

Helium (He)

1. Recommended electron collision cross sections^[1]

The following cross section set was compiled so that it can reproduce the drift velocity, the ND_L and the Townsend's ionization coefficient measured in He gas by the two-term Boltzmann code.

(1) Elastic momentum transfer cross section

Energy (eV)	Cross section(\AA^2)	Energy (eV)	Cross section(\AA^2)
0.00000	5.00000	0.60000	6.60600
0.00100	5.02800	0.80000	6.74000
0.00200	5.05600	1.00000	6.88000
0.00300	5.08400	1.20000	6.93000
0.00400	5.11200	1.50000	6.98000
0.00500	5.14000	2.00000	7.01000
0.00600	5.16800	2.50000	6.95000
0.00800	5.22400	3.00000	6.86000
0.01000	5.28000	4.00000	6.62000
0.02000	5.40000	5.00000	6.32000
0.03000	5.51000	6.00000	5.99000
0.04000	5.56700	8.00000	5.35000
0.05000	5.62400	10.00000	4.76000
0.06000	5.68000	12.00000	4.21000
0.08000	5.80000	15.00000	3.50000
0.10000	5.91000	20.00000	2.58000
0.12000	5.95900	25.00000	1.95000
0.15000	6.03250	30.00000	1.51000
0.20000	6.15500	40.00000	0.98000
0.25000	6.27750	50.00000	0.70200
0.30000	6.40000	60.00000	0.50400
0.40000	6.47000	80.00000	0.31500
0.50000	6.54000	100.00000	0.21800

(2) Electron excitation cross section, Threshold = 19.820 eV, Energy loss = 19.820 eV

Energy (eV)	Cross section(\AA^2)	Energy (eV)	Cross section(\AA^2)
19.82000	0.00000 ^[2]	30.00000	0.13500
20.00000	0.03000	35.00000	0.16200
21.00000	0.05000	40.00000	0.17700
22.00000	0.06300	45.00000	0.18600
23.00000	0.07300	50.00000	0.18800
24.00000	0.08200	60.00000	0.18800
25.00000	0.09200	80.00000	0.18400
26.00000	0.10100	100.00000	0.17500
28.00000	0.12000		

(3) Electron ionization cross section, Threshold = 24.460 eV, Energy loss = 24.460 eV

Energy (eV)	Cross section(\AA^2)	Energy (eV)	Cross section(\AA^2)
24.46000	0.00000 ^[3]	35.00000	0.13000
25.00000	0.00540	40.00000	0.17000
26.00000	0.01700	50.00000	0.23700
28.00000	0.03100	60.00000	0.28000
30.00000	0.06500	80.00000	0.33000
32.00000	0.09000	100.00000	0.34500

[1] S. Takeda and Y. Nakamura, *Trans. IEE of Jpn.*, **102** (1982) 491 - 498

[2]

[3]

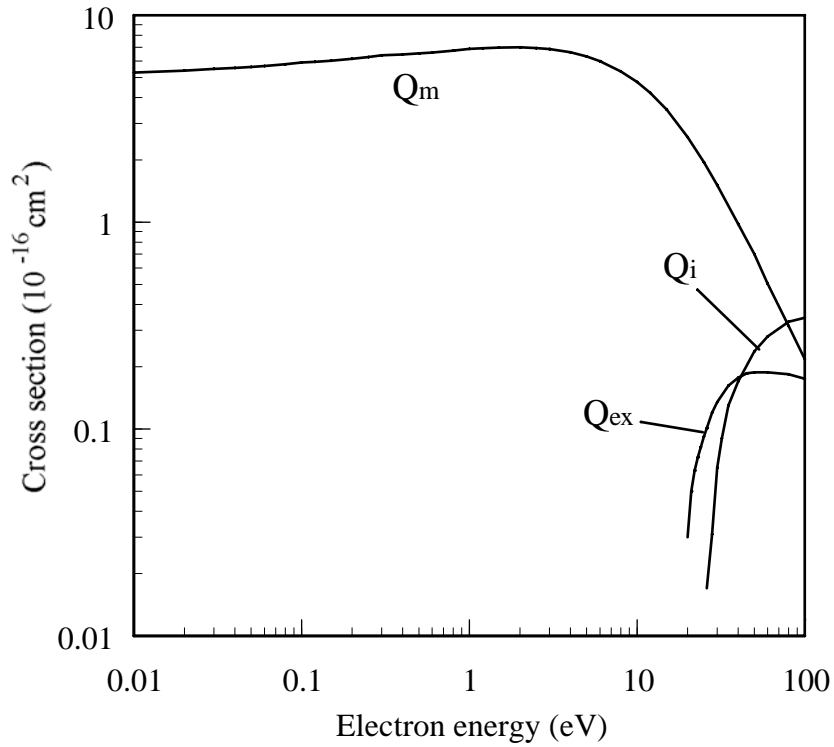


Fig.1 Recommended cross sections for He.

2. Related electron swarm data

(1) Electron drift velocity, W, in He

E/N (Td)	W (10 ⁶ cm/s)	E/N (Td)	W (10 ⁶ cm/s)
0.008	3.47 ^[4]	0.35	29.70
0.01	4.12	0.4	31.70
0.012	4.70	0.42	33.00 ^[1]
0.014	5.23	0.5	35.30
0.017	5.96	0.57	36.00
0.02	6.61	0.6	38.50
0.025	7.58	0.7	41.40
0.03	8.45	0.71	41.60
0.035	9.23	0.8	44.10
0.04	9.94	0.85	45.00
0.05	11.24	0.99	49.50
0.06	12.39	1.	49.10
0.07	13.43	1.13	52.00
0.08	14.40	1.2	53.60
0.1	16.12	1.4	57.80
0.12	17.67	1.41	57.00
0.14	19.08	1.7	63.60
0.17	21.00	1.98	69.50
0.2	22.70	2.26	74.50
0.25	25.30	2.83	82.00
0.3	27.60	3.39	93.00

4.24	105.0	16.97	390.0
5.66	129.0	19.80	445.0
7.07	155.0	22.63	520.0
8.49	185.0	25.46	605.0
9.90	208.0	28.29	670.0
11.31	245.0	33.94	810.0
14.14	303.0	42.43	1030.0

[4] R. W. Crompton, M. T. Elford and A. G. Robertson, *Aust. J. Phys.*, **23** (1970) 667 -

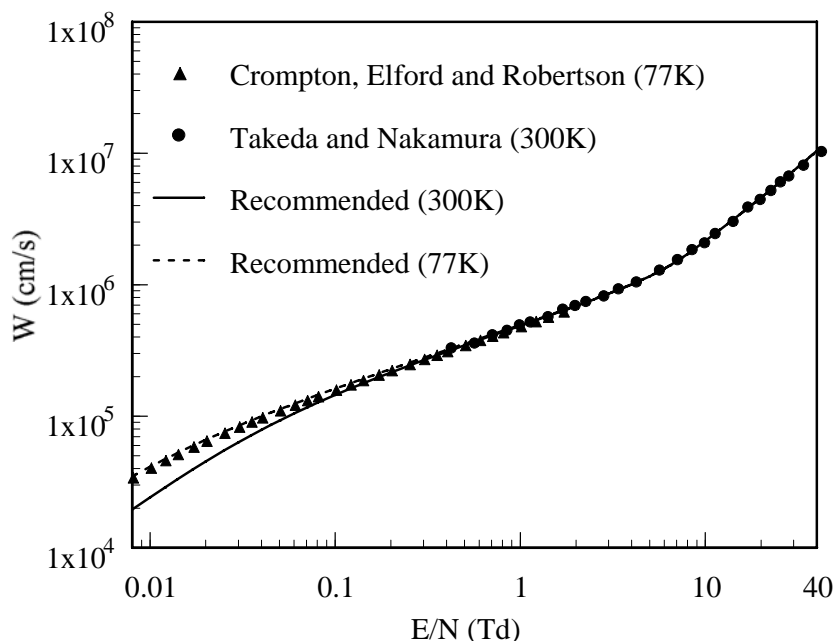


Fig.2 Electron drift velocity in He

(2) Product of longitudinal diffusion coefficient and gas number density, ND_L , in He

E/N (Td)	$ND_L (10^{21} \text{ cm/s})$	E/N (Td)	$ND_L (10^{21} \text{ cm/s})$
0.025	5.64 ^[5]	0.6	8.54
0.03	5.70	0.707	10.25
0.035	5.77	0.849	9.83
0.04	5.70	0.990	11.45
0.05	5.48	1.131	12.02
0.06	5.60	1.414	13.58
0.07	5.73	1.697	12.48
0.08	5.76	1.980	15.10
0.1	5.64	2.263	16.26
0.12	5.94	2.829	17.50
0.14	6.03	3.394	19.44
0.17	6.22	4.243	22.63
0.2	6.51	5.657	34.29
0.25	6.74	7.072	49.85
0.3	7.02	8.486	76.36
0.35	7.75	9.900	84.85
0.4	8.25	11.314	97.22
0.424	9.19 ^[1]	14.143	106.1
0.5	8.17	16.972	95.45
0.566	7.95	19.800	88.38

22.629	93.33	33.943	109.9
25.458	77.78	42.429	70.71
28.286	93.69		

[5] M. T. Elford, *Aust. J. Phys.*, **27** (1974) 235 - 239

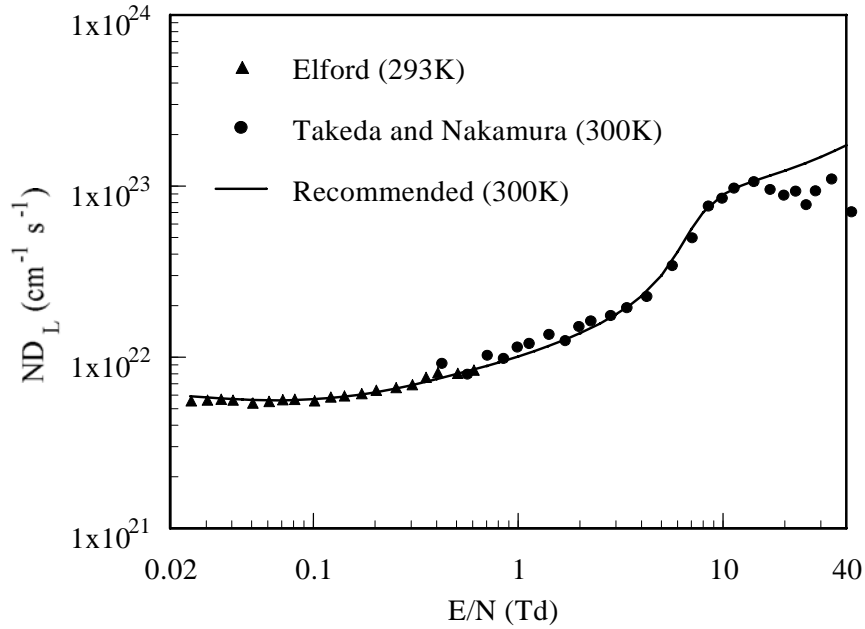


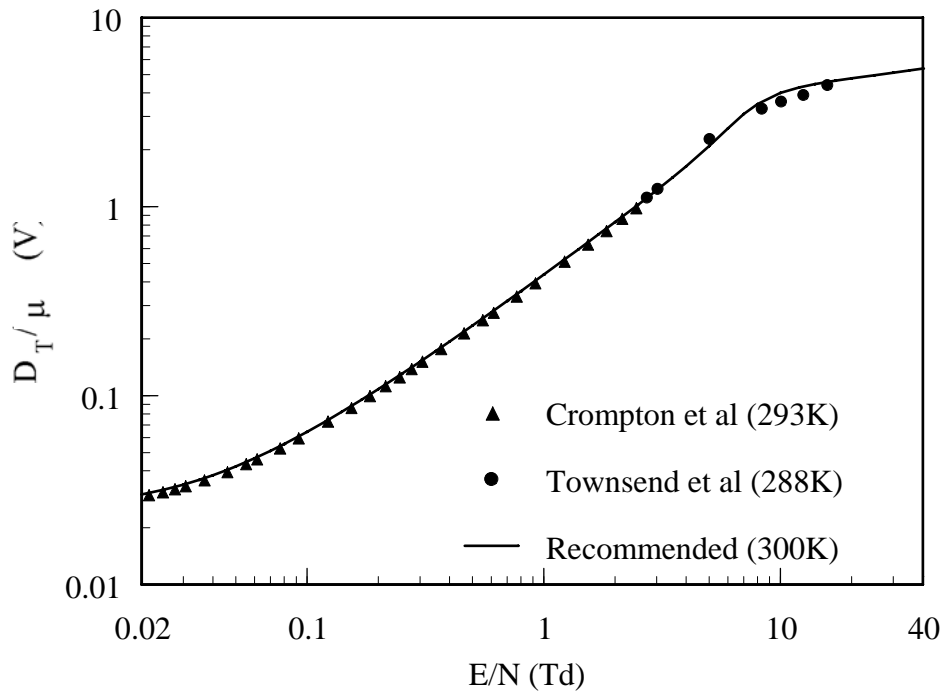
Fig.3 ND_L in He

(3) Characteristic energy, D_T/μ , in He

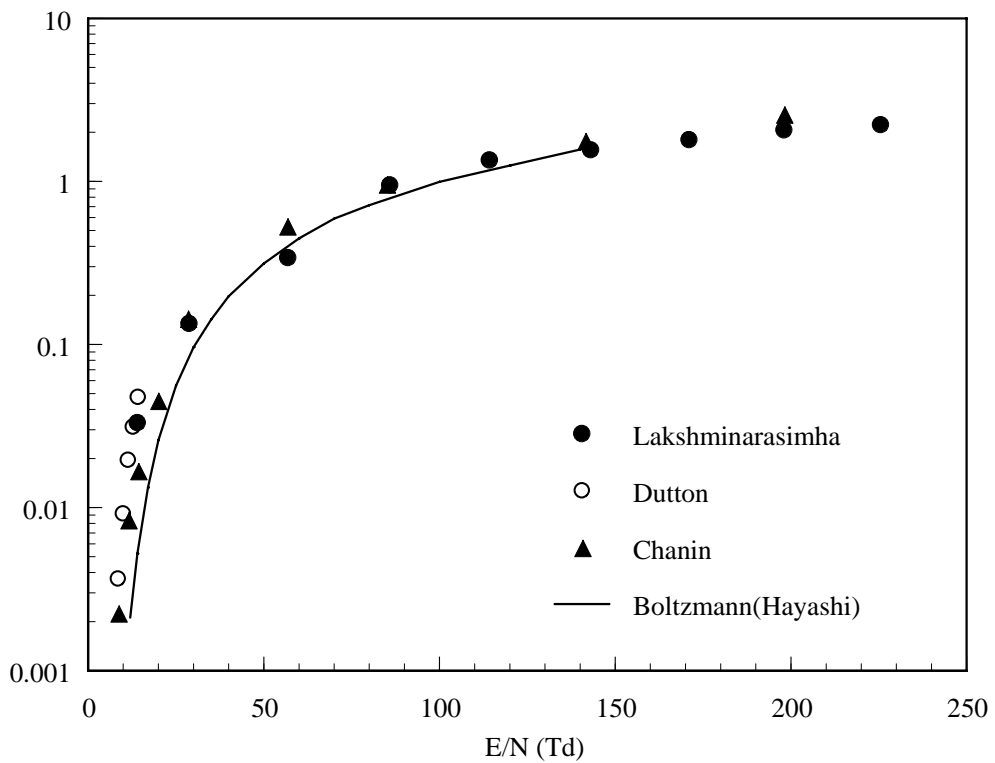
E/N (Td)	D_T/μ (V)	E/N (Td)	D_T/μ (V)
0.0212	0.0302 ^[6]	0.455	0.2170
0.0243	0.0313	0.546	0.2545
0.0273	0.0325	0.607	0.2789
0.0303	0.0337	0.759	0.340
0.0364	0.0362	0.910	0.399
0.0455	0.0400	1.21	0.520
0.0546	0.0441	1.52	0.640
0.0607	0.0468	1.82	0.755
0.0759	0.0534	2.12	0.876
0.0910	0.0604	2.43	0.996
0.121	0.0741	2.73	1.117 ^[7]
0.152	0.0874	3.03	1.241
0.182	0.1010	5.02	2.28
0.212	0.1141	8.35	3.3
0.243	0.1271	10.07	3.6
0.273	0.1405	12.52	3.9
0.303	0.1536	15.8	4.4
0.364	0.1792		

[6] R. W. Crompton et al., *Aust. J. Phys.* **20** (1967) 369 -

[7] J. S. Townsend et al., *Phil. Mag.* **46** (1923) 657 -



(4) Ionization coefficient



E/N (Td)	α/N ($\times 10^{-18} \text{cm}^2$)	E/N (Td)	α/N ($\times 10^{-18} \text{cm}^2$)	E/N (Td)	α/N ($\times 10^{-18} \text{cm}^2$)	E/N (Td)	α/N ($\times 10^{-18} \text{cm}^2$)
8.486	0.03677	33.943	2.687	8.486	0.0226	9.052	0.0185
9.900	0.09221	70.715	8.203	11.31	0.0843	9.476	0.0247

11.314	0.1963	91.93	13.38	14.14	0.1689	9.900	0.0407
12.729	0.3140	141.431	19.09	19.80	0.4554	11.31	0.0729
14.143	0.4780	169.717	21.50	28.29	1.451	12.72	0.1131
		274.376	31.40	56.57	5.346	14.14	0.1796
				84.86	9.674	14.70	0.2266
				141.4	17.82	15.84	0.3041
				198.0	25.94	16.972	0.3912
				182.9	37.05	17.537	0.4356
				424.3	51.76	18.669	0.5431
				565.7	58.84	19.800	0.6138
				848.6	68.74	20.932	0.6775
						22.063	0.7552
						22.629	0.7948
						23.760	0.8486
						24.892	0.9787
						26.023	1.052

1. Dutton, J. and Rees, D. B., *Brit. J. Appl. Phys.* **18**, 309- (1965),e
2. Chanin, L. H. and Rork, G. D., *J. Appl. Phys.* **35**, 2801- (1964), e
- 3.
4. Cavalleri, G., *Phys. Rev. A***179**, 186- (1969),e