stationary target and projectile wave functions ϕ_i and ϕ'_f in their respective frames. Here E_i and E_f are the relativistic energies including the electron rest mass, and r_T and z_T are the magnitude and the z component of $\mathbf{r}_T$, respectively. The final wave function is phase-distorted by the electron–target interaction. In this way, in a certain approximation, the electron–target interaction is treated nonperturbatively, while the electron–projectile interaction explicitly enters in first order in Eq. (2). It has the Coulombic form Z_P/r'_P in the projectile system and is subsequently transformed into the target system.[1,4] Since the cross section (1) is evaluated exactly, it contains no-spin-flip as well as spin-flip contributions.

The eikonal approximation may also be formulated in the *post* version, which is obtained by inverting the role of target and projectile in Eqs. (2), (4), and (5), that is, by replacing Z_P by Z_T and *vice versa* and by interchanging initial and final states. Since the theory is not post–prior symmetric, the two versions yield different results.

Since in an asymmetric theory like the eikonal approximation the stronger one of the electron–target and electron–projectile interactions should be treated nonperturbatively, the usual prescription is

$$\begin{aligned}&\text{if } Z_P \leqslant Z_T, \quad \text{use the } prior \text{ form;}\\ &\text{if } Z_P > Z_T, \quad \text{use the } post \text{ form.} \qquad (6)\end{aligned}$$

An alternative prescription which deviates from (6) for higher principal shells has also been proposed;[6] however in our tables, we adopt the standard form (6).

Regarding its applicability, it should be noted that the eikonal approach is a high-energy approach; that is, using the more familiar nonrelativistic terminology, the projectile velocity should "considerably" exceed the velocity of the active electron, where the meaning of considerably is not well defined. Relativistically, a comparison of velocities is not meaningful; instead one should compare the kinetic energy of an electron traveling with the speed of the projectile to the binding energy of the bound electron. Equality of the two leads to a "matching energy" E_m or a matching Lorentz factor γ_m. For a $1s_{1/2}$ electron bound to the charge Z, we have

$$m_ec^2(\gamma_m - 1) = m_ec^2(1 - \sqrt{1 - \alpha^2Z^2}), \qquad (7)$$

where $\alpha = 1/137$ is the fine-structure constant. Translating Eq. (7) into projectile energy measured in GeV/u, we have, equivalently

$$E_m = 0.9315(1 - \sqrt{1-\alpha^2Z^2})\,(\text{GeV/u}). \qquad (8)$$

The charge Z should be identified with the larger of the target and projectile charges. If, for example, the heavier partner is Au, we have $E_m(\text{Au}) = 0.17$ GeV/u; if it is U, we have $E_m(\text{U}) = 0.24$ GeV/u. From overall experience, also derived from nonrelativistic collisions, we generally require that the projectile energy $E_P \geqslant 2E_m$.

The eikonal approach has been compared with other theoretical calculations as well as with experimental data. For electron capture by 1.05-GeV/u Ne^{10+} ions from target atoms with charges Z_T = 13, 30, 47, 73, and 92, the eikonal calculations are in rather close agreement with relativistic boundary-corrected Born calculations,[7] which are post–prior symmetric. One also obtains reasonable agreement with the experimental data for Z_T = 47, 73, and 92.[5] In all cases, the Oppenheimer–Brinkman–Kramers (OBK) approximation overestimates the data by a factor of between 5 and 15.[5] Comparison of theory with experiment has also been made[5] for the following systems: C^{6+} at 0.14, 0.25, and 0.4 GeV/u on targets between Z_T = 13 and 92; Ne^{10+} at 0.25, 0.4, and 2.1 GeV/u on targets between Z_T = 30 and 92; and Ar^{18+} at 0.4 and 1.05 GeV/u on targets between Z_T = 30 and 92. Furthermore, experimental data[6] are available for Xe^{54+} and Xe^{52+} with energies between 0.08 and 0.2 GeV/u colliding with targets with charges Z_T = 13, 29, 47, and 79. In all these cases, the data are reasonably well represented by eikonal cross sections.[6] In fact, for Z_T = 47 and 79, detailed two-center coupled-channel calculations[3] yield cross sections of a similar, but not superior, quality. In any kind of comparison, one must take into consideration that capture cross sections vary over many orders of magnitude as a function of projectile and target charge and as a function of collision energy. For the actual multielectron targets, one must take into account the screening due to outer electrons. However, for the innermost shells considered, the effect of Slater screening does not change the results appreciably.

Since the cross sections depend on a number of parameters, namely the target and projectile charges Z_T and Z_P, the projectile energy E, and the initial and final states, it is useful to illustrate the tables by three examples.

In Fig. 1, we show the dependence on target and projectile charges for the leading transition ($1s_{1/2}$–$1s_{1/2}$) at a fixed projectile energy of 10 GeV/u; cross sections for other transitions follow a similar pattern. The set of curves reflects the approximate dependence as $Z_T^5 Z_P^5$ of the capture cross section.

In Fig. 2, we display the capture cross sections for completely stripped Au ions impinging on hydrogen-like C as a function of energy. In the state-to-state cross sections presented, either the initial or the final state is a $1s_{1/2}$ state (in order to reduce the number of curves). The curves clearly exhibit the transition from an essentially nonrelativistic to a relativistic behavior: At rather low collision energies around 1 GeV/u, the cross-section curves still reflect the rapid decrease as E^{-6} or $E^{-5.5}$ known from nonrelativistic collisions, while in the extreme-relativistic energy range above 10 GeV/u, the curves bend over to the E^{-1} dependence (see, for example, Ref. 1).

In Fig. 3, we show, for comparison, the capture cross sections for completely stripped U ions impinging on hydrogen-like C as a function of energy. In the state-to-state cross sections presented, either the initial or the final state is a $1s_{1/2}$ state.

It should be remarked here that with the same computer code, we can produce OBK cross sections. They are

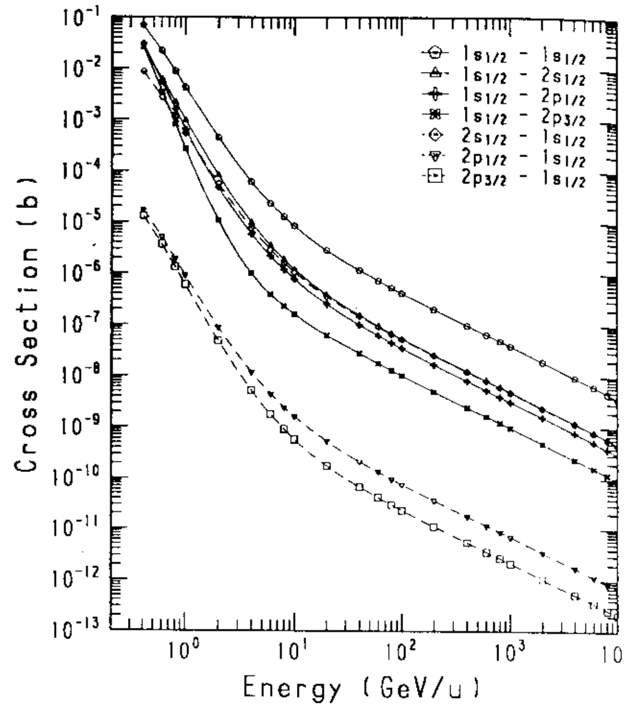

Figure 2. Cross sections (in barns) for electron capture from C^{5+} targets by bare Au^{79+} ions as a function of the collision energy (Au^{79+} + C^{5+} → Au^{78+} + C^{6+}). In order to reduce the number of curves, either the initial or the final state is taken to be a $1s_{1/2}$ state. The cross sections are calculated using Eq. (1) according to the prescription in (6) and refer to a single electron.

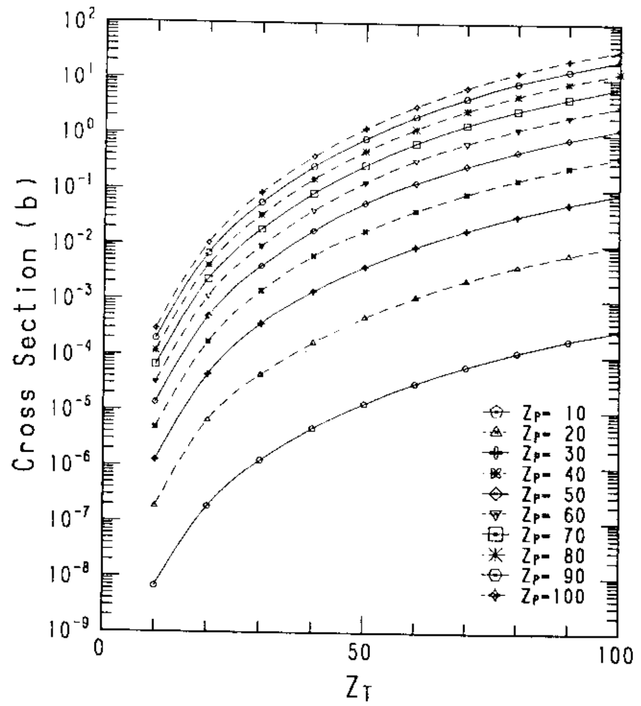

Figure 1. Cross sections (in barns) for $1s_{1/2}$–$1s_{1/2}$ electron capture at a projectile energy of 10 GeV/u as a function of the target and projectile charges Z_T and Z_P. The cross sections are calculated using Eq (1) according to the prescription in (6) and refer to a single electron.

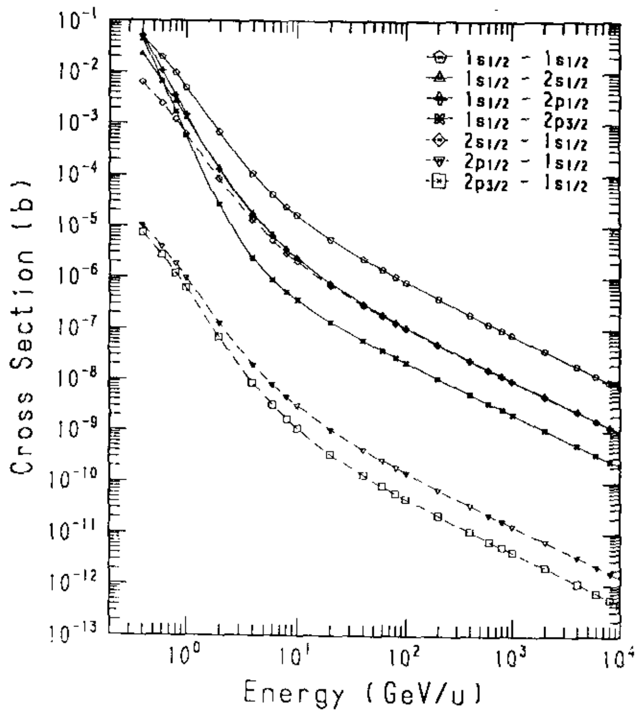

Figure 3. Same as Fig. 2 but for electron capture from C^{5+} targets by bare U^{92+} ions ($U^{92+} + C^{5+} \rightarrow U^{91+} + C^{6+}$).

post–prior symmetric but shifted to higher values by a factor of 5 to 15 while the order and spacing of the cross section curves are almost unchanged.

In summary, we believe the eikonal cross sections presented here are the best estimates currently available. While it is difficult to quantitatively assess the accuracy of the results, it is expected to increase with collision energy.

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EXPLANATION OF TABLES

TABLE I. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, and Au^{78+} by Au^{79+}

TABLE II. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, Au^{78+}, and U^{91+} by U^{92+}

The projectile and target are identified at the top of each page. For each projectile–target combination, we give the state-to-state cross sections between initial $1s_{1/2}$, $2s_{1/2}$, $2p_{1/2}$, and $2p_{3/2}$ states and final $1s_{1/2}$, $2s_{1/2}$, $2p_{1/2}$, and $2p_{3/2}$ states. Values for the first two initial states are contained in the upper portion of each page, while those for the last two initial states are contained in the lower portion. Associated with each initial state are four data columns headed by the relevant final state. The projectile energy E is given in GeV/u. All cross sections are given in barns (1b = 10^{-24} cm^2). The cross sections are calculated using Eq. (1) according to the prescription in (6). For estimating total cross sections including higher principal shells, one may make use of the scaling rule (see, for example, Ref. 1) which state that the contributions of individual shells n decrease approximately (for high enough energies) as n^{-3}. By noting that $\sum_{n=1}^{\infty} 1/n^3 = 1.202$, one may estimate the sum of all contributions not explicitly included in the tables.

TABLE I. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, and Au^{78+} by Au^{79+}

See page 68 for Explanation of Tables

$Au^{79+} + C^{5+} \rightarrow Au^{78+} + C^{6+}$

E (GeV/u)	initial state $1s_{1/2}$				initial state $2s_{1/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E−01	3.13E−01	1.96E−01	5.03E−01	6.40E−01	3.93E−02	2.46E−02	6.38E−02	8.14E−02
4.00E−01	6.96E−02	2.50E−02	3.03E−02	2.61E−02	8.74E−03	3.14E−03	3.82E−03	3.30E−03
6.00E−01	2.19E−02	6.22E−03	5.34E−03	3.47E−03	2.74E−03	7.81E−04	6.73E−04	4.37E−04
8.00E−01	8.86E−03	2.19E−03	1.58E−03	8.14E−04	1.11E−03	2.75E−04	1.99E−04	1.03E−04
1.00E+00	4.28E−03	9.66E−04	6.31E−04	2.68E−04	5.37E−04	1.21E−04	7.92E−05	3.37E−05
2.00E+00	4.46E−04	8.16E−05	4.68E−05	1.08E−05	5.58E−05	1.02E−05	5.87E−06	1.36E−06
4.00E+00	6.01E−05	9.66E−06	5.77E−06	9.91E−07	7.52E−06	1.21E−06	7.22E−07	1.24E−07
6.00E+00	2.28E−05	3.46E−06	2.15E−06	3.87E−07	2.85E−06	4.34E−07	2.70E−07	4.84E−08
8.00E+00	1.26E−05	1.85E−06	1.18E−06	2.28E−07	1.57E−06	2.31E−07	1.47E−07	2.85E−08
1.00E+01	8.31E−06	1.19E−06	7.69E−07	1.59E−07	1.04E−06	1.49E−07	9.62E−08	1.99E−08
2.00E+01	2.81E−06	3.83E−07	2.51E−07	6.18E−08	3.52E−07	4.80E−08	3.13E−08	7.73E−09
4.00E+01	1.16E−06	1.53E−07	9.97E−08	2.74E−08	1.45E−07	1.91E−08	1.25E−08	3.42E−09
6.00E+01	7.23E−07	9.45E−08	6.14E−08	1.75E−08	9.04E−08	1.18E−08	7.68E−09	2.19E−09
8.00E+01	5.25E−07	6.83E−08	4.43E−08	1.29E−08	6.57E−08	8.55E−09	5.54E−09	1.61E−09
1.00E+02	4.12E−07	5.34E−08	3.46E−08	1.02E−08	5.16E−08	6.68E−09	4.33E−09	1.27E−09
2.00E+02	1.98E−07	2.55E−08	1.65E−08	4.97E−09	2.48E−08	3.20E−09	2.06E−09	6.22E−10
4.00E+02	9.73E−08	1.25E−08	8.04E−09	2.46E−09	1.22E−08	1.56E−09	1.01E−09	3.07E−10
6.00E+02	6.45E−08	8.26E−09	5.32E−09	1.63E−09	8.07E−09	1.03E−09	6.65E−10	2.04E−10
8.00E+02	4.82E−08	6.17E−09	3.97E−09	1.22E−09	6.03E−09	7.73E−10	4.97E−10	1.53E−10
1.00E+03	3.85E−08	4.93E−09	3.17E−09	9.76E−10	4.82E−09	6.17E−10	3.96E−10	1.22E−10
2.00E+03	1.92E−08	2.45E−09	1.58E−09	4.87E−10	2.40E−09	3.07E−10	1.97E−10	6.09E−11
4.00E+03	9.57E−09	1.22E−09	7.86E−10	2.43E−10	1.20E−09	1.53E−10	9.84E−11	3.04E−11
6.00E+03	6.37E−09	8.15E−10	5.24E−10	1.62E−10	7.98E−10	1.02E−10	6.55E−11	2.03E−11
8.00E+03	4.78E−09	6.11E−10	3.93E−10	1.21E−10	5.98E−10	7.65E−11	4.91E−11	1.52E−11
1.00E+04	3.82E−09	4.89E−10	3.14E−10	9.72E−11	4.78E−10	6.12E−11	3.93E−11	1.22E−11

E (GeV/u)	initial state $2p_{1/2}$				initial state $2p_{3/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E−01	7.82E−05	9.03E−05	2.72E−04	3.47E−04	6.23E−05	7.96E−05	2.35E−04	3.19E−04
4.00E−01	1.70E−05	8.64E−06	1.18E−05	9.71E−06	1.29E−05	7.12E−06	9.40E−06	8.50E−06
6.00E−01	5.04E−06	1.81E−06	1.73E−06	1.04E−06	3.64E−06	1.41E−06	1.28E−06	8.69E−07
8.00E−01	1.95E−06	5.72E−07	4.55E−07	2.15E−07	1.34E−06	4.22E−07	3.18E−07	1.70E−07
1.00E+00	9.08E−07	2.34E−07	1.68E−07	6.47E−08	5.98E−07	1.64E−07	1.11E−07	4.86E−08
2.00E+00	8.80E−08	1.69E−08	1.05E−08	2.29E−09	4.84E−08	9.83E−09	5.74E−09	1.28E−09
4.00E+00	1.17E−08	1.90E−09	1.20E−09	2.13E−10	5.19E−09	8.85E−10	5.42E−10	7.88E−11
6.00E+00	4.44E−09	6.74E−10	4.40E−10	8.16E−11	1.76E−09	2.80E−10	1.81E−10	2.61E−11
8.00E+00	2.44E−09	3.58E−10	2.39E−10	4.68E−11	9.06E−10	1.39E−10	9.31E−11	1.43E−11
1.00E+01	1.61E−09	2.30E−10	1.56E−10	3.19E−11	5.72E−10	8.52E−11	5.86E−11	9.59E−12
2.00E+01	5.33E−10	7.28E−11	5.06E−11	1.17E−11	1.74E−10	2.44E−11	1.76E−11	3.46E−12
4.00E+01	2.15E−10	2.86E−11	2.02E−11	4.98E−12	6.76E−11	9.13E−12	6.70E−12	1.48E−12
6.00E+01	1.33E−10	1.75E−11	1.24E−11	3.15E−12	4.14E−11	5.52E−12	4.07E−12	9.40E−13
8.00E+01	9.62E−11	1.26E−11	8.96E−12	2.30E−12	2.97E−11	3.94E−12	2.91E−12	6.88E−13
1.00E+02	7.53E−11	9.85E−12	7.00E−12	1.81E−12	2.32E−11	3.06E−12	2.26E−12	5.42E−13
2.00E+02	3.60E−11	4.68E−12	3.34E−12	8.76E−13	1.10E−11	1.44E−12	1.07E−12	2.63E−13
4.00E+02	1.76E−11	2.28E−12	1.63E−12	4.31E−13	5.37E−12	7.01E−13	5.18E−13	1.29E−13
6.00E+02	1.17E−11	1.51E−12	1.08E−12	2.86E−13	3.55E−12	4.63E−13	3.42E−13	8.58E−14
8.00E+02	8.71E−12	1.13E−12	8.05E−13	2.14E−13	2.65E−12	3.45E−13	2.55E−13	6.42E−14
1.00E+03	6.95E−12	9.00E−13	6.42E−13	1.71E−13	2.12E−12	2.75E−13	2.04E−13	5.13E−14
2.00E+03	3.46E−12	4.48E−13	3.20E−13	8.51E−14	1.05E−12	1.37E−13	1.01E−13	2.56E−14
4.00E+03	1.73E−12	2.23E−13	1.59E−13	4.25E−14	5.25E−13	6.83E−14	5.05E−14	1.28E−14
6.00E+03	1.15E−12	1.49E−13	1.06E−13	2.83E−14	3.50E−13	4.55E−14	3.36E−14	8.51E−15
8.00E+03	8.62E−13	1.12E−13	7.96E−14	2.12E−14	2.62E−13	3.41E−14	2.52E−14	6.38E−15
1.00E+04	6.89E−13	8.92E−14	6.37E−14	1.70E−14	2.10E−13	2.73E−14	2.02E−14	5.10E−15

TABLE I. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, and Au^{78+} by Au^{79+}

See page 68 for Explanation of Tables

$Au^{79+} + Al^{12+} \rightarrow Au^{78+} + Al^{13+}$

E (GeV/u)	initial state $1s_{1/2}$				initial state $2s_{1/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	1.50E+01	8.89E+00	2.18E+01	2.71E+01	1.89E+00	1.14E+00	2.92E+00	3.68E+00
4.00E-01	3.33E+00	1.17E+00	1.38E+00	1.17E+00	4.23E-01	1.49E-01	1.81E-01	1.54E-01
6.00E-01	1.05E+00	2.94E-01	2.50E-01	1.59E-01	1.34E-01	3.76E-02	3.24E-02	2.07E-02
8.00E-01	4.28E-01	1.05E-01	7.53E-02	3.80E-02	5.44E-02	1.34E-02	9.66E-03	4.92E-03
1.00E+00	2.08E-01	4.65E-02	3.04E-02	1.26E-02	2.64E-02	5.92E-03	3.88E-03	1.63E-03
2.00E+00	2.21E-02	4.02E-03	2.32E-03	5.30E-04	2.79E-03	5.09E-04	2.93E-04	6.74E-05
4.00E+00	3.03E-03	4.86E-04	2.90E-04	5.03E-05	3.82E-04	6.12E-05	3.66E-05	6.35E-06
6.00E+00	1.16E-03	1.76E-04	1.09E-04	1.98E-05	1.46E-04	2.21E-05	1.38E-05	2.50E-06
8.00E+00	6.41E-04	9.41E-05	5.99E-05	1.17E-05	8.07E-05	1.18E-05	7.53E-06	1.47E-06
1.00E+01	4.25E-04	6.10E-05	3.93E-05	8.18E-06	5.35E-05	7.67E-06	4.93E-06	1.03E-06
2.00E+01	1.44E-04	1.97E-05	1.29E-05	3.18E-06	1.81E-05	2.47E-06	1.61E-06	4.00E-07
4.00E+01	5.95E-05	7.86E-06	5.13E-06	1.41E-06	7.47E-06	9.87E-07	6.44E-07	1.77E-07
6.00E+01	3.72E-05	4.86E-06	3.16E-06	9.02E-07	4.67E-06	6.11E-07	3.97E-07	1.13E-07
8.00E+01	2.70E-05	3.51E-06	2.28E-06	6.63E-07	3.39E-06	4.41E-07	2.86E-07	8.33E-08
1.00E+02	2.12E-05	2.75E-06	1.78E-06	5.24E-07	2.66E-06	3.45E-07	2.24E-07	6.58E-08
2.00E+02	1.02E-05	1.31E-06	8.50E-07	2.56E-07	1.28E-06	1.65E-07	1.07E-07	3.21E-08
4.00E+02	5.01E-06	6.43E-07	4.15E-07	1.26E-07	6.29E-07	8.07E-08	5.21E-08	1.59E-08
6.00E+02	3.32E-06	4.25E-07	2.74E-07	8.39E-08	4.17E-07	5.34E-08	3.44E-08	1.05E-08
8.00E+02	2.48E-06	3.18E-07	2.05E-07	6.28E-08	3.11E-07	3.99E-08	2.57E-08	7.89E-09
1.00E+03	1.98E-06	2.54E-07	1.64E-07	5.02E-08	2.49E-07	3.19E-08	2.05E-08	6.30E-09
2.00E+03	9.87E-07	1.26E-07	8.14E-08	2.50E-08	1.24E-07	1.59E-08	1.02E-08	3.14E-09
4.00E+03	4.92E-07	6.30E-08	4.06E-08	1.25E-08	6.18E-08	7.91E-09	5.09E-09	1.57E-09
6.00E+03	3.28E-07	4.20E-08	2.70E-08	8.33E-09	4.12E-08	5.27E-09	3.39E-09	1.05E-09
8.00E+03	2.46E-07	3.15E-08	2.03E-08	6.25E-09	3.09E-08	3.95E-09	2.54E-09	7.84E-10
1.00E+04	1.97E-07	2.52E-08	1.62E-08	5.00E-09	2.47E-08	3.16E-09	2.03E-09	6.28E-10

E (GeV/u)	initial state $2p_{1/2}$				initial state $2p_{3/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	1.83E-02	2.04E-02	6.06E-02	7.69E-02	1.41E-02	1.76E-02	5.15E-02	6.89E-02
4.00E-01	3.97E-03	1.98E-03	2.68E-03	2.20E-03	2.93E-03	1.59E-03	2.10E-03	1.87E-03
6.00E-01	1.18E-03	4.20E-04	3.98E-04	2.40E-04	8.29E-04	3.18E-04	2.90E-04	1.94E-04
8.00E-01	4.57E-04	1.33E-04	1.06E-04	4.97E-05	3.06E-04	9.58E-05	7.22E-05	3.82E-05
1.00E+00	2.13E-04	5.46E-05	3.91E-05	1.51E-05	1.37E-04	3.75E-05	2.53E-05	1.10E-05
2.00E+00	2.08E-05	3.98E-06	2.47E-06	5.39E-07	1.12E-05	2.27E-06	1.33E-06	2.95E-07
4.00E+00	2.78E-06	4.49E-07	2.84E-07	5.04E-08	1.21E-06	2.07E-07	1.27E-07	1.85E-08
6.00E+00	1.06E-06	1.60E-07	1.04E-07	1.93E-08	4.14E-07	6.57E-08	4.26E-08	6.20E-09
8.00E+00	5.81E-07	8.51E-08	5.67E-08	1.11E-08	2.14E-07	3.26E-08	2.20E-08	3.40E-09
1.00E+01	3.82E-07	5.48E-08	3.70E-08	7.59E-09	1.35E-07	2.01E-08	1.38E-08	2.28E-09
2.00E+01	1.27E-07	1.73E-08	1.20E-08	2.78E-09	4.13E-08	5.78E-09	4.17E-09	8.22E-10
4.00E+01	5.12E-08	6.80E-09	4.79E-09	1.19E-09	1.60E-08	2.17E-09	1.59E-09	3.52E-10
6.00E+01	3.17E-08	4.18E-09	2.96E-09	7.50E-10	9.82E-09	1.31E-09	9.66E-10	2.23E-10
8.00E+01	2.29E-08	3.01E-09	2.13E-09	5.48E-10	7.06E-09	9.36E-10	6.91E-10	1.63E-10
1.00E+02	1.79E-08	2.35E-09	1.67E-09	4.32E-10	5.51E-09	7.27E-10	5.37E-10	1.29E-10
2.00E+02	8.58E-09	1.12E-09	7.94E-10	2.09E-10	2.62E-09	3.43E-10	2.54E-10	6.24E-11
4.00E+02	4.20E-09	5.44E-10	3.87E-10	1.03E-10	1.28E-09	1.66E-10	1.23E-10	3.07E-11
6.00E+02	2.78E-09	3.60E-10	2.56E-10	6.82E-11	8.43E-10	1.10E-10	8.14E-11	2.04E-11
8.00E+02	2.08E-09	2.69E-10	1.91E-10	5.10E-11	6.30E-10	8.20E-11	6.07E-11	1.52E-11
1.00E+03	1.66E-09	2.14E-10	1.53E-10	4.07E-11	5.03E-10	6.54E-11	4.85E-11	1.22E-11
2.00E+03	8.25E-10	1.07E-10	7.60E-11	2.03E-11	2.50E-10	3.25E-11	2.41E-11	6.07E-12
4.00E+03	4.11E-10	5.32E-11	3.79E-11	1.01E-11	1.25E-10	1.62E-11	1.20E-11	3.03E-12
6.00E+03	2.74E-10	3.54E-11	2.53E-11	6.75E-12	8.31E-11	1.08E-11	8.00E-12	2.02E-12
8.00E+03	2.05E-10	2.66E-11	1.89E-11	5.06E-12	6.23E-11	8.09E-12	6.00E-12	1.51E-12
1.00E+04	1.64E-10	2.13E-11	1.51E-11	4.05E-12	4.98E-11	6.47E-12	4.80E-12	1.21E-12

TABLE I. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, and Au^{78+} by Au^{79+}

See page 68 for Explanation of Tables

$Au^{79+} + Cu^{28+} \rightarrow Au^{78+} + Cu^{29+}$

E (GeV/u)	initial state $1s_{1/2}$				initial state $2s_{1/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E−01	7.50E+02	3.54E+02	6.80E+02	7.55E+02	1.01E+02	5.09E+01	1.19E+02	1.42E+02
4.00E−01	1.66E+02	5.20E+01	5.52E+01	4.28E+01	2.27E+01	7.35E+00	8.56E+00	7.00E+00
6.00E−01	5.39E+01	1.40E+01	1.13E+01	6.66E+00	7.34E+00	1.95E+00	1.65E+00	1.02E+00
8.00E−01	2.25E+01	5.23E+00	3.63E+00	1.72E+00	3.05E+00	7.18E−01	5.15E−01	2.53E−01
1.00E+00	1.12E+01	2.40E+00	1.54E+00	6.02E−01	1.50E+00	3.26E−01	2.13E−01	8.67E−02
2.00E+00	1.27E+00	2.27E−01	1.30E−01	2.91E−02	1.67E−01	3.00E−02	1.73E−02	3.96E−03
4.00E+00	1.84E−01	2.92E−02	1.75E−02	3.08E−03	2.39E−02	3.79E−03	2.27E−03	4.05E−04
6.00E+00	7.21E−02	1.08E−02	6.74E−03	1.25E−03	9.31E−03	1.40E−03	8.69E−04	1.63E−04
8.00E+00	4.05E−02	5.90E−03	3.74E−03	7.50E−04	5.21E−03	7.59E−04	4.81E−04	9.71E−05
1.00E+01	2.70E−02	3.85E−03	2.47E−03	5.28E−04	3.47E−03	4.95E−04	3.17E−04	6.81E−05
2.00E+01	9.32E−03	1.27E−03	8.24E−04	2.07E−04	1.19E−03	1.62E−04	1.05E−04	2.65E−05
4.00E+01	3.86E−03	5.10E−04	3.32E−04	9.17E−05	4.94E−04	6.51E−05	4.23E−05	1.17E−05
6.00E+01	2.42E−03	3.16E−04	2.05E−04	5.88E−05	3.09E−04	4.04E−05	2.61E−05	7.52E−06
8.00E+01	1.76E−03	2.29E−04	1.48E−04	4.32E−05	2.25E−04	2.92E−05	1.89E−05	5.53E−06
1.00E+02	1.38E−03	1.79E−04	1.16E−04	3.42E−05	1.76E−04	2.28E−05	1.48E−05	4.37E−06
2.00E+02	6.66E−04	8.57E−05	5.54E−05	1.67E−05	8.50E−05	1.09E−05	7.04E−06	2.13E−06
4.00E+02	3.27E−04	4.19E−05	2.71E−05	8.25E−06	4.17E−05	5.35E−06	3.44E−06	1.05E−06
6.00E+02	2.16E−04	2.78E−05	1.79E−05	5.48E−06	2.76E−05	3.54E−06	2.28E−06	7.00E−07
8.00E+02	1.62E−04	2.07E−05	1.34E−05	4.10E−06	2.07E−05	2.65E−06	1.70E−06	5.24E−07
1.00E+03	1.29E−04	1.66E−05	1.07E−05	3.28E−06	1.65E−05	2.11E−06	1.36E−06	4.18E−07
2.00E+03	6.44E−05	8.24E−06	5.31E−06	1.63E−06	8.22E−06	1.05E−06	6.75E−07	2.09E−07
4.00E+03	3.21E−05	4.11E−06	2.65E−06	8.16E−07	4.10E−06	5.25E−07	3.37E−07	1.04E−07
6.00E+03	2.14E−05	2.74E−06	1.77E−06	5.44E−07	2.73E−06	3.49E−07	2.24E−07	6.94E−08
8.00E+03	1.61E−05	2.05E−06	1.32E−06	4.08E−07	2.05E−06	2.62E−07	1.68E−07	5.21E−08
1.00E+04	1.28E−05	1.64E−06	1.06E−06	3.26E−07	1.64E−06	2.10E−07	1.35E−07	4.17E−08

E (GeV/u)	initial state $2p_{1/2}$				initial state $2p_{3/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E−01	5.43E+00	5.33E+00	1.47E+01	1.80E+01	3.87E+00	4.31E+00	1.18E+01	1.52E+01
4.00E−01	1.18E+00	5.50E−01	7.16E−01	5.76E−01	8.02E−01	4.13E−01	5.27E−01	4.57E−01
6.00E−01	3.53E−01	1.20E−01	1.12E−01	6.62E−02	2.29E−01	8.49E−02	7.63E−02	4.96E−02
8.00E−01	1.38E−01	3.91E−02	3.05E−02	1.42E−02	8.56E−02	2.61E−02	1.96E−02	1.00E−02
1.00E+00	6.53E−02	1.63E−02	1.15E−02	4.40E−03	3.87E−02	1.04E−02	7.01E−03	2.95E−03
2.00E+00	6.53E−03	1.24E−03	7.64E−04	1.66E−04	3.26E−03	6.54E−04	3.86E−04	8.42E−05
4.00E+00	8.88E−04	1.43E−04	9.00E−05	1.60E−05	3.65E−04	6.17E−05	3.81E−05	5.63E−06
6.00E+00	3.40E−04	5.14E−05	3.34E−05	6.22E−06	1.26E−04	1.99E−05	1.30E−05	1.92E−06
8.00E+00	1.88E−04	2.74E−05	1.82E−05	3.59E−06	6.57E−05	9.97E−06	6.72E−06	1.06E−06
1.00E+01	1.24E−04	1.77E−05	1.19E−05	2.46E−06	4.17E−05	6.18E−06	4.26E−06	7.14E−07
2.00E+01	4.13E−05	5.63E−06	3.90E−06	9.06E−07	1.29E−05	1.80E−06	1.30E−06	2.58E−07
4.00E+01	1.67E−05	2.22E−06	1.56E−06	3.88E−07	5.01E−06	6.77E−07	4.96E−07	1.11E−07
6.00E+01	1.04E−05	1.37E−06	9.60E−07	2.46E−07	3.07E−06	4.10E−07	3.02E−07	7.00E−08
8.00E+01	7.50E−06	9.83E−07	6.93E−07	1.80E−07	2.21E−06	2.93E−07	2.16E−07	5.12E−08
1.00E+02	5.87E−06	7.67E−07	5.41E−07	1.42E−07	1.73E−06	2.28E−07	1.68E−07	4.03E−08
2.00E+02	2.81E−06	3.65E−07	2.58E−07	6.86E−08	8.20E−07	1.07E−07	7.96E−08	1.95E−08
4.00E+02	1.38E−06	1.78E−07	1.26E−07	3.38E−08	4.00E−07	5.22E−08	3.87E−08	9.62E−09
6.00E+02	9.10E−07	1.18E−07	8.33E−08	2.24E−08	2.64E−07	3.44E−08	2.55E−08	6.38E−09
8.00E+02	6.80E−07	8.80E−08	6.23E−08	1.68E−08	1.98E−07	2.57E−08	1.91E−08	4.78E−09
1.00E+03	5.43E−07	7.02E−08	4.97E−08	1.34E−08	1.58E−07	2.05E−08	1.52E−08	3.81E−09
2.00E+03	2.70E−07	3.49E−08	2.47E−08	6.67E−09	7.84E−08	1.02E−08	7.56E−09	1.90E−09
4.00E+03	1.35E−07	1.74E−08	1.23E−08	3.33E−09	3.91E−08	5.08E−09	3.77E−09	9.49E−10
6.00E+03	8.98E−08	1.16E−08	8.22E−09	2.22E−09	2.61E−08	3.39E−09	2.51E−09	6.32E−10
8.00E+03	6.73E−08	8.70E−09	6.16E−09	1.66E−09	1.95E−08	2.54E−09	1.88E−09	4.74E−10
1.00E+04	5.39E−08	6.96E−09	4.93E−09	1.33E−09	1.56E−08	2.03E−09	1.51E−09	3.79E−10

TABLE I. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, and Au^{78+} by Au^{79+}

See page 68 for Explanation of Tables

$Au^{79+} + Ag^{46+} \rightarrow Au^{78+} + Ag^{47+}$

E (GeV/u)	initial state $1s_{1/2}$				initial state $2s_{1/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	5.83E+03	1.73E+03	2.10E+03	1.88E+03	9.14E+02	3.13E+02	5.85E+02	6.31E+02
4.00E-01	1.34E+03	3.35E+02	2.89E+02	1.92E+02	2.11E+02	5.65E+01	6.00E+01	4.59E+01
6.00E-01	4.60E+02	1.04E+02	7.45E+01	3.86E+01	7.13E+01	1.68E+01	1.36E+01	7.92E+00
8.00E-01	2.02E+02	4.24E+01	2.75E+01	1.16E+01	3.07E+01	6.64E+00	4.64E+00	2.18E+00
1.00E+00	1.04E+02	2.08E+01	1.27E+01	4.51E+00	1.56E+01	3.17E+00	2.04E+00	7.96E-01
2.00E+00	1.33E+01	2.31E+00	1.32E+00	2.83E-01	1.89E+00	3.30E-01	1.90E-01	4.34E-02
4.00E+00	2.13E+00	3.32E-01	1.98E-01	3.59E-02	2.91E-01	4.55E-02	2.71E-02	5.06E-03
6.00E+00	8.67E-01	1.29E-01	7.97E-02	1.54E-02	1.17E-01	1.74E-02	1.07E-02	2.11E-03
8.00E+00	4.97E-01	7.18E-02	4.52E-02	9.41E-03	6.66E-02	9.61E-03	6.01E-03	1.28E-03
1.00E+01	3.36E-01	4.76E-02	3.03E-02	6.69E-03	4.48E-02	6.34E-03	4.01E-03	9.02E-04
2.00E+01	1.19E-01	1.61E-02	1.04E-02	2.67E-03	1.57E-02	2.12E-03	1.36E-03	3.55E-04
4.00E+01	5.00E-02	6.58E-03	4.24E-03	1.19E-03	6.58E-03	8.64E-04	5.51E-04	1.58E-04
6.00E+01	3.14E-02	4.10E-03	2.64E-03	7.67E-04	4.13E-03	5.38E-04	3.42E-04	1.01E-04
8.00E+01	2.29E-02	2.97E-03	1.91E-03	5.65E-04	3.01E-03	3.90E-04	2.48E-04	7.45E-05
1.00E+02	1.80E-02	2.33E-03	1.50E-03	4.47E-04	2.36E-03	3.05E-04	1.94E-04	5.89E-05
2.00E+02	8.69E-03	1.12E-03	7.16E-04	2.18E-04	1.14E-03	1.46E-04	9.27E-05	2.88E-05
4.00E+02	4.27E-03	5.48E-04	3.50E-04	1.08E-04	5.60E-04	7.17E-05	4.54E-05	1.42E-05
6.00E+02	2.83E-03	3.63E-04	2.32E-04	7.18E-05	3.71E-04	4.75E-05	3.00E-05	9.44E-06
8.00E+02	2.12E-03	2.71E-04	1.73E-04	5.37E-05	2.78E-04	3.55E-05	2.24E-05	7.06E-06
1.00E+03	1.69E-03	2.16E-04	1.38E-04	4.29E-05	2.22E-04	2.83E-05	1.79E-05	5.64E-06
2.00E+03	8.43E-04	1.08E-04	6.89E-05	2.14E-05	1.10E-04	1.41E-05	8.91E-06	2.82E-06
4.00E+03	4.21E-04	5.38E-05	3.44E-05	1.07E-05	5.51E-05	7.04E-06	4.45E-06	1.41E-06
6.00E+03	2.80E-04	3.58E-05	2.29E-05	7.13E-06	3.67E-05	4.69E-06	2.96E-06	9.37E-07
8.00E+03	2.10E-04	2.69E-05	1.72E-05	5.34E-06	2.75E-05	3.52E-06	2.22E-06	7.03E-07
1.00E+04	1.68E-04	2.15E-05	1.37E-05	4.28E-06	2.20E-05	2.81E-06	1.78E-06	5.62E-07

E (GeV/u)	initial state $2p_{1/2}$				initial state $2p_{3/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	1.63E+02	1.25E+02	2.94E+02	3.37E+02	1.06E+02	9.52E+01	2.26E+02	2.72E+02
4.00E-01	3.53E+01	1.46E+01	1.76E+01	1.35E+01	2.19E+01	1.01E+01	1.21E+01	1.00E+01
6.00E-01	1.09E+01	3.42E+00	3.04E+00	1.74E+00	6.38E+00	2.21E+00	1.92E+00	1.19E+00
8.00E-01	4.35E+00	1.16E+00	8.81E-01	3.98E-01	2.43E+00	7.05E-01	5.20E-01	2.56E-01
1.00E+00	2.09E+00	5.00E-01	3.46E-01	1.29E-01	1.12E+00	2.88E-01	1.93E-01	7.80E-02
2.00E+00	2.20E-01	4.09E-02	2.51E-02	5.45E-03	9.90E-02	1.95E-02	1.15E-02	2.47E-03
4.00E+00	3.11E-02	4.97E-03	3.11E-03	5.62E-04	1.16E-02	1.94E-03	1.20E-03	1.80E-04
6.00E+00	1.21E-02	1.82E-03	1.17E-03	2.22E-04	4.07E-03	6.39E-04	4.17E-04	6.32E-05
8.00E+00	6.74E-03	9.82E-04	6.46E-04	1.30E-04	2.14E-03	3.24E-04	2.18E-04	3.53E-05
1.00E+01	4.47E-03	6.38E-04	4.26E-04	8.94E-05	1.37E-03	2.02E-04	1.39E-04	2.39E-05
2.00E+01	1.51E-03	2.06E-04	1.41E-04	3.33E-05	4.29E-04	5.97E-05	4.29E-05	8.69E-06
4.00E+01	6.15E-04	8.16E-05	5.65E-05	1.44E-05	1.68E-04	2.27E-05	1.66E-05	3.73E-06
6.00E+01	3.82E-04	5.03E-05	3.50E-05	9.11E-06	1.03E-04	1.38E-05	1.01E-05	2.36E-06
8.00E+01	2.77E-04	3.62E-05	2.52E-05	6.66E-06	7.44E-05	9.84E-06	7.25E-06	1.73E-06
1.00E+02	2.17E-04	2.83E-05	1.97E-05	5.25E-06	5.81E-05	7.65E-06	5.64E-06	1.36E-06
2.00E+02	1.04E-04	1.35E-05	9.43E-06	2.55E-06	2.76E-05	3.62E-06	2.67E-06	6.60E-07
4.00E+02	5.09E-05	6.59E-06	4.60E-06	1.26E-06	1.35E-05	1.76E-06	1.30E-06	3.25E-07
6.00E+02	3.37E-05	4.36E-06	3.05E-06	8.33E-07	8.92E-06	1.16E-06	8.59E-07	2.16E-07
8.00E+02	2.52E-05	3.25E-06	2.28E-06	6.23E-07	6.66E-06	8.67E-07	6.41E-07	1.61E-07
1.00E+03	2.01E-05	2.60E-06	1.82E-06	4.98E-07	5.31E-06	6.91E-07	5.11E-07	1.29E-07
2.00E+03	1.00E-05	1.29E-06	9.04E-07	2.48E-07	2.64E-06	3.44E-07	2.54E-07	6.42E-08
4.00E+03	4.99E-06	6.44E-07	4.51E-07	1.24E-07	1.32E-06	1.71E-07	1.27E-07	3.21E-08
6.00E+03	3.33E-06	4.29E-07	3.00E-07	8.25E-08	8.79E-07	1.14E-07	8.44E-08	2.14E-08
8.00E+03	2.49E-06	3.22E-07	2.25E-07	6.19E-08	6.59E-07	8.56E-08	6.33E-08	1.60E-08
1.00E+04	1.99E-06	2.57E-07	1.80E-07	4.95E-08	5.27E-07	6.84E-08	5.06E-08	1.28E-08

TABLE I. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, and Au^{78+} by Au^{79+}

See page 68 for Explanation of Tables

$Au^{79+} + Au^{78+} \rightarrow Au^{78+} + Au^{79+}$

E (GeV/u)	initial state $1s_{1/2}$				initial state $2s_{1/2}$			
	final state $1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	final state $1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	1.25E+04	1.16E+03	5.58E+02	2.77E+02	3.36E+03	2.69E+02	1.77E+02	1.45E+02
4.00E-01	4.46E+03	6.48E+02	3.50E+02	1.46E+02	9.43E+02	1.20E+02	8.39E+01	4.97E+01
6.00E-01	1.99E+03	3.18E+02	1.72E+02	6.12E+01	3.85E+02	5.81E+01	3.82E+01	1.89E+01
8.00E-01	1.04E+03	1.71E+02	9.20E+01	2.85E+01	1.91E+02	3.05E+01	1.88E+01	7.86E+00
1.00E+00	6.13E+02	1.01E+02	5.42E+01	1.49E+01	1.08E+02	1.76E+01	1.04E+01	3.74E+00
2.00E+00	1.12E+02	1.77E+01	9.78E+00	1.97E+00	1.77E+01	2.81E+00	1.57E+00	3.78E-01
4.00E+00	2.31E+01	3.46E+00	2.03E+00	3.97E-01	3.40E+00	5.07E-01	2.91E-01	6.36E-02
6.00E+00	1.05E+01	1.52E+00	9.18E-01	1.95E-01	1.50E+00	2.16E-01	1.27E-01	2.95E-02
8.00E+00	6.39E+00	9.01E-01	5.53E-01	1.27E-01	8.98E-01	1.26E-01	7.48E-02	1.86E-02
1.00E+01	4.48E+00	6.22E-01	3.85E-01	9.29E-02	6.25E-01	8.63E-02	5.14E-02	1.35E-02
2.00E+01	1.71E+00	2.28E-01	1.42E-01	3.92E-02	2.34E-01	3.11E-02	1.85E-02	5.52E-03
4.00E+01	7.43E-01	9.71E-02	6.03E-02	1.80E-02	1.01E-01	1.31E-02	7.77E-03	2.50E-03
6.00E+01	4.73E-01	6.13E-02	3.80E-02	1.17E-02	6.41E-02	8.27E-03	4.88E-03	1.61E-03
8.00E+01	3.47E-01	4.47E-02	2.77E-02	8.64E-03	4.69E-02	6.03E-03	3.55E-03	1.19E-03
1.00E+02	2.74E-01	3.52E-02	2.18E-02	6.86E-03	3.70E-02	4.74E-03	2.79E-03	9.40E-04
2.00E+02	1.33E-01	1.70E-02	1.05E-02	3.37E-03	1.80E-02	2.29E-03	1.34E-03	4.61E-04
4.00E+02	6.56E-02	8.38E-03	5.16E-03	1.67E-03	8.85E-03	1.13E-03	6.58E-04	2.28E-04
6.00E+02	4.35E-02	5.56E-03	3.42E-03	1.11E-03	5.87E-03	7.46E-04	4.36E-04	1.52E-04
8.00E+02	3.26E-02	4.16E-03	2.56E-03	8.32E-04	4.39E-03	5.58E-04	3.26E-04	1.13E-04
1.00E+03	2.60E-02	3.32E-03	2.04E-03	6.64E-04	3.51E-03	4.46E-04	2.60E-04	9.07E-05
2.00E+03	1.30E-02	1.65E-03	1.02E-03	3.32E-04	1.75E-03	2.22E-04	1.30E-04	4.52E-05
4.00E+03	6.48E-03	8.26E-04	5.08E-04	1.66E-04	8.74E-04	1.11E-04	6.47E-05	2.26E-05
6.00E+03	4.32E-03	5.50E-04	3.38E-04	1.10E-04	5.82E-04	7.39E-05	4.31E-05	1.51E-05
8.00E+03	3.24E-03	4.13E-04	2.54E-04	8.28E-05	4.37E-04	5.54E-05	3.23E-05	1.13E-05
1.00E+04	2.59E-03	3.30E-04	2.03E-04	6.62E-05	3.49E-04	4.43E-05	2.59E-05	9.04E-06

E (GeV/u)	initial state $2p_{1/2}$				initial state $2p_{3/2}$			
	final state $1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	final state $1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	4.67E+03	1.71E+03	2.47E+03	2.26E+03	2.77E+03	1.34E+03	2.10E+03	2.09E+03
4.00E-01	1.05E+03	3.01E+02	2.91E+02	1.92E+02	5.80E+02	1.99E+02	1.97E+02	1.42E+02
6.00E-01	3.52E+02	8.73E+01	6.85E+01	3.48E+01	1.80E+02	5.13E+01	4.04E+01	2.24E+01
8.00E-01	1.52E+02	3.41E+01	2.38E+01	9.81E+00	7.23E+01	1.83E+01	1.27E+01	5.66E+00
1.00E+00	7.72E+01	1.62E+01	1.06E+01	3.66E+00	3.47E+01	8.07E+00	5.20E+00	1.93E+00
2.00E+00	9.61E+00	1.69E+00	1.01E+00	2.19E-01	3.52E+00	6.63E-01	3.90E-01	8.06E-02
4.00E+00	1.54E+00	2.39E-01	1.47E-01	2.80E-02	4.57E-01	7.49F-02	4.64E-02	7.18E-03
6.00E+00	6.30E-01	9.30E-02	5.88E-02	1.19E-02	1.69E-01	2.60E-02	1.69E-02	2.70E-03
8.00E+00	3.61E-01	5.18E-02	3.33E-02	7.13E-03	9.10E-02	1.36E-02	9.11E-03	1.55E-03
1.00E+01	2.44E-01	3.43E-02	2.23E-02	5.00E-03	5.92E-02	8.62E-03	5.90E-03	1.06E-03
2.00E+01	8.55E-02	1.15E-02	7.67E-03	1.92E-03	1.91E-02	2.64E-03	1.88E-03	3.96E-04
4.00E+01	3.55E-02	4.68E-03	3.14E-03	8.43E-04	7.62E-03	1.02E-03	7.39E-04	1.71E-04
6.00E+01	2.22E-02	2.91E-03	1.95E-03	5.38E-04	4.71E-03	6.24E-04	4.53E-04	1.09E-04
8.00E+01	1.62E-02	2.10E-03	1.42E-03	3.95E-04	3.40E-03	4.48E-04	3.26E-04	7.97E-05
1.00E+02	1.27E-02	1.65E-03	1.11E-03	3.11E-04	2.66E-03	3.49E-04	2.54E-04	6.28E-05
2.00E+02	6.11E-03	7.89E-04	5.31E-04	1.52E-04	1.27E-03	1.66E-04	1.21E-04	3.05E-05
4.00E+02	3.00E-03	3.86E-04	2.60E-04	7.48E-05	6.20E-04	8.06E-05	5.89E-05	1.50E-05
6.00E+02	1.98E-03	2.55E-04	1.72E-04	4.96E-05	4.10E-04	5.33E-05	3.89E-05	9.98E-06
8.00E+02	1.48E-03	1.91E-04	1.29E-04	3.71E-05	3.06E-04	3.98E-05	2.91E-05	7.47E-06
1.00E+03	1.18E-03	1.52E-04	1.03E-04	2.97E-05	2.45E-04	3.17E-05	2.32E-05	5.97E-06
2.00E+03	5.90E-04	7.59E-05	5.11E-05	1.48E-05	1.22E-04	1.58E-05	1.15E-05	2.98E-06
4.00E+03	2.94E-04	3.78E-05	2.55E-05	7.39E-06	6.07E-05	7.87E-06	5.75E-06	1.49E-06
6.00E+03	1.96E-04	2.52E-05	1.70E-05	4.92E-06	4.04E-05	5.24E-06	3.83E-06	9.90E-07
8.00E+03	1.47E-04	1.89E-05	1.27E-05	3.69E-06	3.03E-05	3.93E-06	2.87E-06	7.42E-07
1.00E+04	1.18E-04	1.51E-05	1.02E-05	2.95E-06	2.43E-05	3.14E-06	2.30E-06	5.94E-07

TABLE II. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, Au^{78+}, and U^{91+} by U^{92+}

See page 68 for Explanation of Tables

$U^{92+} + C^{5+} \rightarrow U^{91+} + C^{6+}$

E (GeV/u)	initial state $1s_{1/2}$, final state $1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	initial state $2s_{1/2}$, final state $1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	1.44E-01	1.64E-01	5.84E-01	7.97E-01	1.80E-02	2.07E-02	7.38E-02	1.01E-01
4.00E-01	4.96E-02	2.15E-02	5.11E-02	4.37E-02	6.21E-03	2.70E-03	6.44E-03	5.52E-03
6.00E-01	1.96E-02	6.54E-03	1.06E-02	6.60E-03	2.46E-03	8.20E-04	1.34E-03	8.32E-04
8.00E-01	9.21E-03	2.63E-03	3.46E-03	1.67E-03	1.16E-03	3.30E-04	4.35E-04	2.10E-04
1.00E+00	4.93E-03	1.27E-03	1.47E-03	5.76E-04	6.18E-04	1.59E-04	1.84E-04	7.25E-05
2.00E+00	6.59E-04	1.32E-04	1.25E-04	2.58E-05	8.25E-05	1.66E-05	1.57E-05	3.23E-06
4.00E+00	1.04E-04	1.78E-05	1.67E-05	2.36E-06	1.31E-05	2.23E-06	2.09E-06	2.95E-07
6.00E+00	4.19E-05	6.68E-06	6.42E-06	8.92E-07	5.24E-06	8.36E-07	8.03E-07	1.12E-07
8.00E+00	2.37E-05	3.64E-06	3.55E-06	5.16E-07	2.97E-06	4.55E-07	4.44E-07	6.46E-08
1.00E+01	1.59E-05	2.37E-06	2.34E-06	3.56E-07	1.99E-06	2.97E-07	2.93E-07	4.46E-08
2.00E+01	5.52E-06	7.74E-07	7.76E-07	1.36E-07	6.91E-07	9.68E-08	9.70E-08	1.70E-08
4.00E+01	2.29E-06	3.10E-07	3.11E-07	5.98E-08	2.87E-07	3.87E-08	3.89E-08	7.48E-09
6.00E+01	1.44E-06	1.91E-07	1.92E-07	3.82E-08	1.80E-07	2.39E-08	2.40E-08	4.78E-09
8.00E+01	1.04E-06	1.38E-07	1.39E-07	2.81E-08	1.31E-07	1.73E-08	1.74E-08	3.51E-09
1.00E+02	8.19E-07	1.08E-07	1.08E-07	2.22E-08	1.03E-07	1.35E-08	1.36E-08	2.78E-09
2.00E+02	3.95E-07	5.17E-08	5.17E-08	1.08E-08	4.94E-08	6.46E-09	6.47E-09	1.35E-09
4.00E+02	1.94E-07	2.52E-08	2.53E-08	5.34E-09	2.42E-08	3.16E-09	3.16E-09	6.69E-10
6.00E+02	1.28E-07	1.67E-08	1.67E-08	3.55E-09	1.61E-08	2.09E-09	2.09E-09	4.44E-10
8.00E+02	9.60E-08	1.25E-08	1.25E-08	2.66E-09	1.20E-08	1.56E-09	1.56E-09	3.32E-10
1.00E+03	7.66E-08	9.96E-09	9.96E-09	2.12E-09	9.59E-09	1.25E-09	1.25E-09	2.65E-10
2.00E+03	3.82E-08	4.96E-09	4.96E-09	1.06E-09	4.78E-09	6.20E-10	6.20E-10	1.32E-10
4.00E+03	1.91E-08	2.47E-09	2.47E-09	5.28E-10	2.38E-09	3.10E-10	3.09E-10	6.61E-11
6.00E+03	1.27E-08	1.65E-09	1.65E-09	3.52E-10	1.59E-09	2.06E-10	2.06E-10	4.41E-11
8.00E+03	9.52E-09	1.24E-09	1.24E-09	2.64E-10	1.19E-09	1.55E-10	1.55E-10	3.30E-11
1.00E+04	7.61E-09	9.88E-10	9.88E-10	2.11E-10	9.52E-10	1.24E-10	1.24E-10	2.64E-11

E (GeV/u)	initial state $2p_{1/2}$, final state $1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	initial state $2p_{3/2}$, final state $1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	2.70E-05	6.90E-05	2.69E-04	3.82E-04	1.99E-05	6.07E-05	2.29E-04	3.47E-04
4.00E-01	1.01E-05	6.61E-06	1.82E-05	1.53E-05	7.19E-06	5.33E-06	1.43E-05	1.32E-05
6.00E-01	3.97E-06	1.75E-06	3.24E-06	1.91E-06	2.71E-06	1.33E-06	2.37E-06	1.57E-06
8.00E-01	1.83E-06	6.46E-07	9.51E-07	4.28E-07	1.20E-06	4.66E-07	6.55E-07	3.35E-07
1.00E+00	9.67E-07	2.92E-07	3.76E-07	1.37E-07	6.05E-07	2.01E-07	2.46E-07	1.01E-07
2.00E+00	1.26E-07	2.67E-08	2.75E-08	5.40E-09	6.64E-08	1.53E-08	1.49E-08	3.05E-09
4.00E+00	2.00E-08	3.43E-09	3.43E-09	5.00E-10	8.66E-09	1.59E-09	1.54E-09	1.92E-10
6.00E+00	8.06E-09	1.28E-09	1.29E-09	1.87E-10	3.15E-09	5.31E-10	5.31E-10	6.16E-11
8.00E+00	4.57E-09	6.95E-10	7.12E-10	1.06E-10	1.69E-09	2.70E-10	2.77E-10	3.29E-11
1.00E+01	3.06E-09	4.53E-10	4.69E-10	7.14E-11	1.09E-09	1.69E-10	1.76E-10	2.17E-11
2.00E+01	1.05E-09	1.46E-10	1.55E-10	2.56E-11	3.44E-10	4.95E-11	5.37E-11	7.62E-12
4.00E+01	4.28E-10	5.80E-11	6.23E-11	1.09E-11	1.35E-10	1.87E-11	2.06E-11	3.23E-12
6.00E+01	2.66E-10	3.57E-11	3.85E-11	6.85E-12	8.32E-11	1.13E-11	1.26E-11	2.04E-12
8.00E+01	1.93E-10	2.57E-11	2.78E-11	5.00E-12	5.99E-11	8.09E-12	9.00E-12	1.49E-12
1.00E+02	1.51E-10	2.01E-11	2.17E-11	3.93E-12	4.68E-11	6.28E-12	7.00E-12	1.18E-12
2.00E+02	7.24E-11	9.57E-12	1.04E-11	1.90E-12	2.23E-11	2.96E-12	3.31E-12	5.70E-13
4.00E+02	3.55E-11	4.67E-12	5.07E-12	9.35E-13	1.09E-11	1.44E-12	1.61E-12	2.80E-13
6.00E+02	2.35E-11	3.09E-12	3.35E-12	6.20E-13	7.19E-12	9.50E-13	1.06E-12	1.86E-13
8.00E+02	1.75E-11	2.31E-12	2.51E-12	4.64E-13	5.37E-12	7.09E-13	7.93E-13	1.39E-13
1.00E+03	1.40E-11	1.84E-12	2.00E-12	3.70E-13	4.29E-12	5.66E-13	6.33E-13	1.11E-13
2.00E+03	6.97E-12	9.15E-13	9.95E-13	1.84E-13	2.13E-12	2.81E-13	3.15E-13	5.54E-14
4.00E+03	3.48E-12	4.57E-13	4.97E-13	9.21E-14	1.06E-12	1.40E-13	1.57E-13	2.76E-14
6.00E+03	2.32E-12	3.04E-13	3.31E-13	6.14E-14	7.09E-13	9.34E-14	1.05E-13	1.84E-14
8.00E+03	1.74E-12	2.28E-13	2.48E-13	4.60E-14	5.31E-13	7.00E-14	7.83E-14	1.38E-14
1.00E+04	1.39E-12	1.82E-13	1.98E-13	3.68E-14	4.25E-13	5.60E-14	6.26E-14	1.10E-14

TABLE II. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, Au^{78+}, and U^{91+} by U^{92+}

See page 68 for Explanation of Tables

$U^{92+} + Al^{12+} \rightarrow U^{91+} + Al^{13+}$

E (GeV/u)	initial state $1s_{1/2}$				initial state $2s_{1/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E−01	7.02E+00	7.35E+00	2.61E+01	3.45E+01	8.82E−01	9.61E−01	3.43E+00	4.63E+00
4.00E−01	2.40E+00	1.02E+00	2.36E+00	1.97E+00	3.04E−01	1.29E−01	3.07E−01	2.59E−01
6.00E−01	9.54E−01	3.12E−01	5.02E−01	3.05E−01	1.21E−01	3.97E−02	6.46E−02	3.96E−02
8.00E−01	4.50E−01	1.27E−01	1.66E−01	7.83E−02	5.69E−02	1.61E−02	2.12E−02	1.01E−02
1.00E+00	2.41E−01	6.14E−02	7.10E−02	2.73E−02	3.05E−02	7.79E−03	9.05E−03	3.51E−03
2.00E+00	3.28E−02	6.54E−03	6.21E−03	1.26E−03	4.14E−03	8.26E−04	7.86E−04	1.61E−04
4.00E+00	5.27E−03	8.96E−04	8.42E−04	1.19E−04	6.63E−04	1.13E−04	1.06E−04	1.51E−05
6.00E+00	2.13E−03	3.39E−04	3.26E−04	4.56E−05	2.68E−04	4.26E−05	4.10E−05	5.75E−06
8.00E+00	1.21E−03	1.85E−04	1.81E−04	2.65E−05	1.52E−04	2.33E−05	2.27E−05	3.33E−06
1.00E+01	8.15E−04	1.21E−04	1.20E−04	1.83E−05	1.02E−04	1.52E−05	1.50E−05	2.31E−06
2.00E+01	2.84E−04	3.97E−05	3.98E−05	6.99E−06	3.57E−05	4.99E−06	5.00E−06	8.78E−07
4.00E+01	1.18E−04	1.59E−05	1.60E−05	3.08E−06	1.48E−05	2.00E−06	2.01E−06	3.86E−07
6.00E+01	7.39E−05	9.85E−06	9.90E−06	1.97E−06	9.28E−06	1.24E−06	1.24E−06	2.47E−07
8.00E+01	5.37E−05	7.11E−06	7.15E−06	1.44E−06	6.74E−06	8.93E−07	8.97E−07	1.81E−07
1.00E+02	4.22E−05	5.56E−06	5.59E−06	1.14E−06	5.30E−06	6.99E−07	7.01E−07	1.43E−07
2.00E+02	2.03E−05	2.66E−06	2.67E−06	5.56E−07	2.55E−06	3.34E−07	3.35E−07	6.99E−08
4.00E+02	9.97E−06	1.30E−06	1.30E−06	2.75E−07	1.25E−06	1.63E−07	1.64E−07	3.45E−08
6.00E+02	6.61E−06	8.60E−07	8.62E−07	1.82E−07	8.30E−07	1.08E−07	1.08E−07	2.29E−08
8.00E+02	4.94E−06	6.43E−07	6.44E−07	1.37E−07	6.20E−07	8.07E−08	8.08E−08	1.72E−08
1.00E+03	3.94E−06	5.13E−07	5.14E−07	1.09E−07	4.95E−07	6.44E−08	6.45E−08	1.37E−08
2.00E+03	1.97E−06	2.55E−07	2.56E−07	5.44E−08	2.47E−07	3.21E−08	3.21E−08	6.84E−09
4.00E+03	9.81E−07	1.27E−07	1.28E−07	2.72E−08	1.23E−07	1.60E−08	1.60E−08	3.41E−09
6.00E+03	6.53E−07	8.49E−08	8.50E−08	1.81E−08	8.20E−08	1.07E−08	1.07E−08	2.27E−09
8.00E+03	4.90E−07	6.36E−08	6.37E−08	1.36E−08	6.15E−08	7.99E−09	8.00E−09	1.71E−09
1.00E+04	3.92E−07	5.09E−08	5.10E−08	1.09E−08	4.92E−08	6.39E−09	6.40E−09	1.36E−09

E (GeV/u)	initial state $2p_{1/2}$				initial state $2p_{3/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E−01	6.38E−03	1.56E−02	6.08E−02	8.54E−02	4.55E−03	1.34E−02	5.06E−02	7.56E−02
4.00E−01	2.37E−03	1.53E−03	4.18E−03	3.48E−03	1.64E−03	1.20E−03	3.21E−03	2.92E−03
6.00E−01	9.34E−04	4.08E−04	7.49E−04	4.40E−04	6.20E−04	3.02E−04	5.37E−04	3.51E−04
8.00E−01	4.32E−04	1.51E−04	2.21E−04	9.93E−05	2.74E−04	1.06E−04	1.49E−04	7.54E−05
1.00E+00	2.28E−04	6.85E−05	8.79E−05	3.18E−05	1.39E−04	4.59E−05	5.62E−05	2.29E−05
2.00E+00	2.98E−05	6.30E−06	6.49E−06	1.27E−06	1.54E−05	3.52E−06	3.45E−06	7.02E−07
4.00E+00	4.74E−06	8.14E−07	8.11E−07	1.18E−07	2.03E−06	3.72E−07	3.60E−07	4.51E−08
6.00E+00	1.92E−06	3.04E−07	3.07E−07	4.43E−08	7.42E−07	1.25E−07	1.25E−07	1.46E−08
8.00E+00	1.09E−06	1.65E−07	1.69E−07	2.50E−08	3.97E−07	6.36E−08	6.52E−08	7.80E−09
1.00E+01	7.28E−07	1.08E−07	1.11E−07	1.70E−08	2.57E−07	3.97E−08	4.15E−08	5.16E−09
2.00E+01	2.49E−07	3.49E−08	3.69E−08	6.10E−09	8.15E−08	1.17E−08	1.27E−08	1.81E−09
4.00E+01	1.02E−07	1.38E−08	1.48E−08	2.59E−09	3.21E−08	4.43E−09	4.90E−09	7.68E−10
6.00E+01	6.34E−08	8.51E−09	9.16E−09	1.63E−09	1.98E−08	2.69E−09	2.98E−09	4.85E−10
8.00E+01	4.60E−08	6.13E−09	6.61E−09	1.19E−09	1.42E−08	1.92E−09	2.14E−09	3.54E−10
1.00E+02	3.60E−08	4.79E−09	5.17E−09	9.37E−10	1.11E−08	1.49E−09	1.66E−09	2.79E−10
2.00E+02	1.73E−08	2.28E−09	2.47E−09	4.54E−10	5.29E−09	7.04E−10	7.87E−10	1.35E−10
4.00E+02	8.45E−09	1.11E−09	1.21E−09	2.23E−10	2.58E−09	3.42E−10	3.83E−10	6.65E−11
6.00E+02	5.59E−09	7.35E−10	7.98E−10	1.48E−10	1.71E−09	2.26E−10	2.53E−10	4.41E−11
8.00E+02	4.18E−09	5.49E−10	5.96E−10	1.11E−10	1.28E−09	1.68E−10	1.89E−10	3.30E−11
1.00E+03	3.34E−09	4.38E−10	4.76E−10	8.83E−11	1.02E−09	1.34E−10	1.50E−10	2.63E−11
2.00E+03	1.66E−09	2.18E−10	2.37E−10	4.40E−11	5.06E−10	6.68E−11	7.48E−11	1.31E−11
4.00E+03	8.29E−10	1.09E−10	1.18E−10	2.20E−11	2.53E−10	3.33E−11	3.73E−11	6.56E−12
6.00E+03	5.52E−10	7.25E−11	7.87E−11	1.46E−11	1.68E−10	2.22E−11	2.48E−11	4.37E−12
8.00E+03	4.14E−10	5.43E−11	5.90E−11	1.10E−11	1.26E−10	1.66E−11	1.86E−11	3.28E−12
1.00E+04	3.31E−10	4.34E−11	4.72E−11	8.78E−12	1.01E−10	1.33E−11	1.49E−11	2.62E−12

TABLE II. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, Au^{78+}, and U^{91+} by U^{92+}

See page 68 for Explanation of Tables

$U^{92+} + Cu^{28+} \rightarrow U^{91+} + Cu^{29+}$

E (GeV/u)	initial state $1s_{1/2}$				initial state $2s_{1/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	3.88E+02	2.87E+02	9.24E+02	1.07E+03	5.00E+01	4.32E+01	1.50E+02	1.90E+02
4.00E-01	1.28E+02	4.85E+01	9.97E+01	7.57E+01	1.71E+01	6.62E+00	1.50E+01	1.21E+01
6.00E-01	5.14E+01	1.56E+01	2.33E+01	1.31E+01	6.86E+00	2.11E+00	3.36E+00	1.98E+00
8.00E-01	2.46E+01	6.52E+00	8.17E+00	3.60E+00	3.27E+00	8.80E-01	1.14E+00	5.26E-01
1.00E+00	1.34E+01	3.25E+00	3.65E+00	1.32E+00	1.78E+00	4.36E-01	5.02E-01	1.88E-01
2.00E+00	1.91E+00	3.72E-01	3.52E-01	6.96E-02	2.50E-01	4.90E-02	4.67E-02	9.43E-03
4.00E+00	3.22E-01	5.41E-02	5.08E-02	7.29E-03	4.17E-02	7.02E-03	6.60E-03	9.58E-04
6.00E+00	1.33E-01	2.10E-02	2.01E-02	2.88E-03	1.72E-02	2.70E-03	2.59E-03	3.75E-04
8.00E+00	7.66E-02	1.16E-02	1.13E-02	1.69E-03	9.85E-03	1.49E-03	1.45E-03	2.19E-04
1.00E+01	5.19E-02	7.67E-03	7.54E-03	1.18E-03	6.66E-03	9.84E-04	9.67E-04	1.52E-04
2.00E+01	1.83E-02	2.55E-03	2.55E-03	4.54E-04	2.34E-03	3.27E-04	3.26E-04	5.83E-05
4.00E+01	7.65E-03	1.03E-03	1.04E-03	2.00E-04	9.78E-04	1.32E-04	1.32E-04	2.57E-05
6.00E+01	4.81E-03	6.40E-04	6.42E-04	1.28E-04	6.14E-04	8.17E-05	8.18E-05	1.64E-05
8.00E+01	3.50E-03	4.63E-04	4.64E-04	9.42E-05	4.46E-04	5.91E-05	5.91E-05	1.20E-05
1.00E+02	2.75E-03	3.62E-04	3.63E-04	7.44E-05	3.51E-04	4.62E-05	4.62E-05	9.52E-06
2.00E+02	1.32E-03	1.73E-04	1.74E-04	3.63E-05	1.69E-04	2.21E-05	2.21E-05	4.64E-06
4.00E+02	6.51E-04	8.48E-05	8.50E-05	1.79E-05	8.30E-05	1.08E-05	1.08E-05	2.29E-06
6.00E+02	4.31E-04	5.61E-05	5.62E-05	1.19E-05	5.50E-05	7.16E-06	7.15E-06	1.52E-06
8.00E+02	3.22E-04	4.19E-05	4.20E-05	8.91E-06	4.11E-05	5.35E-06	5.34E-06	1.14E-06
1.00E+03	2.57E-04	3.35E-05	3.35E-05	7.12E-06	3.28E-05	4.27E-06	4.27E-06	9.10E-07
2.00E+03	1.28E-04	1.67E-05	1.67E-05	3.55E-06	1.64E-05	2.13E-06	2.12E-06	4.54E-07
4.00E+03	6.40E-05	8.31E-06	8.33E-06	1.77E-06	8.16E-06	1.06E-06	1.06E-06	2.27E-07
6.00E+03	4.26E-05	5.54E-06	5.55E-06	1.18E-06	5.44E-06	7.06E-07	7.06E-07	1.51E-07
8.00E+03	3.20E-05	4.15E-06	4.16E-06	8.86E-07	4.08E-06	5.30E-07	5.29E-07	1.13E-07
1.00E+04	2.56E-05	3.32E-06	3.33E-06	7.09E-07	3.26E-06	4.24E-07	4.23E-07	9.06E-08

E (GeV/u)	initial state $2p_{1/2}$				initial state $2p_{3/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	1.99E+00	4.01E+00	1.55E+01	2.09E+01	1.30E+00	3.22E+00	1.22E+01	1.74E+01
4.00E-01	7.26E-01	4.36E-01	1.14E+00	9.26E-01	4.61E-01	3.18E-01	8.24E-01	7.24E-01
6.00E-01	2.87E-01	1.19E-01	2.13E-01	1.23E-01	1.75E-01	8.20E-02	1.43E-01	9.07E-02
8.00E-01	1.33E-01	4.49E-02	6.46E-02	2.86E-02	7.80E-02	2.92E-02	4.08E-02	2.00E-02
1.00E+00	7.08E-02	2.07E-02	2.61E-02	9.36E-03	3.98E-02	1.28E-02	1.57E-02	6.20E-03
2.00E+00	9.40E-03	1.97E-03	2.01E-03	3.93E-04	4.52E-03	1.02E-03	1.01E-03	2.01E-04
4.00E+00	1.52E-03	2.60E-04	2.58E-04	3.77E-05	6.11E-04	1.11E-04	1.08E-04	1.36E-05
6.00E+00	6.17E-04	9.77E-05	9.83E-05	1.42E-05	2.27E-04	3.78E-05	3.80E-05	4.51E-06
8.00E+00	3.51E-04	5.34E-05	5.44E-05	8.09E-06	1.22E-04	1.94E-05	2.00E-05	2.43E-06
1.00E+01	2.36E-04	3.49E-05	3.59E-05	5.50E-06	7.93E-05	1.22E-05	1.28E-05	1.61E-06
2.00E+01	8.12E-05	1.13E-05	1.19E-05	1.99E-06	2.54E-05	3.64E-06	3.95E-06	5.68E-07
4.00E+01	3.33E-05	4.51E-06	4.81E-06	8.47E-07	1.00E-05	1.38E-06	1.53E-06	2.41E-07
6.00E+01	2.07E-05	2.78E-06	2.98E-06	5.35E-07	6.18E-06	8.40E-07	9.33E-07	1.52E-07
8.00E+01	1.50E-05	2.00E-06	2.15E-06	3.91E-07	4.46E-06	6.01E-07	6.69E-07	1.11E-07
1.00E+02	1.18E-05	1.56E-06	1.68E-06	3.08E-07	3.48E-06	4.67E-07	5.21E-07	8.75E-08
2.00E+02	5.65E-06	7.45E-07	8.04E-07	1.49E-07	1.66E-06	2.21E-07	2.47E-07	4.24E-08
4.00E+02	2.77E-06	3.64E-07	3.93E-07	7.32E-08	8.10E-07	1.07E-07	1.20E-07	2.08E-08
6.00E+02	1.83E-06	2.41E-07	2.60E-07	4.86E-08	5.35E-07	7.08E-08	7.93E-08	1.38E-08
8.00E+02	1.37E-06	1.80E-07	1.94E-07	3.63E-08	4.00E-07	5.28E-08	5.92E-08	1.03E-08
1.00E+03	1.09E-06	1.43E-07	1.55E-07	2.90E-08	3.19E-07	4.21E-08	4.72E-08	8.26E-09
2.00E+03	5.44E-07	7.14E-08	7.71E-08	1.45E-08	1.59E-07	2.09E-08	2.35E-08	4.12E-09
4.00E+03	2.71E-07	3.56E-08	3.85E-08	7.22E-09	7.92E-08	1.04E-08	1.17E-08	2.05E-09
6.00E+03	1.81E-07	2.37E-08	2.56E-08	4.81E-09	5.28E-08	6.95E-09	7.80E-09	1.37E-09
8.00E+03	1.36E-07	1.78E-08	1.92E-08	3.61E-09	3.96E-08	5.21E-09	5.85E-09	1.03E-09
1.00E+04	1.08E-07	1.42E-08	1.54E-08	2.88E-09	3.16E-08	4.17E-09	4.68E-09	8.21E-10

TABLE II. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, Au^{78+}, and U^{91+} by U^{92+}

See page 68 for Explanation of Tables

$U^{92+} + Ag^{46+} \rightarrow U^{91+} + Ag^{47+}$

E (GeV/u)	initial state $1s_{1/2}$				initial state $2s_{1/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	3.71E+03	1.58E+03	3.58E+03	3.19E+03	5.21E+02	2.81E+02	8.78E+02	9.72E+02
4.00E-01	1.18E+03	3.56E+02	5.78E+02	3.67E+02	1.74E+02	5.55E+01	1.13E+02	8.35E+01
6.00E-01	4.83E+02	1.26E+02	1.64E+02	7.96E+01	7.13E+01	1.93E+01	2.87E+01	1.58E+01
8.00E-01	2.37E+02	5.63E+01	6.45E+01	2.51E+01	3.47E+01	8.48E+00	1.06E+01	4.61E+00
1.00E+00	1.32E+02	2.95E+01	3.11E+01	1.01E+01	1.92E+01	4.37E+00	4.91E+00	1.76E+00
2.00E+00	2.07E+01	3.87E+00	3.60E+00	6.79E-01	2.90E+00	5.47E-01	5.17E-01	1.04E-01
4.00E+00	3.77E+00	6.20E-01	5.80E-01	8.43E-02	5.13E-01	8.46E-02	7.90E-02	1.19E-02
6.00E+00	1.61E+00	2.50E-01	2.39E-01	3.52E-02	2.17E-01	3.36E-02	3.20E-02	4.84E-03
8.00E+00	9.45E-01	1.42E-01	1.37E-01	2.12E-02	1.26E-01	1.89E-02	1.82E-02	2.88E-03
1.00E+01	6.48E-01	9.48E-02	9.27E-02	1.49E-02	8.62E-02	1.26E-02	1.22E-02	2.01E-03
2.00E+01	2.34E-01	3.25E-02	3.22E-02	5.86E-03	3.09E-02	4.28E-03	4.21E-03	7.80E-04
4.00E+01	9.90E-02	1.33E-02	1.32E-02	2.61E-03	1.30E-02	1.75E-03	1.72E-03	3.45E-04
6.00E+01	6.24E-02	8.29E-03	8.26E-03	1.67E-03	8.19E-03	1.09E-03	1.07E-03	2.21E-04
8.00E+01	4.55E-02	6.01E-03	5.99E-03	1.23E-03	5.96E-03	7.87E-04	7.77E-04	1.62E-04
1.00E+02	3.58E-02	4.71E-03	4.69E-03	9.73E-04	4.69E-03	6.17E-04	6.09E-04	1.28E-04
2.00E+02	1.73E-02	2.26E-03	2.25E-03	4.76E-04	2.26E-03	2.96E-04	2.92E-04	6.26E-05
4.00E+02	8.50E-03	1.11E-03	1.10E-03	2.35E-04	1.11E-03	1.45E-04	1.43E-04	3.09E-05
6.00E+02	5.63E-03	7.33E-04	7.29E-04	1.56E-04	7.38E-04	9.58E-05	9.45E-05	2.05E-05
8.00E+02	4.21E-03	5.48E-04	5.45E-04	1.17E-04	5.52E-04	7.16E-05	7.06E-05	1.54E-05
1.00E+03	3.36E-03	4.37E-04	4.35E-04	9.34E-05	4.40E-04	5.72E-05	5.64E-05	1.23E-05
2.00E+03	1.68E-03	2.18E-04	2.17E-04	4.66E-05	2.19E-04	2.85E-05	2.81E-05	6.13E-06
4.00E+03	8.37E-04	1.09E-04	1.08E-04	2.33E-05	1.10E-04	1.42E-05	1.40E-05	3.06E-06
6.00E+03	5.58E-04	7.24E-05	7.20E-05	1.55E-05	7.30E-05	9.46E-06	9.33E-06	2.04E-06
8.00E+03	4.18E-04	5.43E-05	5.40E-05	1.16E-05	5.47E-05	7.09E-06	6.99E-06	1.53E-06
1.00E+04	3.34E-04	4.34E-05	4.32E-05	9.30E-06	4.38E-05	5.67E-06	5.59E-06	1.22E-06

E (GeV/u)	initial state $2p_{1/2}$				initial state $2p_{3/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	6.60E+01	9.36E+01	3.46E+02	4.27E+02	3.84E+01	7.00E+01	2.57E+02	3.37E+02
4.00E-01	2.33E+01	1.22E+01	2.94E+01	2.26E+01	1.33E+01	8.21E+00	1.98E+01	1.64E+01
6.00E-01	9.26E+00	3.52E+00	5.96E+00	3.29E+00	5.07E+00	2.20E+00	3.69E+00	2.23E+00
8.00E-01	4.35E+00	1.37E+00	1.90E+00	8.14E-01	2.28E+00	8.08E-01	1.10E+00	5.16E-01
1.00E+00	2.33E+00	6.46E-01	7.96E-01	2.77E-01	1.18E+00	3.62E-01	4.36E-01	1.66E-01
2.00E+00	3.22E-01	6.57E-02	6.64E-02	1.29E-02	1.39E-01	3.07E-02	3.02E-02	5.90E-03
4.00E+00	5.36E-02	9.07E-03	8.93E-03	1.32E-03	1.95E-02	3.50E-03	3.41E-03	4.34E-04
6.00E+00	2.21E-02	3.47E-03	3.47E-03	5.09E-04	7.35E-03	1.22E-03	1.22E-03	1.48E-04
8.00E+00	1.27E-02	1.91E-03	1.94E-03	2.92E-04	4.00E-03	6.32E-04	6.50E-04	8.07E-05
1.00E+01	8.54E-03	1.26E-03	1.28E-03	2.00E-04	2.61E-03	4.00E-04	4.18E-04	5.38E-05
2.00E+01	2.97E-03	4.14E-04	4.32E-04	7.32E-05	8.46E-04	1.21E-04	1.31E-04	1.91E-05
4.00E+01	1.22E-03	1.65E-04	1.75E-04	3.13E-05	3.37E-04	4.63E-05	5.11E-05	8.12E-06
6.00E+01	7.64E-04	1.02E-04	1.09E-04	1.98E-05	2.08E-04	2.82E-05	3.12E-05	5.14E-06
8.00E+01	5.54E-04	7.37E-05	7.85E-05	1.45E-05	1.50E-04	2.02E-05	2.24E-05	3.75E-06
1.00E+02	4.35E-04	5.76E-05	6.14E-05	1.14E-05	1.17E-04	1.57E-05	1.75E-05	2.95E-06
2.00E+02	2.09E-04	2.75E-05	2.94E-05	5.53E-06	5.59E-05	7.42E-06	8.29E-06	1.43E-06
4.00E+02	1.02E-04	1.34E-05	1.44E-05	2.72E-06	2.73E-05	3.61E-06	4.04E-06	7.04E-07
6.00E+02	6.77E-05	8.88E-06	9.50E-06	1.81E-06	1.80E-05	2.38E-06	2.67E-06	4.67E-07
8.00E+02	5.06E-05	6.64E-06	7.10E-06	1.35E-06	1.35E-05	1.78E-06	1.99E-06	3.49E-07
1.00E+03	4.04E-05	5.30E-06	5.67E-06	1.08E-06	1.08E-05	1.42E-06	1.59E-06	2.79E-07
2.00E+03	2.01E-05	2.64E-06	2.82E-06	5.38E-07	5.35E-06	7.06E-07	7.90E-07	1.39E-07
4.00E+03	1.00E-05	1.31E-06	1.41E-06	2.69E-07	2.67E-06	3.52E-07	3.94E-07	6.94E-08
6.00E+03	6.69E-06	8.76E-07	9.38E-07	1.79E-07	1.78E-06	2.34E-07	2.62E-07	4.62E-08
8.00E+03	5.01E-06	6.57E-07	7.03E-07	1.34E-07	1.33E-06	1.76E-07	1.97E-07	3.47E-08
1.00E+04	4.01E-06	5.25E-07	5.62E-07	1.07E-07	1.07E-06	1.41E-07	1.57E-07	2.77E-08

TABLE II. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, Au^{78+}, and U^{91+} by U^{92+}

See page 68 for Explanation of Tables

$U^{92+} + Au^{78+} \rightarrow U^{91+} + Au^{79+}$

E (GeV/u)	initial state $1s_{1/2}$				initial state $2s_{1/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	1.56E+04	1.72E+03	1.46E+03	6.31E+02	3.43E+03	4.12E+02	4.90E+02	2.94E+02
4.00E-01	5.77E+03	9.36E+02	8.78E+02	3.30E+02	1.12E+03	1.71E+02	2.15E+02	1.14E+02
6.00E-01	2.71E+03	4.75E+02	4.40E+02	1.41E+02	4.94E+02	8.33E+01	9.55E+01	4.24E+01
8.00E-01	1.49E+03	2.65E+02	2.41E+02	6.64E+01	2.61E+02	4.54E+01	4.79E+01	1.78E+01
1.00E+00	9.13E+02	1.62E+02	1.45E+02	3.52E+01	1.55E+02	2.71E+01	2.70E+01	8.61E+00
2.00E+00	1.87E+02	3.15E+01	2.78E+01	4.73E+00	2.90E+01	4.88E+00	4.41E+00	8.96E-01
4.00E+00	4.25E+01	6.63E+00	6.06E+00	9.18E-01	6.17E+00	9.61E-01	8.67E-01	1.47E-01
6.00E+00	1.99E+01	2.98E+00	2.79E+00	4.42E-01	2.82E+00	4.21E-01	3.85E-01	6.69E-02
8.00E+00	1.23E+01	1.79E+00	1.70E+00	2.83E-01	1.72E+00	2.49E-01	2.30E-01	4.17E-02
1.00E+01	8.71E+00	1.24E+00	1.19E+00	2.06E-01	1.21E+00	1.72E-01	1.59E-01	2.99E-02
2.00E+01	3.36E+00	4.60E-01	4.43E-01	8.62E-02	4.58E-01	6.23E-02	5.80E-02	1.21E-02
4.00E+01	1.47E+00	1.96E-01	1.89E-01	3.94E-02	1.99E-01	2.63E-02	2.45E-02	5.46E-03
6.00E+01	9.37E-01	1.24E-01	1.19E-01	2.55E-02	1.26E-01	1.66E-02	1.54E-02	3.52E-03
8.00E+01	6.87E-01	9.01E-02	8.71E-02	1.88E-02	9.25E-02	1.21E-02	1.12E-02	2.59E-03
1.00E+02	5.42E-01	7.09E-02	6.85E-02	1.49E-02	7.29E-02	9.50E-03	8.81E-03	2.05E-03
2.00E+02	2.64E-01	3.43E-02	3.31E-02	7.34E-03	3.54E-02	4.59E-03	4.25E-03	1.01E-03
4.00E+02	1.30E-01	1.69E-02	1.63E-02	3.64E-03	1.75E-02	2.25E-03	2.09E-03	4.98E-04
6.00E+02	8.63E-02	1.12E-02	1.08E-02	2.42E-03	1.16E-02	1.49E-03	1.38E-03	3.30E-04
8.00E+02	6.46E-02	8.36E-03	8.07E-03	1.81E-03	8.66E-03	1.12E-03	1.03E-03	2.47E-04
1.00E+03	5.16E-02	6.68E-03	6.45E-03	1.45E-03	6.92E-03	8.92E-04	8.26E-04	1.98E-04
2.00E+03	2.57E-02	3.33E-03	3.21E-03	7.22E-04	3.45E-03	4.45E-04	4.11E-04	9.87E-05
4.00E+03	1.28E-02	1.66E-03	1.60E-03	3.61E-04	1.72E-03	2.22E-04	2.05E-04	4.93E-05
6.00E+03	8.56E-03	1.11E-03	1.07E-03	2.40E-04	1.15E-03	1.48E-04	1.37E-04	3.28E-05
8.00E+03	6.42E-03	8.30E-04	8.01E-04	1.80E-04	8.61E-04	1.11E-04	1.03E-04	2.46E-05
1.00E+04	5.13E-03	6.64E-04	6.41E-04	1.44E-04	6.89E-04	8.87E-05	8.20E-05	1.97E-05

E (GeV/u)	initial state $2p_{1/2}$				initial state $2p_{3/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	2.55E+03	1.46E+03	3.95E+03	3.68E+03	1.27E+03	1.07E+03	3.11E+03	3.21E+03
4.00E-01	8.47E+02	2.99E+02	5.55E+02	3.57E+02	4.12E+02	1.85E+02	3.60E+02	2.55E+02
6.00E-01	3.46E+02	1.01E+02	1.46E+02	7.04E+01	1.60E+02	5.62E+01	8.30E+01	4.42E+01
8.00E-01	1.69E+02	4.36E+01	5.44E+01	2.09E+01	7.40E+01	2.24E+01	2.82E+01	1.18E+01
1.00E+00	9.41E+01	2.23E+01	2.54E+01	8.12E+00	3.92E+01	1.07E+01	1.22E+01	4.21E+00
2.00E+00	1.46E+01	2.78E+00	2.73E+00	5.21E-01	5.10E+00	1.07E+00	1.04E+00	1.93E-01
4.00E+00	2.70E+00	4.42E-01	4.26E-01	6.54E-02	7.82E-01	1.37E-01	1.33E-01	1.72E-02
6.00E+00	1.16E+00	1.79E-01	1.75E-01	2.70E-02	3.07E-01	4.98E-02	4.99E-02	6.27E-03
8.00E+00	6.83E-01	1.01E-01	1.00E-01	1.60E-02	1.71E-01	2.66E-02	2.72E-02	3.53E-03
1.00E+01	4.68E-01	6.79E-02	6.78E-02	1.11E-02	1.13E-01	1.71E-02	1.78E-02	2.39E-03
2.00E+01	1.68E-01	2.32E-02	2.37E-02	4.23E-03	3.77E-02	5.36E-03	5.76E-03	8.70E-04
4.00E+01	7.05E-02	9.48E-03	9.76E-03	1.84E-03	1.52E-02	2.09E-03	2.28E-03	3.73E-04
6.00E+01	4.43E-02	5.89E-03	6.09E-03	1.17E-03	9.45E-03	1.28E-03	1.40E-03	2.37E-04
8.00E+01	3.22E-02	4.27E-03	4.42E-03	8.59E-04	6.84E-03	9.18E-04	1.01E-03	1.73E-04
1.00E+02	2.53E-02	3.34E-03	3.46E-03	6.78E-04	5.35E-03	7.15E-04	7.89E-04	1.36E-04
2.00E+02	1.22E-02	1.60E-03	1.66E-03	3.29E-04	2.56E-03	3.39E-04	3.75E-04	6.62E-05
4.00E+02	5.99E-03	7.84E-04	8.14E-04	1.62E-04	1.25E-03	1.65E-04	1.83E-04	3.26E-05
6.00E+02	3.97E-03	5.19E-04	5.39E-04	1.08E-04	8.29E-04	1.09E-04	1.21E-04	2.16E-05
8.00E+02	2.97E-03	3.88E-04	4.03E-04	8.06E-05	6.19E-04	8.16E-05	9.04E-05	1.62E-05
1.00E+03	2.37E-03	3.10E-04	3.22E-04	6.44E-05	4.94E-04	6.51E-05	7.21E-05	1.29E-05
2.00E+03	1.18E-03	1.54E-04	1.60E-04	3.21E-05	2.46E-04	3.24E-05	3.59E-05	6.44E-06
4.00E+03	5.89E-04	7.69E-05	7.99E-05	1.60E-05	1.23E-04	1.61E-05	1.79E-05	3.22E-06
6.00E+03	3.93E-04	5.12E-05	5.32E-05	1.07E-05	8.18E-05	1.08E-05	1.19E-05	2.14E-06
8.00E+03	2.94E-04	3.84E-05	3.99E-05	8.02E-06	6.13E-05	8.06E-06	8.93E-06	1.61E-06
1.00E+04	2.36E-04	3.07E-05	3.19E-05	6.41E-06	4.90E-05	6.45E-06	7.15E-06	1.29E-06

TABLE II. Cross Sections for Electron Capture from Hydrogen-Like Ions C^{5+}, Al^{12+}, Cu^{28+}, Ag^{46+}, Au^{78+}, and U^{91+} by U^{92+}

See page 68 for Explanation of Tables

$U^{92+} + U^{91+} \rightarrow U^{91+} + U^{92+}$

E (GeV/u)	initial state $1s_{1/2}$				initial state $2s_{1/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	1.19E+04	7.59E+02	4.48E+02	1.52E+02	3.35E+03	3.97E+02	6.97E+02	8.24E+02
4.00E-01	5.74E+03	7.06E+02	5.32E+02	1.53E+02	1.13E+03	1.06E+02	8.38E+01	3.87E+01
6.00E-01	3.08E+03	4.49E+02	3.59E+02	9.24E+01	5.44E+02	6.43E+01	5.63E+01	2.16E+01
8.00E-01	1.84E+03	2.86E+02	2.34E+02	5.41E+01	3.09E+02	4.16E+01	3.73E+01	1.27E+01
1.00E+00	1.20E+03	1.91E+02	1.58E+02	3.33E+01	1.94E+02	2.81E+01	2.50E+01	7.60E+00
2.00E+00	2.91E+02	4.66E+01	3.99E+01	6.54E+00	4.32E+01	6.71E+00	5.77E+00	1.24E+00
4.00E+00	7.48E+01	1.14E+01	1.02E+01	1.60E+00	1.04E+01	1.57E+00	1.36E+00	2.57E-01
6.00E+00	3.70E+01	5.44E+00	5.00E+00	8.28E-01	5.05E+00	7.33E-01	6.43E-01	1.25E-01
8.00E+00	2.35E+01	3.37E+00	3.14E+00	5.48E-01	3.17E+00	4.50E-01	3.97E-01	8.02E-02
1.00E+01	1.69E+01	2.39E+00	2.24E+00	4.08E-01	2.26E+00	3.16E-01	2.80E-01	5.86E-02
2.00E+01	6.79E+00	9.21E-01	8.71E-01	1.76E-01	8.94E-01	1.20E-01	1.06E-01	2.44E-02
4.00E+01	3.03E+00	4.01E-01	3.80E-01	8.19E-02	3.96E-01	5.20E-02	4.59E-02	1.11E-02
6.00E+01	1.94E+00	2.55E-01	2.41E-01	5.33E-02	2.53E-01	3.30E-02	2.90E-02	7.20E-03
8.00E+01	1.43E+00	1.87E-01	1.77E-01	3.95E-02	1.86E-01	2.41E-02	2.12E-02	5.32E-03
1.00E+02	1.13E+00	1.47E-01	1.39E-01	3.13E-02	1.47E-01	1.90E-02	1.67E-02	4.22E-03
2.00E+02	5.51E-01	7.15E-02	6.76E-02	1.54E-02	7.16E-02	9.23E-03	8.09E-03	2.07E-03
4.00E+02	2.72E-01	3.52E-02	3.33E-02	7.66E-03	3.54E-02	4.55E-03	3.98E-03	1.03E-03
6.00E+02	1.81E-01	2.34E-02	2.21E-02	5.10E-03	2.35E-02	3.02E-03	2.64E-03	6.81E-04
8.00E+02	1.35E-01	1.75E-02	1.65E-02	3.82E-03	1.76E-02	2.26E-03	1.97E-03	5.10E-04
1.00E+03	1.08E-01	1.40E-02	1.32E-02	3.05E-03	1.40E-02	1.80E-03	1.58E-03	4.08E-04
2.00E+03	5.39E-02	6.97E-03	6.58E-03	1.52E-03	7.01E-03	8.98E-04	7.86E-04	2.04E-04
4.00E+03	2.69E-02	3.48E-03	3.28E-03	7.62E-04	3.50E-03	4.49E-04	3.92E-04	1.02E-04
6.00E+03	1.79E-02	2.32E-03	2.19E-03	5.08E-04	2.33E-03	2.99E-04	2.61E-04	6.78E-05
8.00E+03	1.35E-02	1.74E-03	1.64E-03	3.81E-04	1.75E-03	2.24E-04	1.96E-04	5.08E-05
1.00E+04	1.08E-02	1.39E-03	1.31E-03	3.04E-04	1.40E-03	1.79E-04	1.57E-04	4.06E-05

E (GeV/u)	initial state $2p_{1/2}$				initial state $2p_{3/2}$			
	final state				final state			
	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2}$
2.00E-01	6.51E+03	2.31E+03	4.88E+03	3.83E+03	3.21E+03	1.86E+03	4.52E+03	4.10E+03
4.00E-01	2.13E+03	6.00E+02	9.60E+02	5.52E+02	1.02E+03	3.85E+02	6.70E+02	4.37E+02
6.00E-01	8.95E+02	2.24E+02	2.95E+02	1.31E+02	4.00E+02	1.26E+02	1.74E+02	8.64E+01
8.00E-01	4.50E+02	1.04E+02	1.21E+02	4.37E+01	1.89E+02	5.26E+01	6.32E+01	2.52E+01
1.00E+00	2.56E+02	5.55E+01	6.04E+01	1.83E+01	1.02E+02	2.59E+01	2.86E+01	9.44E+00
2.00E+00	4.31E+01	7.86E+00	7.55E+00	1.44E+00	1.39E+01	2.83E+00	2.72E+00	4.98E-01
4.00E+00	8.47E+00	1.36E+00	1.29E+00	2.04E-01	2.23E+00	3.85E-01	3.73E-01	4.88E-02
6.00E+00	3.75E+00	5.68E-01	5.48E-01	8.79E-02	8.94E-01	1.44E-01	1.43E-01	1.84E-02
8.00E+00	2.23E+00	3.28E-01	3.20E-01	5.31E-02	5.04E-01	7.77E-02	7.93E-02	1.05E-02
1.00E+01	1.55E+00	2.22E-01	2.19E-01	3.73E-02	3.36E-01	5.04E-02	5.22E-02	7.16E-03
2.00E+01	5.67E-01	7.79E-02	7.80E-02	1.44E-02	1.14E-01	1.61E-02	1.72E-02	2.65E-03
4.00E+01	2.41E-01	3.22E-02	3.25E-02	6.35E-03	4.63E-02	6.32E-03	6.87E-03	1.14E-03
6.00E+01	1.52E-01	2.01E-02	2.04E-02	4.06E-03	2.88E-02	3.88E-03	4.24E-03	7.26E-04
8.00E+01	1.11E-01	1.46E-02	1.48E-02	2.98E-03	2.08E-02	2.79E-03	3.06E-03	5.31E-04
1.00E+02	8.70E-02	1.14E-02	1.16E-02	2.35E-03	1.63E-02	2.18E-03	2.39E-03	4.19E-04
2.00E+02	4.20E-02	5.50E-03	5.59E-03	1.15E-03	7.82E-03	1.04E-03	1.14E-03	2.03E-04
4.00E+02	2.07E-02	2.69E-03	2.74E-03	5.66E-04	3.83E-03	5.05E-04	5.55E-04	1.00E-04
6.00E+02	1.37E-02	1.78E-03	1.82E-03	3.75E-04	2.53E-03	3.34E-04	3.67E-04	6.65E-05
8.00E+02	1.02E-02	1.33E-03	1.36E-03	2.81E-04	1.89E-03	2.49E-04	2.74E-04	4.98E-05
1.00E+03	8.18E-03	1.07E-03	1.08E-03	2.24E-04	1.51E-03	1.99E-04	2.19E-04	3.98E-05
2.00E+03	4.07E-03	5.30E-04	5.40E-04	1.12E-04	7.53E-04	9.90E-05	1.09E-04	1.98E-05
4.00E+03	2.03E-03	2.65E-04	2.70E-04	5.59E-05	3.76E-04	4.94E-05	5.43E-05	9.90E-06
6.00E+03	1.35E-03	1.76E-04	1.80E-04	3.72E-05	2.50E-04	3.29E-05	3.62E-05	6.60E-06
8.00E+03	1.02E-03	1.32E-04	1.35E-04	2.79E-05	1.88E-04	2.47E-05	2.71E-05	4.94E-06
1.00E+04	8.12E-04	1.06E-04	1.08E-04	2.23E-05	1.50E-04	1.97E-05	2.17E-05	3.96E-06