

Table 21.6. (Continued.)

λ (μm)	$R_V = 3.1$	5	λ (μm)	$R_V = 3.1$	5	λ (μm)	$R_V = 3.1$	5
35	3.7(-3)	4.2(-3)	1.65 (H)	0.176	0.204	0.18	2.52	1.52
25	0.014	0.016	1.25 (J)	0.282	0.327	0.15	2.66	1.49
20	0.021	0.025	0.9 (I)	0.479	0.556	0.13	3.12	1.60
18	0.023	0.027	0.7 (R)	0.749	0.794	0.12	3.58	1.74
15	0.015	0.017	0.55 (V)	1.00	1.00	0.091 ^c	4.85	...
12	0.028	0.032	0.44 (B)	1.31	1.20	0.073	5.38	...
10	0.054	0.063	0.365 (U)	1.56	1.33	0.041	2.58	...
9.7	0.059	0.068	0.33	1.65	1.35	0.023	2.06	...
9.0	0.042	0.051	0.28	1.94	1.42	0.004	0.96	...
7.0	0.020	0.023	0.26	2.15	1.50	0.002	0.38	...

Notes

^aExcept as noted below, entries are from [1]. Values of $A(\lambda)/A(V)$ for other values of R_V can be determined from that paper.

^bFor $\lambda > 250 \mu\text{m}$, multiply entry for $250 \mu\text{m}$ by $(250 \mu\text{m}/\lambda)^2$.

^cFor $\lambda < 0.1 \mu\text{m}$, entries are from [2], increased by 1.15 for continuity at $0.12 \mu\text{m}$.

References

1. Cardelli, J.A., Clayton, G.C., & Mathis, J.S. 1989, *ApJ*, **345**, 245
2. Martin, P.G., & Rouleau, F. 1990, in *Extreme Ultraviolet Astronomy*, edited by R.F. Malina and S. Bowyer (Pergamon, Oxford), p. 341

21.2.2 Opacity in X-Ray Region of Spectrum [15]

The cross section per H atom is given by $\sigma = (c_1 + c_2 E + c_3 E^2) E^{-3} \times 10^{-24} \text{ cm}^2 (\text{H atom})^{-1}$. There are breaks in σ at various energies as detailed in Table 21.7.

Table 21.7. X-ray opacity of interstellar gas and dust.

E range (keV)	Edge ^a	c_1	c_2	c_3
0.030–0.100	...	17.3	608.1	-2150
0.100–0.284	C	34.6	267.9	-476.1
0.284–0.400	N	78.1	18.8	4.3
0.400–0.532	O	71.4	66.8	-51.4
0.532–0.707	Fe–L	95.5	145.8	-61.1
0.707–0.867	Ne	308.9	-380.6	294.0
0.867–1.303	Mg	120.6	169.3	-47.7
1.303–1.840	Si	141.3	146.8	-31.5
1.840–2.471	S	202.7	104.7	-17.0
2.471–3.210	Ar	342.7	18.7	0.0
3.210–4.038	Ca	352.2	18.7	0.0
4.038–7.111	Fe	433.9	2.4	0.75
7.111–8.331	Ni	629.0	30.9	0.0
8.331–10.00	...	701.2	25.2	0.0

Note

^aThe element whose absorption produces a discontinuity at the upper energy of the range.