IPPJ-AM-37

IONIZATION CROSS SECTIONS OF ATOMS AND IONS BY ELECTRON IMPACT

H. TAWARA, T. KATO AND M. OHNISHI

INSTITUTE OF PLASMA PHYSICS
NAGOYA UNIVERSITY

NAGOYA, JAPAN

IPPJ-AM-37

IONIZATION CROSS SECTIONS OF ATOMS AND IONS BY ELECTRON IMPACT

Hiroyuki TAWARA, Takako KATO and Mari OHNISHI

Institute of Plasma Physics, Nagoya University
Chikusa-ku, Nagoya 464, Japan

February 1985

Abstract

Experimental data of the ionization cross sections for atoms and ions ranging from H to U in electron impact are compiled and given, in graphical forms, as a function of the electron impact energy. Some theoretical data are also included. The literature is surveyed up to the end of 1984. Some comments on the compiled data are also given.

Contents

The process

$$Li^{+} + e \rightarrow Li^{3+} + 3e$$

indicates that singly charged Li^{+} ions are doubly ionized in electron impact, resulting in triply charged Li^{3+} ions.

INTRODUCTION

The ionization processes of atoms and ions by electron impact are important not only in atomic physics but also in detailed understanding of a number of processes in, for example discharge, radiation physics, laboratory plasmas as well as astrophysical plasmas. In as early as 1920s, the relative ionization probabilities for rare gas atoms by electrons were measured[1]. Then, in 1930s, total absolute ionization efficiencies defined as "numbers of positive charge per electron per cm path per mm Hg pressure at 0°C" were determined[2] for rare gas atoms and common molecules. The partial absolute ionization efficiencies for production of Ne^{3+}, Ar^{5+} and Hg^{5+} ions were also determined.[3] Since then, a number of experimental and theoretical investigations have been made. Kieffer and Dunn[4] and Kieffer[5] summarized and reviewed these results on ionization cross sections. Recently much attention has been paid to these ionization processes involving highly ionized ions in high temperature plasmas. Also it has been realized that the ionization processes play a key role even in low temperature plasmas such as those in the periphery of high temperature plasmas and in divertor plasmas[6]. To handle the ionization processes more easily, a number of the empirical formulas for calculating the ionization cross sections had been proposed. In particular, the formula derived by Lotz is widely used which has the following forms:

$$\sigma = \sum_{i=1} a_i q_i \frac{\ln(E/P_i)}{E\, P_i} \{1 - b_i \exp[-c_i(E/P_i - 1)]\} \qquad (1)$$

where σ is the total ionization cross section, E the electron impact energy, P_i the binding energy of electrons in the i-th shell, q_i the number of electrons in the i-th shell, a_i, b_i and c_i are constants given in his papers[7]. The summation Σ is made over all shells. More recently, a review on such empirical formulas of the ionization cross sections has been made[8]. Also a critical review of the ionization cross sections for target atoms and ions up to Z=10 has been made by Belfast group[9]. A list of the bibliographical references on the ionizations of ions by electron impact up to 1983 can be found[10].

In this Report, experimental ionization cross sections for atoms and ions ranging from H to U in elemental forms published up to the end of 1984 are compiled and given in two graphical forms which are hoped to be convenient for different users of these results. In these graphs are also shown the curves calculated by the Lotz formula (1) summed over three outermost subshells (for targets with the atomic number $Z \leq 30$) and selected theoretical data since 1970. Theoretical results analytically fitted to the calculated values and those calculated by the simple plane-wave Born approximation are not included. Data for molecules are not included except for the common molecules such as H_2, D_2, N_2 and O_2. The numerical tables of these cross sections, which are stored as one of the databases (AMDIS: Atomic and Molecular Data Interactive System) at our Institute, are available upon request.

Remarks on compiled data

1. The cross sections are given per collision. That is, those for molecular targets are per molecule.
2. The cross sections indicated as sum $\{A^{n+}+(n+1)e\}$ are defined as $\Sigma n\sigma_n$ where σ_n is the partial ionization cross section for production of A^{n+} ions and are measured in a condenser plate method.
3. It should be kept in mind that highly ionized ions produced in ion sources usually contain a significant fraction of ions in the metastable states which have the ionization cross sections different from those in the ground state. Some discussion on this problem is given[11].
4. When the original data are given for unknown low and high fractions of the metastable ions in the beams, those for low fractions are shown in figures.
5. Experimental data for neutral single atoms such as C, N, O and S which are not commonly available can be obtained through the developed crossed-beam technique[12] recently.
6. Some data obtained in trapped ion beam technique should be borne in mind to be model-dependent[13].

7. Most of the theoretical calculations give only the direct ionization cross sections. The discrepancy between theories and experiments may well be due to the exclusion of the excitation-autoionization for theoretical data.
8. We have tried to include the available recent theoretical calculations on the excitation-autoionization cross sections (e.g., Ca^+, Ti^{3+}, Fe^{15+}, etc.).

Remarks on the future investigations

It is found through the present compilation that most of the total ionization cross sections for gases seem to be in agreement with each other. However, some problems, which should be solved, arise as follows:

1. Some cross sections for production of highly ionized ions from neutral gaseous targets are sometimes in significant disagreement with each other. This is partly due to the incomplete extraction and collection of these ions and partly due to the detection efficiencies for these ions. The measurement of most of the cross sections, in particular for ions with $n \geq 3$, should be repeated.
2. Similar disagreement is also seen even in those for low charge ions from non-gaseous targets. This is mostly due to the lack of proper methods for determining precise target densities.

A method should be developed for accurate determination of the densities of such targets.

3. The experimental data for highly ionized ions, particularly for Fe ions, are urgently required in the investigations of high temperature plasmas.
4. The contribution of the excitation-autoionization to total ionization is quite large for some ions such as Na-like and Mg-like ions. The theoretical studies to find some scaling of this contribution would be useful.

Acknowledgements

A number of people contributed to this compilation of the ionization cross section data. In particular, the authors would like to thank Profs. K. Takayanagi, H. Suzuki, T. Iwai, Y. Itikawa, S. Ohtani and the member of the Study Group of Atomic Processes in Plasmas at Institute of Plasma Physics, Nagoya University. Dr. D. C. Gregory, Dr. K. Okuno and Prof. E. Salzborn kindly provided their experimental data in tabular forms. The authors acknowledge Dr. K. Takasugi for the computer program to draw graphs and lists of references in the retrieval and display system of AMDIS.

REFERENCES FOR INTRODUCTION

1. K. T. Compton and C. C. van Voorhis, Phys. Rev. 26 (1925) 436.

2. P. T. Smith, Phys. Rev. 36 (1930) 1293.

3. W. Bleakney. Phys. Rev. 35 (1930) 139; Phys. Rev. 36 (1930) 1303.

4. L. J. Kieffer and G. H. Dunn, Rev. Mod. Phys. 38 (1966) 1.

5. L. J. Kieffer, Atomic Data 1 (1969) 19.

6. D. E. Post and C. E. Singer, Proc. 6-th Int. Conf. Plasma Surface Interactions in Controlled Fusion Devices (Ed. A. Miyahara, H. Tawara, N. Itoh and K. Kamada, North-Holland, 1984) p.78.

7. W. Lotz, Z. Phys. 206 (1967) 205; Z. Phys. 216 (1968) 241.

8. Y. Itikawa and T. Kato, IPPJ-AM-17 (Institute of Plasma Physics, Nagoya Univ., 1981).

9. K. L. Bell, H. B. Gilbody, J. G. Hughes, A. E. Kingston and F. J. Smith, J. Phys. Chem. Ref. Data 12 (1983) 891.

10. Y. Itikawa, K. Takayanagi and T. Iwai, At. Data and Nucl. Data Tables 31 (1984) 215; Y. Itikawa and T. Iwai, IPPJ-AM-7 (Institute of Plasma Physics, Nagoya Univ., 1977); Y. Itikawa, IPPJ-AM-24 (Institute of Plasma Physics, Nagoya Univ., 1982).

11. R. G. Montague and M. F. A. Harrison, J. Phys. B 16 (1983) 3045.

12. E. Brook, M. F. A. Harrison and A. C. H. Smith, J. Phys. B 11 (1978) 3115.

13. E. D. Donets and V. P. Ovsyannikov, Soviet Phys. - JETP 53 (1981) 466.

LIST OF PROCESSES OF COMPILED DATA

Figure Number	Process	
1.	$H_2 + e$	$\rightarrow$ sum
2.		$\rightarrow H_2^+ + 2e$
3.		$\rightarrow H^+$
4.	$H + e$	$\rightarrow H^+ + 2e$
5.	$H(2S) + e$	$\rightarrow H^+ + 2e$
6.	$D_2 + e$	$\rightarrow$ sum
7.	$He + e$	$\rightarrow$ sum
8.		$\rightarrow He^+ + 2e$
9.		$\rightarrow He^{2+} + 3e$
10.	$He(2S) + e$	$\rightarrow He^+ + 2e$
11.	$He^+ + e$	$\rightarrow He^{2+} + 2e$
12.	$Li + e$	$\rightarrow$ sum
13.		$\rightarrow Li^+ + 2e$
14.		$\rightarrow Li^{2+} + 3e$
15.	$Li^+ + e$	$\rightarrow Li^{2+} + 2e$
16.		$\rightarrow Li^{3+} + 3e$
17.	$Li^{2+} + e$	$\rightarrow Li^{3+} + 2e$
18.	$Be^+ + e$	$\rightarrow Be^{2+} + 2e$
19.	$B^+ + e$	$\rightarrow B^{2+} + 2e$
20.	$B^{2+} + e$	$\rightarrow B^{3+} + 2e$
21.	$B^{3+} + e$	$\rightarrow B^{4+} + 2e$
22.	$C + e$	$\rightarrow C^+ + 2e$
23.	$C^+ + e$	$\rightarrow C^{2+} + 2e$
24.	$C^{2+} + e$	$\rightarrow C^{3+} + 2e$
25.	$C^{3+} + e$	$\rightarrow C^{4+} + 2e$
26.	$C^{4+} + e$	$\rightarrow C^{5+} + 2e$
27.	$C^{5+} + e$	$\rightarrow C^{6+} + 2e$
28.	$N_2 + e$	$\rightarrow$ sum
29.		$\rightarrow N_2^+ + 2e$
30.		$\rightarrow N_2^{2+} + 3e$
31.	$N_2 + e$	$\rightarrow N^+$
32.		$\rightarrow N^{2+}$
33.		$\rightarrow N^{3+}$
34.	$N + e$	$\rightarrow$ sum
35.		$\rightarrow N^+ + 2e$
36.	$N^+ + e$	$\rightarrow N^{2+} + 2e$
37.	$N^{2+} + e$	$\rightarrow N^{3+} + 2e$
38.	$N^{3+} + e$	$\rightarrow N^{4+} + 2e$
39.	$N^{4+} + e$	$\rightarrow N^{5+} + 2e$
40.	$N^{5+} + e$	$\rightarrow N^{6+} + 2e$
41.	$N^{6+} + e$	$\rightarrow N^{7+} + 2e$
42.	$O_2 + e$	$\rightarrow$ sum
43.		$\rightarrow O_2^+ + 2e$
44.		$\rightarrow O_2^{2+} + 3e$
45.		$\rightarrow O^+$
46.	$O + e$	$\rightarrow$ sum
47.		$\rightarrow O^+ + 2e$
48.		$\rightarrow O^{2+} + 3e$
49.	$O^+ + e$	$\rightarrow O^{2+} + 2e$
50.	$O^{2+} + e$	$\rightarrow O^{3+} + 2e$
51.	$O^{3+} + e$	$\rightarrow O^{4+} + 2e$
52.	$O^{4+} + e$	$\rightarrow O^{5+} + 2e$
53.	$O^{5+} + e$	$\rightarrow O^{6+} + 2e$
54.	$O^{6+} + e$	$\rightarrow O^{7+} + 2e$
55.	$O^{7+} + e$	$\rightarrow O^{8+} + 2e$
56.	$F^{2+} + e$	$\rightarrow F^{3+} + 2e$
57.	$F^{5+} + e$	$\rightarrow F^{6+} + 2e$
58.	$Ne + e$	$\rightarrow$ sum
59.		$\rightarrow Ne^+ + 2e$
60.		$\rightarrow Ne^{2+} + 3e$

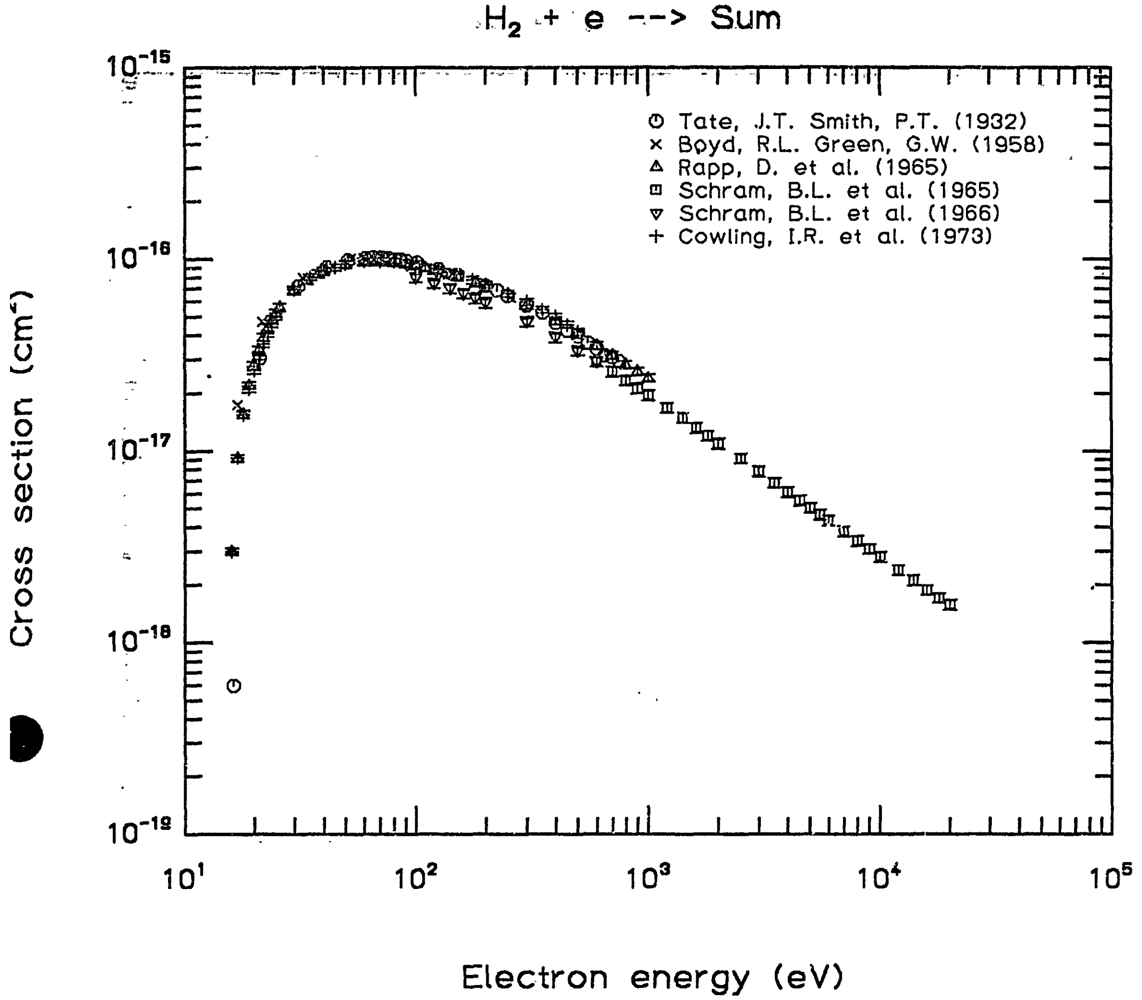
Figure Number	Process	Figure Number	Process
61.	$Ne + e \rightarrow Ne^{3+} + 4e$	91.	$A\ell^{5+} + e \rightarrow A\ell^{6+} + 2e$
62.	$\rightarrow Ne^{4+} + 5e$	92.	$A\ell^{6+} + e \rightarrow A\ell^{7+} + 2e$
63.	$\rightarrow Ne^{5+} + 6e$	93.	$A\ell^{7+} + e \rightarrow A\ell^{8+} + 2e$
64.	$Ne^{+} + e \rightarrow Ne^{2+} + 2e$	94.	$A\ell^{8+} + e \rightarrow A\ell^{9+} + 2e$
65.	$Ne^{2+} + e \rightarrow Ne^{3+} + 2e$	95.	$A\ell^{9+} + e \rightarrow A\ell^{10+} + 2e$
66.	$Ne^{3+} + e \rightarrow Ne^{4+} + 2e$	96.	$A\ell^{10+} + e \rightarrow A\ell^{11+} + 2e$
67.	$Ne^{4+} + e \rightarrow Ne^{5+} + 2e$	97.	$A\ell^{11+} + e \rightarrow A\ell^{12+} + 2e$
68.	$Ne^{5+} + e \rightarrow Ne^{6+} + 2e$	98.	$Si^{3+} + e \rightarrow Si^{4+} + 2e$
69.	$Ne^{6+} + e \rightarrow Ne^{7+} + 2e$	99.	$P^{4+} + e \rightarrow P^{5+} + 2e$
70.	$Ne^{7+} + e \rightarrow Ne^{8+} + 2e$	100.	$S + e \rightarrow S^{+} + 2e$
71.	$Ne^{8+} + e \rightarrow Ne^{9+} + 2e$	101.	$\rightarrow S^{2+} + 3e$
72.	$Ne^{9+} + e \rightarrow Ne^{10+} + 2e$	102.	$\rightarrow S^{3+} + 4e$
73.	$Na + e \rightarrow$ sum	103.	$\rightarrow S^{4+} + 5e$
74.	$\rightarrow Na^{+} + 2e$	104.	$C\ell^{2+} + e \rightarrow C\ell^{3+} + 2e$
75.	$\rightarrow Na^{2+} + 3e$	105.	$Ar + e \rightarrow$ sum
76.	$Na^{+} + e \rightarrow Na^{2+} + 2e$	106.	$\rightarrow Ar^{+} + 2e$
77.	$Na^{2+} + e \rightarrow Na^{3+} + 2e$	107.	$\rightarrow Ar^{2+} + 3e$
78.	$Na^{9+} + e \rightarrow Na^{10+} + 2e$	108.	$\rightarrow Ar^{3+} + 4e$
79.	$Mg + e \rightarrow$ sum	109.	$\rightarrow Ar^{4+} + 5e$
80.	$\rightarrow Mg^{+} + 2e$	110.	$\rightarrow Ar^{5+} + 6e$
81.	$\rightarrow Mg^{2+} + 3e$	111.	$\rightarrow Ar^{6+} + 7e$
82.	$Mg^{+} + e \rightarrow Mg^{2+} + 3e$	112.	$\rightarrow Ar^{7+} + 8e$
83.	$Mg^{2+} + e \rightarrow Mg^{3+} + 2e$	113.	$Ar^{+} + e \rightarrow Ar^{2+} + 2e$
84.	$Mg^{9+} + e \rightarrow Mg^{10+} + 2e$	114.	$\rightarrow Ar^{3+} + 3e$
85.	$A\ell + e \rightarrow$ sum	115.	$\rightarrow Ar^{4+} + 4e$
86.	$\rightarrow A\ell^{+} + 2e$	116.	$\rightarrow Ar^{5+} + 5e$
87.	$A\ell^{+} + e \rightarrow A\ell^{2+} + 2e$	117.	$Ar^{2+} + e \rightarrow Ar^{3+} + 2e$
88.	$A\ell^{2+} + e \rightarrow A\ell^{3+} + 2e$	118.	$\rightarrow Ar^{4+} + 3e$
89.	$A\ell^{3+} + e \rightarrow A\ell^{4+} + 2e$	119.	$\rightarrow Ar^{5+} + 4e$
90.	$A\ell^{4+} + e \rightarrow A\ell^{5+} + 2e$	120.	$Ar^{3+} + e \rightarrow Ar^{4+} + 2e$

Figure Number	Process	Figure Number	Process
121.	$Ar^{3+} + e \rightarrow Ar^{5+} + 3e$	151.	$Fe^{+} + e \rightarrow Fe^{2+} + 2e$
122.	$Ar^{4+} + e \rightarrow Ar^{5+} + 2e$	152.	$Fe^{2+} + e \rightarrow Fe^{3+} + 2e$
123.	[illegible] $+ e \rightarrow Ar^{6+} + 3e$	153.	$Fe^{3+} + e \rightarrow Fe^{4+} + 2e$
124.	$Ar^{5+} + e \rightarrow Ar^{6+} + 2e$	154.	$Fe^{4+} + e \rightarrow Fe^{5+} + 2e$
125.	$Ar^{6+} + e \rightarrow Ar^{7+} + 2e$	155.	$Fe^{5+} + e \rightarrow Fe^{6+} + 2e$
126.	$Ar^{7+} + e \rightarrow Ar^{8+} + 2e$	156.	$Fe^{6+} + e \rightarrow Fe^{7+} + 2e$
127.	$Ar^{8+} + e \rightarrow Ar^{9+} + 2e$	157.	$Fe^{7+} + e \rightarrow Fe^{8+} + 2e$
128.	$Ar^{10+} + e \rightarrow Ar^{11+} + 2e$	158.	$Fe^{8+} + e \rightarrow Fe^{9+} + 2e$
129.	$Ar^{11+} + e \rightarrow Ar^{12+} + 2e$	159.	$Fe^{9+} + e \rightarrow Fe^{10+} + 2e$
130.	$Ar^{12+} + e \rightarrow Ar^{13+} + 2e$	160.	$Fe^{10+} + e \rightarrow Fe^{11+} + 2e$
131.	$Ar^{14+} + e \rightarrow Ar^{15+} + 2e$	161.	$Fe^{11+} + e \rightarrow Fe^{12+} + 2e$
132.	$Ar^{15+} + e \rightarrow Ar^{16+} + 2e$	162.	$Fe^{12+} + e \rightarrow Fe^{13+} + 2e$
133.	$Ar^{16+} + e \rightarrow Ar^{17+} + 2e$	163.	$Fe^{13+} + e \rightarrow Fe^{14+} + 2e$
134.	$Ar^{17+} + e \rightarrow Ar^{18+} + 2e$	164.	$Fe^{14+} + e \rightarrow Fe^{15+} + 2e$
135.	$K + e \rightarrow$ sum	165.	$Fe^{15+} + e \rightarrow Fe^{16+} + 2e$
136.	$K^{+} + e \rightarrow K^{2+} + 2e$	166.	$Fe^{16+} + e \rightarrow Fe^{17+} + 2e$
137.	$K^{2+} + e \rightarrow K^{3+} + 2e$	167.	$Fe^{17+} + e \rightarrow Fe^{18+} + 2e$
138.	$Ca + e \rightarrow$ sum	168.	$Fe^{18+} + e \rightarrow Fe^{19+} + 2e$
139.	$Ca^{+} + e \rightarrow Ca^{2+} + 2e$	169.	$Fe^{19+} + e \rightarrow Fe^{20+} + 2e$
140.	$Ca^{2+} + e \rightarrow Ca^{3+} + 2e$	170.	$Fe^{20+} + e \rightarrow Fe^{21+} + 2e$
141.	$Sc^{3+} + e \rightarrow Sc^{4+} + 2e$	171.	$Fe^{21+} + e \rightarrow Fe^{22+} + 2e$
142.	$Sc^{4+} + e \rightarrow Sc^{5+} + 2e$	172.	$Fe^{22+} + e \rightarrow Fe^{23+} + 2e$
143.	$Sc^{5+} + e \rightarrow Sc^{6+} + 2e$	173.	$Fe^{23+} + e \rightarrow Fe^{24+} + 2e$
144.	$Sc^{6+} + e \rightarrow Sc^{7+} + 2e$	174.	$Fe^{24+} + e \rightarrow Fe^{25+} + 2e$
145.	$Sc^{7+} + e \rightarrow Sc^{8+} + 2e$	175.	$Fe^{25+} + e \rightarrow Fe^{26+} + 2e$
146.	$Sc^{8+} + e \rightarrow Sc^{9+} + 2e$	176.	$Ni^{3+} + e \rightarrow Ni^{4+} + 2e$
147.	$Sc^{9+} + e \rightarrow Sc^{10+} + 2e$	177.	$Ni^{17+} + e \rightarrow Ni^{18+} + 2e$
148.	$Ti^{2+} + e \rightarrow Ti^{3+} + 2e$	178.	$Cu + e \rightarrow$ sum
149.	$Ti^{3+} + e \rightarrow Ti^{4+} + 2e$	179.	$Cu^{2+} + e \rightarrow Cu^{3+} + 2e$
150.	$V^{5+} + e \rightarrow V^{6+} + 2e$	180.	$Cu^{3+} + e \rightarrow Cu^{4+} + 2e$

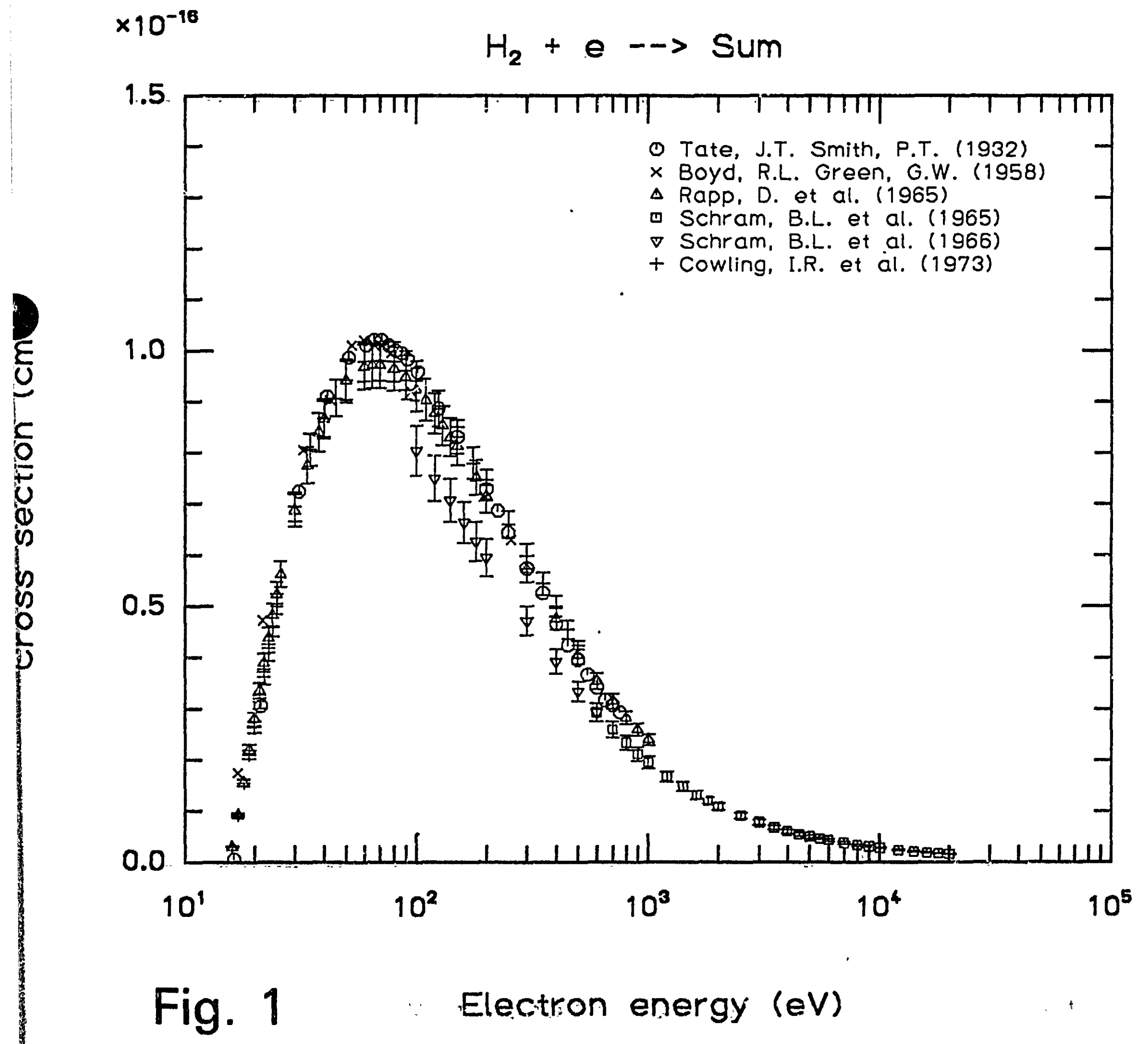
Figure Number	Process
181.	$Zn + e \rightarrow$ sum
182.	$Zn^{+} + e \rightarrow Zn^{2+} + 2e$
183.	$Zn^{19+} + e \rightarrow Zn^{20+} + 2e$
184.	$Ga^{+} + e \rightarrow Ga^{2+} + 2e$
185.	$Kr + e \rightarrow$ sum
186.	$\rightarrow Kr^{+} + 2e$
187.	$\rightarrow Kr^{2+} + 3e$
188.	$\rightarrow Kr^{3+} + 4e$
189.	$\rightarrow Kr^{4+} + 5e$
190.	$\rightarrow Kr^{5+} + 6e$
191.	$\rightarrow Kr^{6+} + 7e$
192.	$\rightarrow Kr^{7+} + 8e$
193.	$\rightarrow Kr^{8+} + 9e$
194.	$\rightarrow Kr^{9+} + 10e$
195.	$Kr^{+} + e \rightarrow Kr^{2+} + 2e$
196.	$\rightarrow Kr^{3+} + 3e$
197.	$Kr^{2+} + e \rightarrow Kr^{3+} + 2e$
198.	$\rightarrow Kr^{4+} + 3e$
199.	$Kr^{3+} + e \rightarrow Kr^{4+} + 2e$
200.	$\rightarrow Kr^{5+} + 3e$
201.	$Kr^{4+} + e \rightarrow Kr^{6+} + 3e$
202.	$Kr^{18+} + e \rightarrow Kr^{19+} + 2e$
203.	$Rb + e \rightarrow$ sum
204.	$Rb^{+} + e \rightarrow Rb^{2+} + 2e$
205.	$\rightarrow Rb^{3+} + 3e$
206.	$\rightarrow Rb^{4+} + 4e$
207.	$\rightarrow Rb^{5+} + 5e$
208.	$Sr + e \rightarrow$ sum
209.	$Sr^{+} + e \rightarrow Sr^{2+} + 2e$
210.	$Zr^{3+} + e \rightarrow Zr^{4+} + 2e$

Figure Number	Process
211.	$Mo^{5+} + e \rightarrow Mo^{6+} + 2e$
212.	$Mo^{14+} + e \rightarrow Mo^{15+} + 2e$
213.	$Mo^{24+} + e \rightarrow Mo^{25+} + 2e$
214.	$Mo^{32+} + e \rightarrow Mo^{33+} + 2e$
215.	$Ag + e \rightarrow$ sum
216.	$\rightarrow Ag^{+} + 2e$
217.	$\rightarrow Ag^{2+} + 3e$
218.	$Cd + e \rightarrow$ sum
219.	$In + e \rightarrow$ sum
220.	$Sb^{+} + e \rightarrow Sb^{2+} + 2e$
221.	$\rightarrow Sb^{3+} + 3e$
222.	$Sb^{2+} + e \rightarrow Sb^{3+} + 2e$
223.	$Sb^{3+} + e \rightarrow Sb^{4+} + 2e$
224.	$Te + e \rightarrow$ sum
225.	$I^{+} + e \rightarrow I^{2+} + 2e$
226.	$Xe + e \rightarrow$ sum
227.	$\rightarrow Xe^{+} + 2e$
228.	$\rightarrow Xe^{2+} + 3e$
229.	$\rightarrow Xe^{3+} + 4e$
230.	$\rightarrow Xe^{4+} + 5e$
231.	$\rightarrow Xe^{5+} + 6e$
232.	$\rightarrow Xe^{6+} + 7e$
233.	$\rightarrow Xe^{7+} + 8e$
234.	$\rightarrow Xe^{8+} + 9e$
235.	$\rightarrow Xe^{9+} + 10e$
236.	$\rightarrow Xe^{10+} + 11e$
237.	$\rightarrow Xe^{11+} + 12e$
238.	$\rightarrow Xe^{12+} + 13e$
239.	$\rightarrow Xe^{13+} + 14e$
240.	$Xe^{+} + e \rightarrow Xe^{2+} + 2e$

Figure Number	Process	Figure Number	Process
241.	$Xe^{+} + e \rightarrow Xe^{3+} + 3e$	271.	$W^{+} + e \rightarrow W^{2+} + 2e$
242.	$\rightarrow Xe^{4+} + 4e$	272.	$Hg + e \rightarrow$ sum
243.	$\rightarrow Xe^{5+} + 5e$	273.	$\rightarrow Hg^{+} + 2e$
244.	$Xe^{2+} + e \rightarrow Xe^{3+} + 2e$	274.	$\rightarrow Hg^{2+} + 3e$
245.	$\rightarrow Xe^{4+} + 3e$	275.	$\rightarrow Hg^{3+} + 4e$
246.	$\rightarrow Xe^{5+} + 4e$	276.	$\rightarrow Hg^{4+} + 5e$
247.	$\rightarrow Xe^{6+} + 5e$	277.	$\rightarrow Hg^{5+} + 6e$
248.	$Xe^{3+} + e \rightarrow Xe^{4+} + 2e$	278.	$Hg^{+} + e \rightarrow Hg^{2+} + 2e$
249.	$\rightarrow Xe^{5+} + 3e$	279.	$Pb + e \rightarrow$ sum
250.	$\rightarrow Xe^{6+} + 4e$	280.	$\rightarrow Pb^{+} + 2e$
251.	$Xe^{4+} + e \rightarrow Xe^{5+} + 2e$	281.	$\rightarrow Pb^{2+} + 3e$
252.	$\rightarrow Xe^{6+} + 3e$	282.	$\rightarrow Pb^{3+} + 4e$
253.	$Xe^{5+} + e \rightarrow Xe^{6+} + 2e$	283.	$Bi^{+} + e \rightarrow Bi^{2+} + 2e$
254.	$Xe^{6+} + e \rightarrow Xe^{7+} + 2e$	284.	$\rightarrow Bi^{3+} + 3e$
255.	$\rightarrow Xe^{8+} + 3e$	285.	$Bi^{2+} + e \rightarrow Bi^{3+} + 2e$
256.	$\rightarrow Xe^{9+} + 4e$	286.	$\rightarrow Bi^{4+} + 3e$
257.	$Cs + e \rightarrow$ sum	287.	$Bi^{3+} + e \rightarrow Bi^{4+} + 3e$
258.	$Cs^{+} + e \rightarrow Cs^{2+} + 2e$	288.	$T\ell + e \rightarrow$ sum
259.	$\rightarrow Cs^{3+} + 3e$	289.	$T\ell^{+} + e \rightarrow T\ell^{2+} + 2e$
260.	$\rightarrow Cs^{4+} + 4e$	290.	$U + e \rightarrow$ sum
261.	$\rightarrow Cs^{5+} + 5e$	291.	$\rightarrow U^{+} + 2e$
262.	$Ba + e \rightarrow$ sum	292.	$\rightarrow U^{2+} + 3e$
263.	$\rightarrow Ba^{+} + 2e$	293.	$\rightarrow U^{3+} + 4e$
264.	$\rightarrow Ba^{2+} + 3e$	294.	$\rightarrow U^{4+} + 5e$
265.	$\rightarrow Ba^{3+} + 4e$		
266.	$\rightarrow Ba^{4+} + 5e$		
267.	$Ba^{+} + e \rightarrow Ba^{2+} + 2e$		
268.	$Au + e \rightarrow$ sum		
269.	$Hf^{3+} + e \rightarrow Hf^{4+} + 2e$		
270.	$Ta^{3+} + e \rightarrow Ta^{4+} + 2e$		



H2 + e --> Sum
Tate, J.T. Smith, P.T. (1932)
Boyd, R.L. Green, G.W. (1958)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Cowling, I.R. et al. (1973)
Cross section (cm²)
Electron energy (eV)



×10⁻¹⁶
H2 + e --> Sum
Tate, J.T. Smith, P.T. (1932)
Boyd, R.L. Green, G.W. (1958)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Cowling, I.R. et al. (1973)
Electron energy (eV)

Fig. 1

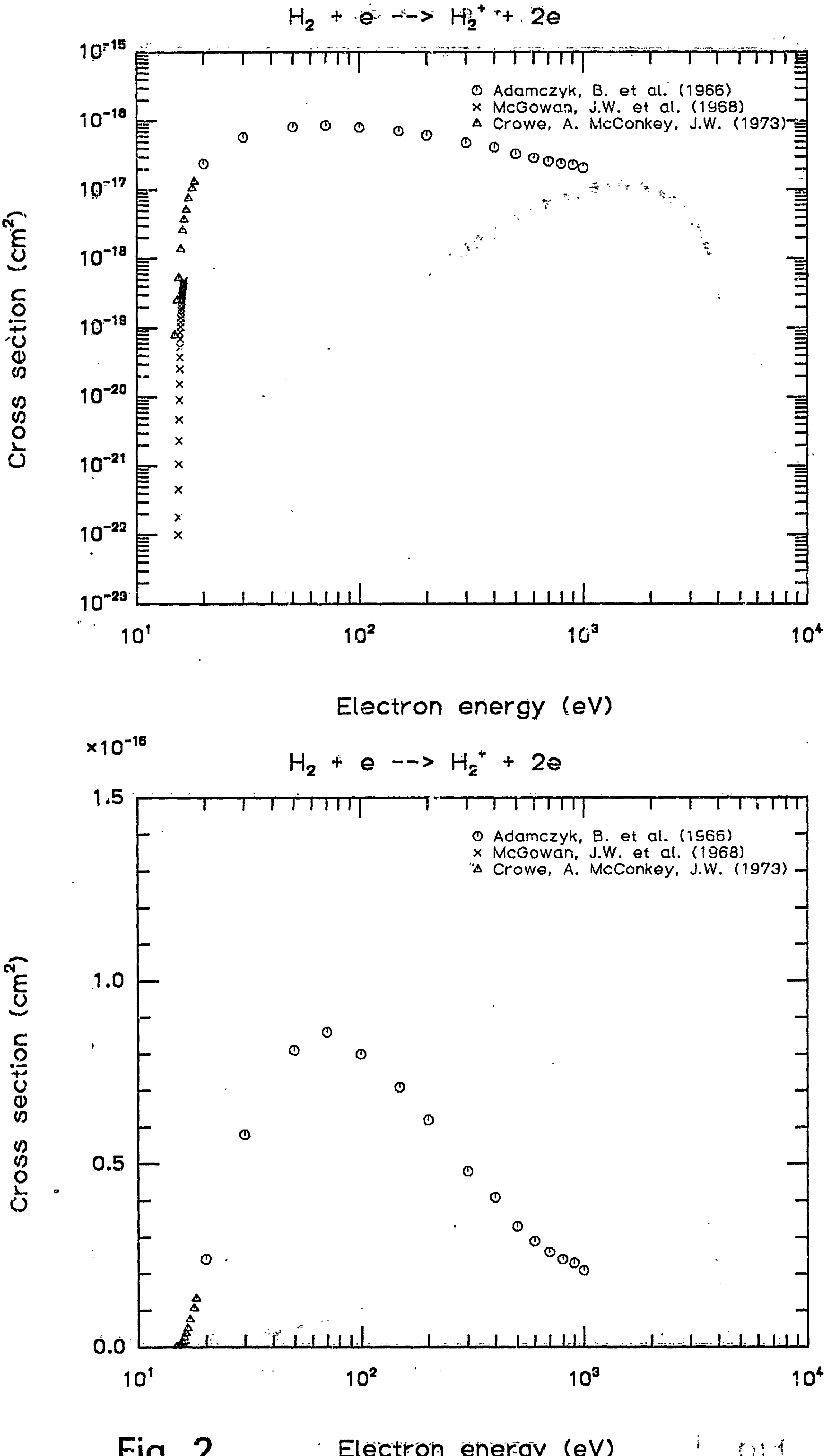
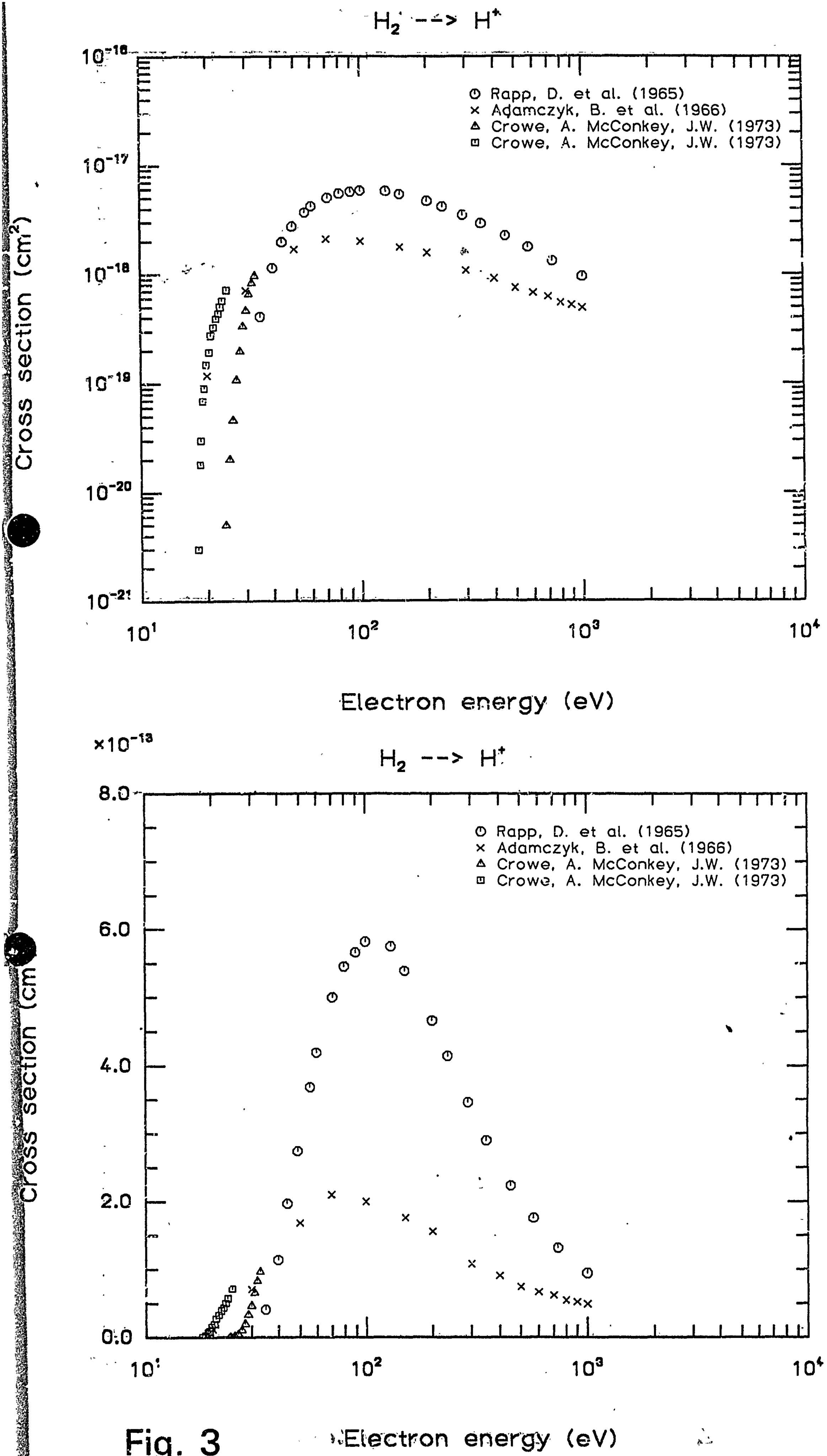
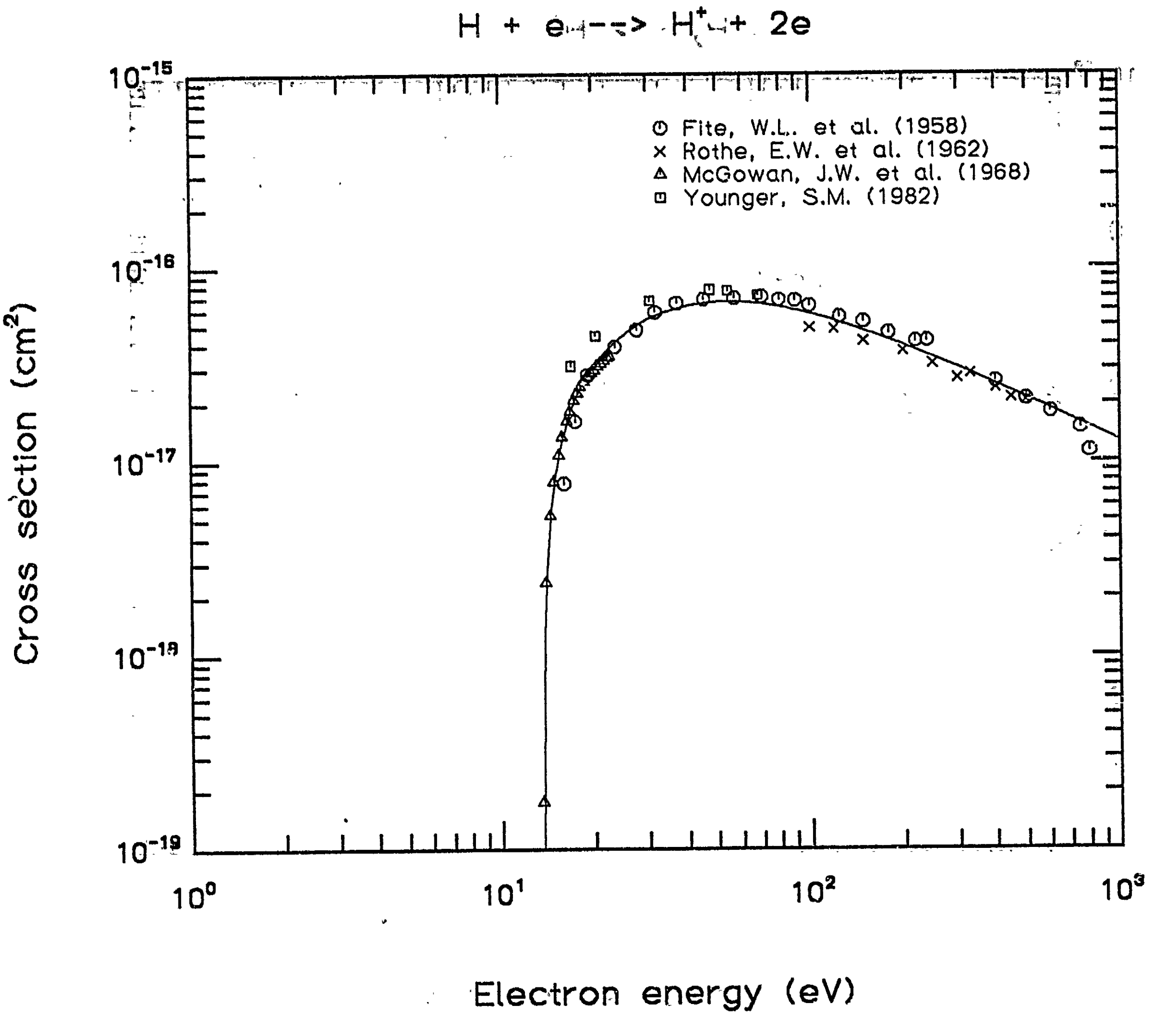

H_2 + e --> H_2^+ + 2e
Adamczyk, B. et al. (1966)
McGowan, J.W. et al. (1968)
Crowe, A. McConkey, J.W. (1973)
Cross section (cm^2)
Electron energy (eV)
×10^-16
H_2 + e --> H_2^+ + 2e
Adamczyk, B. et al. (1966)
McGowan, J.W. et al. (1968)
Crowe, A. McConkey, J.W. (1973)
Cross section (cm^2)
Electron energy (eV)

Fig. 2



H₂ --> H⁺
Rapp, D. et al. (1965)
Adamczyk, B. et al. (1966)
Crowe, A. McConkey, J.W. (1973)
Crowe, A. McConkey, J.W. (1973)
Cross section (cm²)
Electron energy (eV)
H₂ --> H⁺
×10⁻¹⁸
Rapp, D. et al. (1965)
Adamczyk, B. et al. (1966)
Crowe, A. McConkey, J.W. (1973)
Crowe, A. McConkey, J.W. (1973)
Cross section (cm²)
Electron energy (eV)

Fig. 3


H + e --> H+ + 2e
Fite, W.L. et al. (1958)
Rothe, E.W. et al. (1962)
McGowan, J.W. et al. (1968)
Younger, S.M. (1982)
Cross section (cm2)
Electron energy (eV)

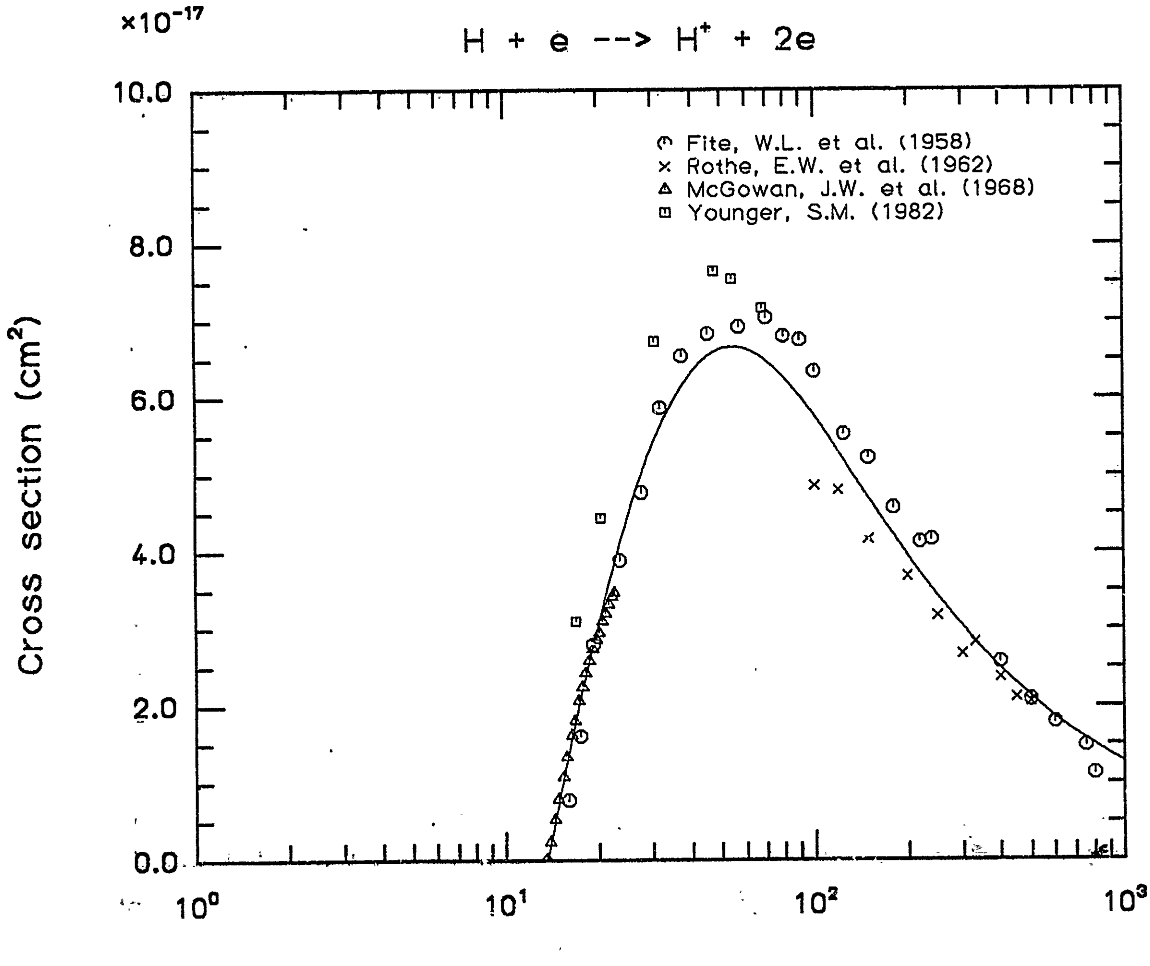
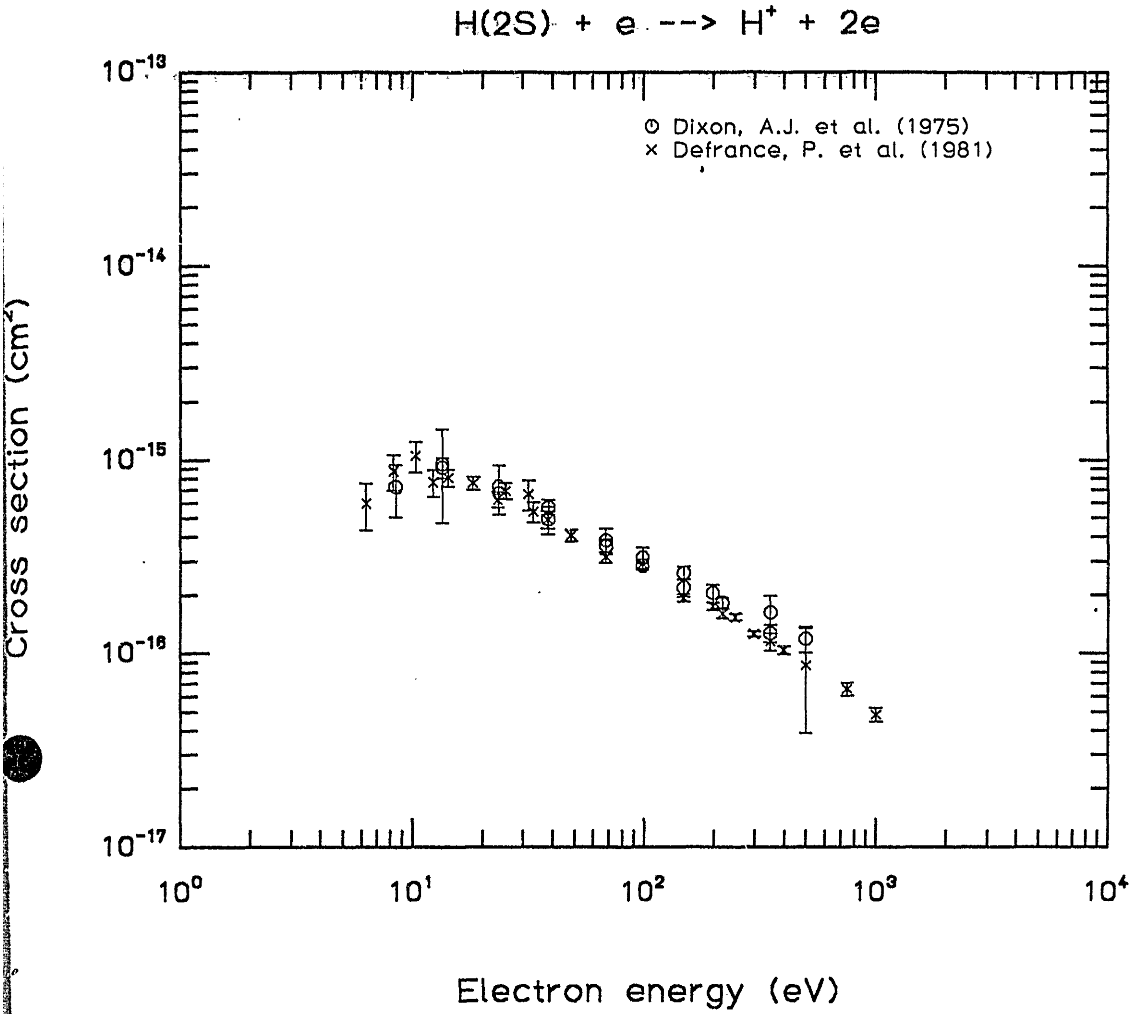

×10-17
H + e --> H+ + 2e
Fite, W.L. et al. (1958)
Rothe, E.W. et al. (1962)
McGowan, J.W. et al. (1968)
Younger, S.M. (1982)
Cross section (cm2)
Electron energy (eV)

Fig. 4


H(2S) + e --> H⁺ + 2e
Cross section (cm²)
Dixon, A.J. et al. (1975)
Defrance, P. et al. (1981)
Electron energy (eV)

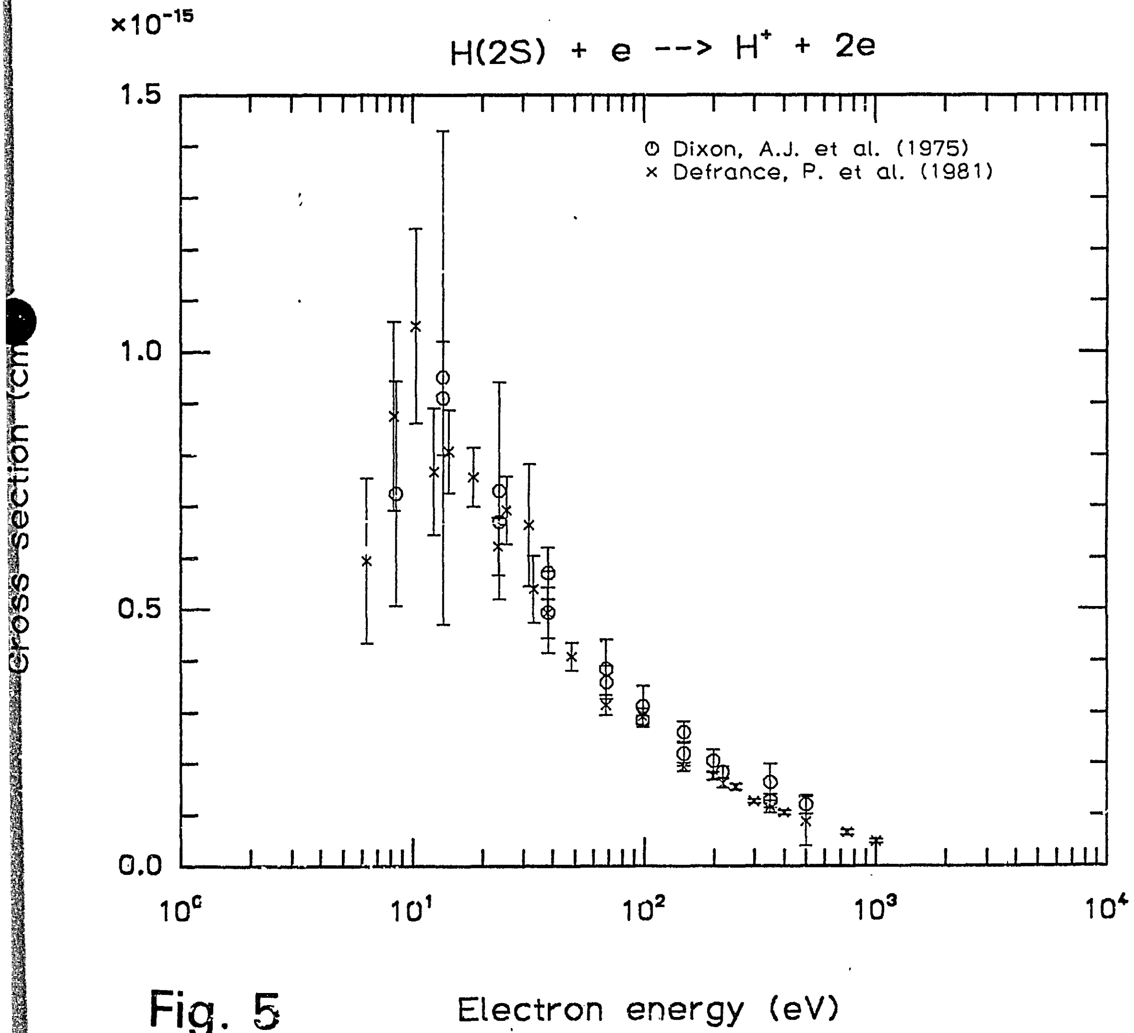
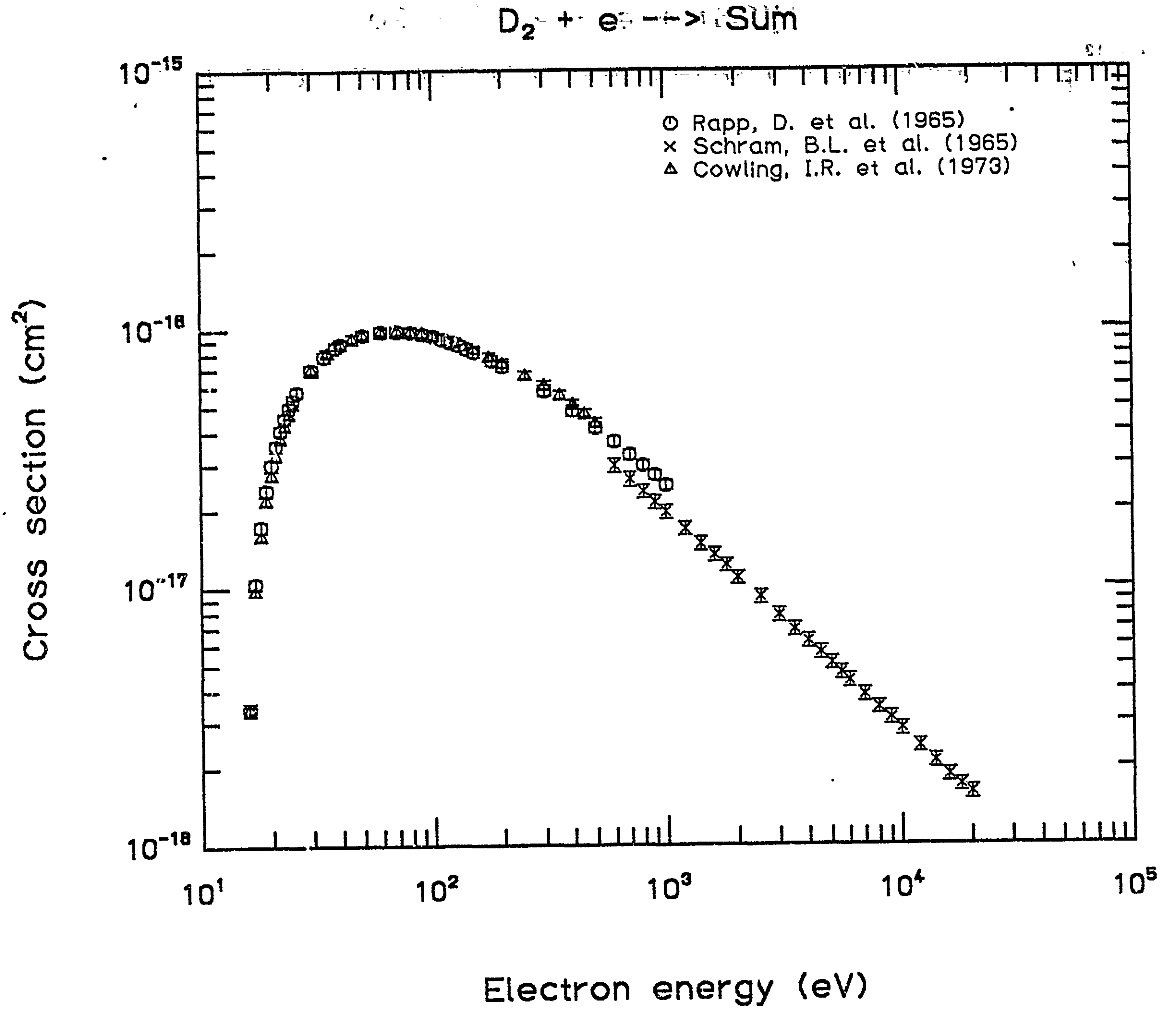
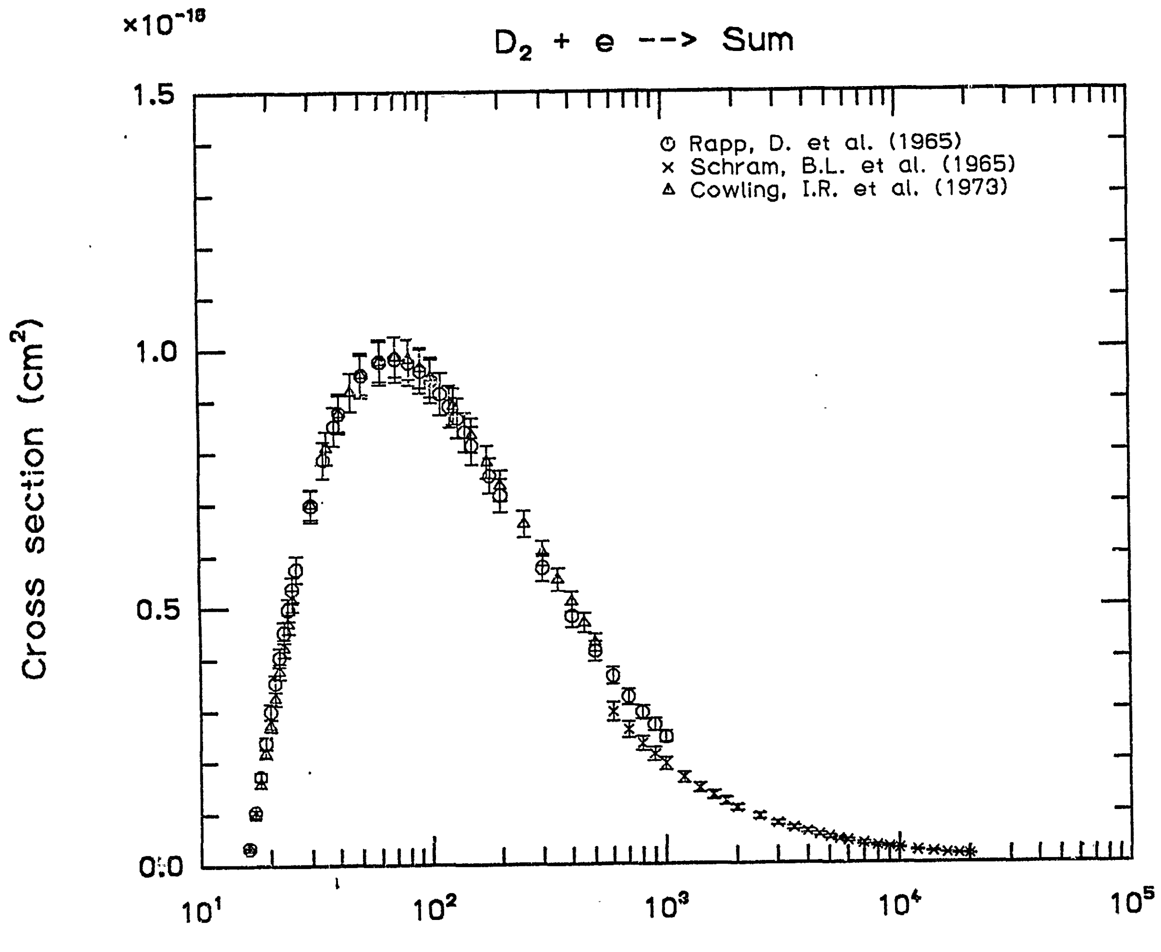

×10⁻¹⁵
H(2S) + e --> H⁺ + 2e
Cross section (cm²)
Dixon, A.J. et al. (1975)
Defrance, P. et al. (1981)
Electron energy (eV)

Fig. 5



D2 + e --> Sum
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Cowling, I.R. et al. (1973)
Cross section (cm2)
Electron energy (eV)



×10-16
D2 + e --> Sum
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Cowling, I.R. et al. (1973)
Cross section (cm2)
Electron energy (eV)

Fig. 6

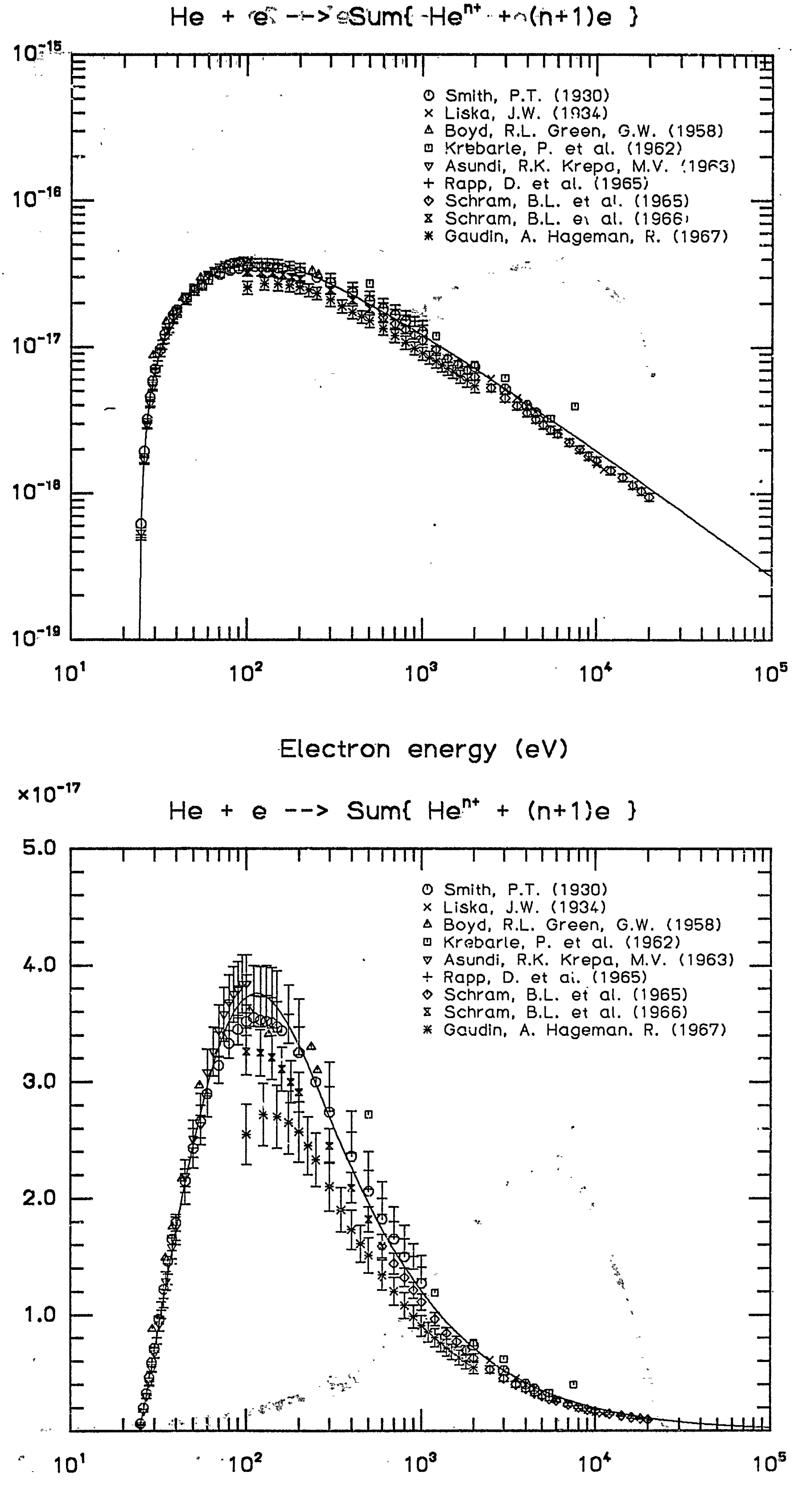

He + e --> Sum{ He^n+ + (n+1)e }
Smith, P.T. (1930)
Liska, J.W. (1934)
Boyd, R.L. Green, G.W. (1958)
Krebarle, P. et al. (1962)
Asundi, R.K. Krepa, M.V. (1963)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Gaudin, A. Hageman, R. (1967)
Cross section (cm²)
Electron energy (eV)
×10⁻¹⁷
He + e --> Sum{ He^n+ + (n+1)e }
Smith, P.T. (1930)
Liska, J.W. (1934)
Boyd, R.L. Green, G.W. (1958)
Krebarle, P. et al. (1962)
Asundi, R.K. Krepa, M.V. (1963)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Gaudin, A. Hageman, R. (1967)
Cross section
Electron energy (eV)

Fig. 7

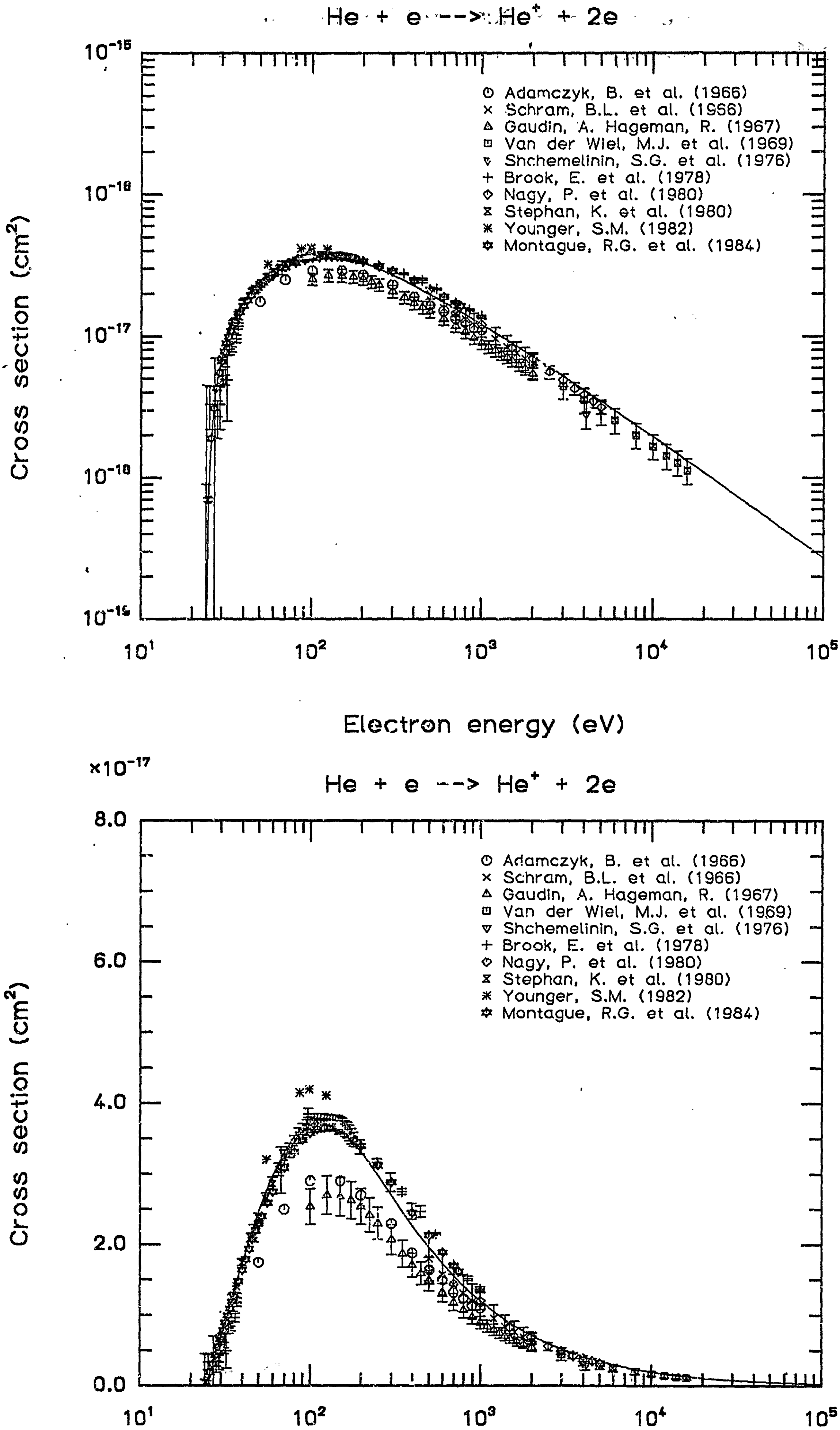
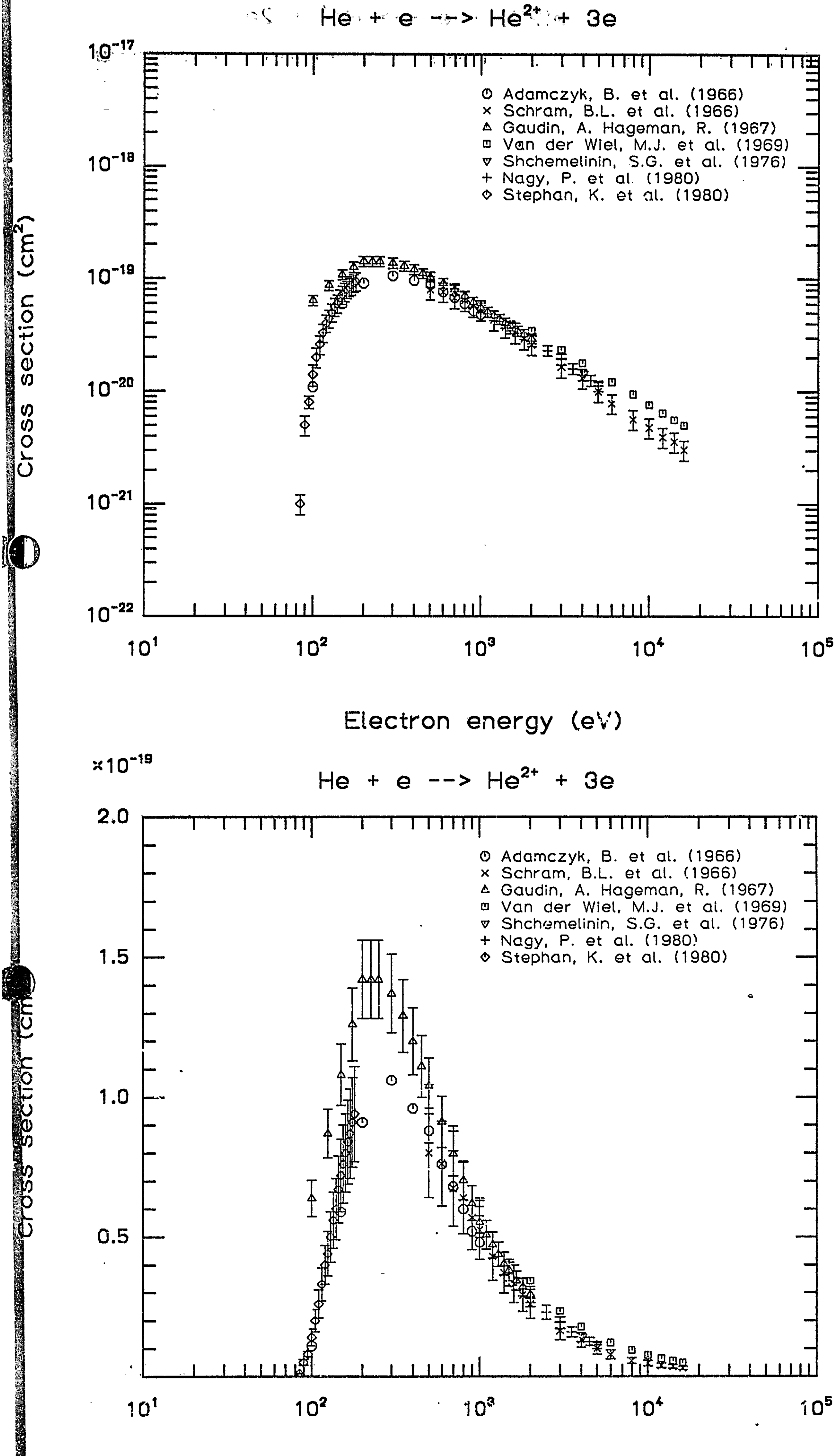


Fig. 8 Electron energy (eV)



He + e --> He^{2+} + 3e
Cross section (cm^2)
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^{-22}
Adamczyk, B. et al. (1966)
Schram, B.L. et al. (1966)
Gaudin, A. Hageman, R. (1967)
Van der Wiel, M.J. et al. (1969)
Shchemelinin, S.G. et al. (1976)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)
×10^{-19}
He + e --> He^{2+} + 3e
Cross section (cm^2)
2.0
1.5
1.0
0.5
Adamczyk, B. et al. (1966)
Schram, B.L. et al. (1966)
Gaudin, A. Hageman, R. (1967)
Van der Wiel, M.J. et al. (1969)
Shchemelinin, S.G. et al. (1976)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 9

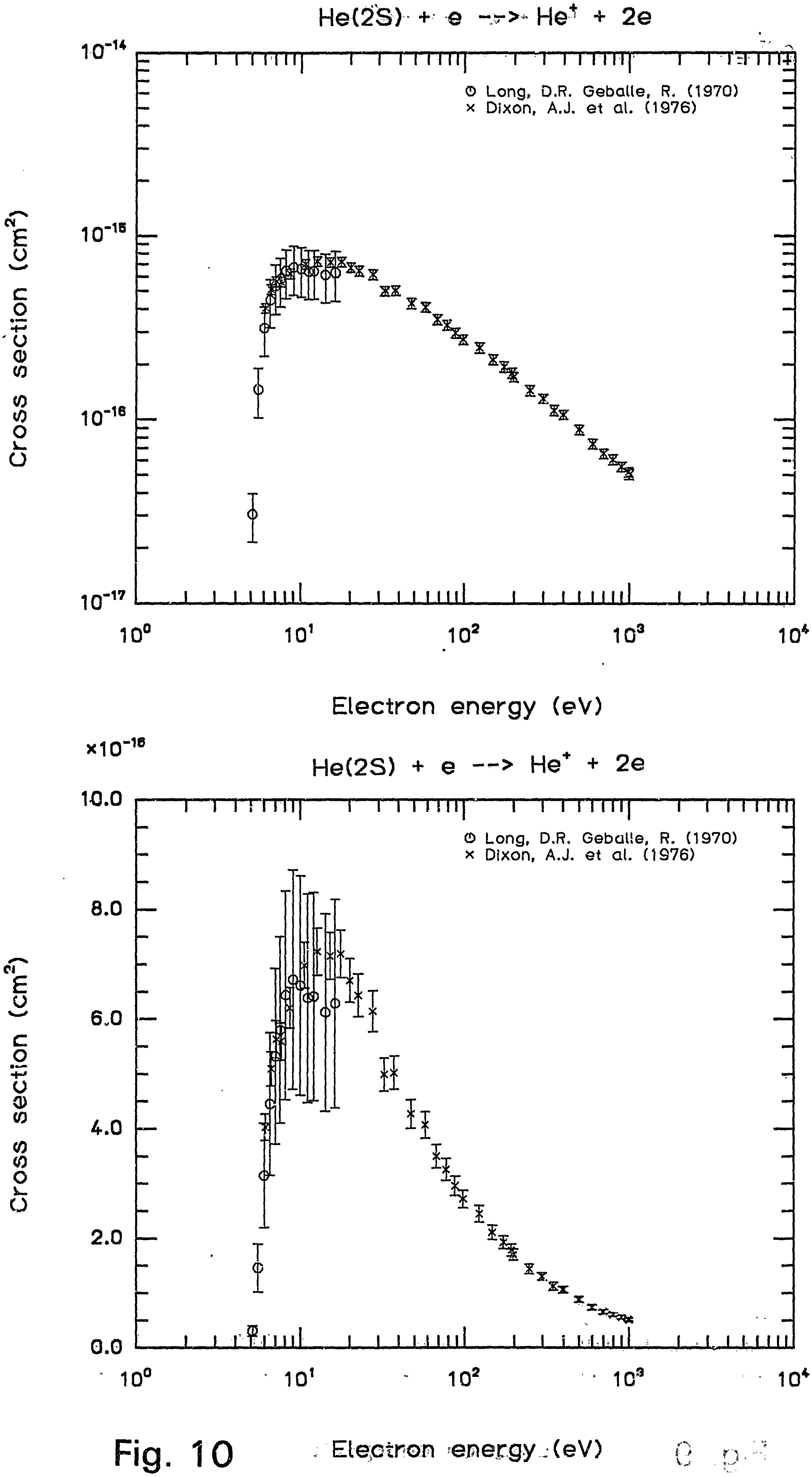
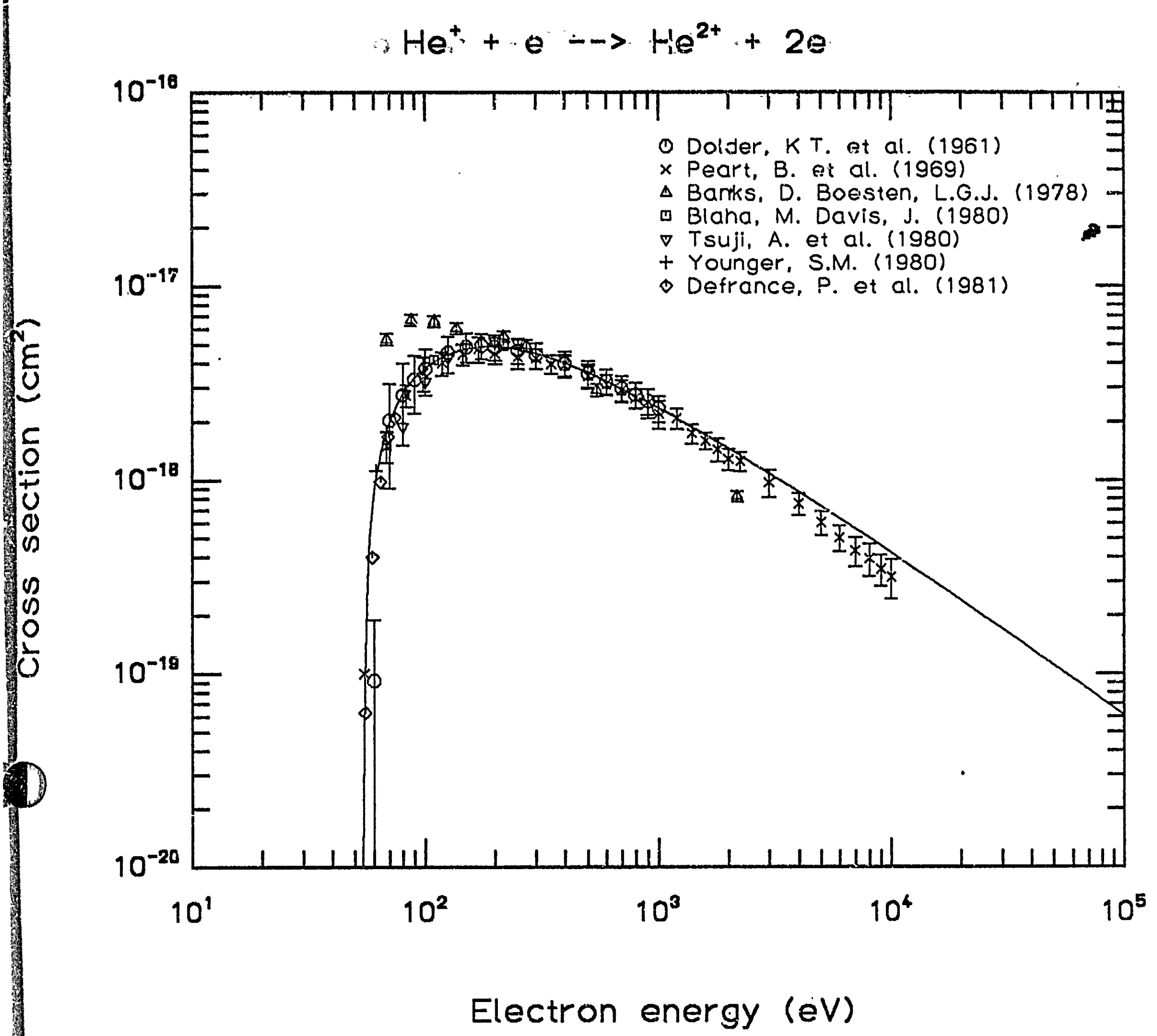

He(2S) + e --> He⁺ + 2e
Long, D.R. Geballe, R. (1970)
Dixon, A.J. et al. (1976)
Cross section (cm²)
Electron energy (eV)
×10⁻¹⁶
He(2S) + e --> He⁺ + 2e
Long, D.R. Geballe, R. (1970)
Dixon, A.J. et al. (1976)
Cross section (cm²)
Electron energy (eV)

Fig. 10


He+ + e --> He2+ + 2e
Cross section (cm2)
10-16
10-17
10-18
10-19
10-20
Dolder, K.T. et al. (1961)
Peart, B. et al. (1969)
Banks, D. Boesten, L.G.J. (1978)
Blaha, M. Davis, J. (1980)
Tsuji, A. et al. (1980)
Younger, S.M. (1980)
Defrance, P. et al. (1981)
101
102
103
104
105
Electron energy (eV)

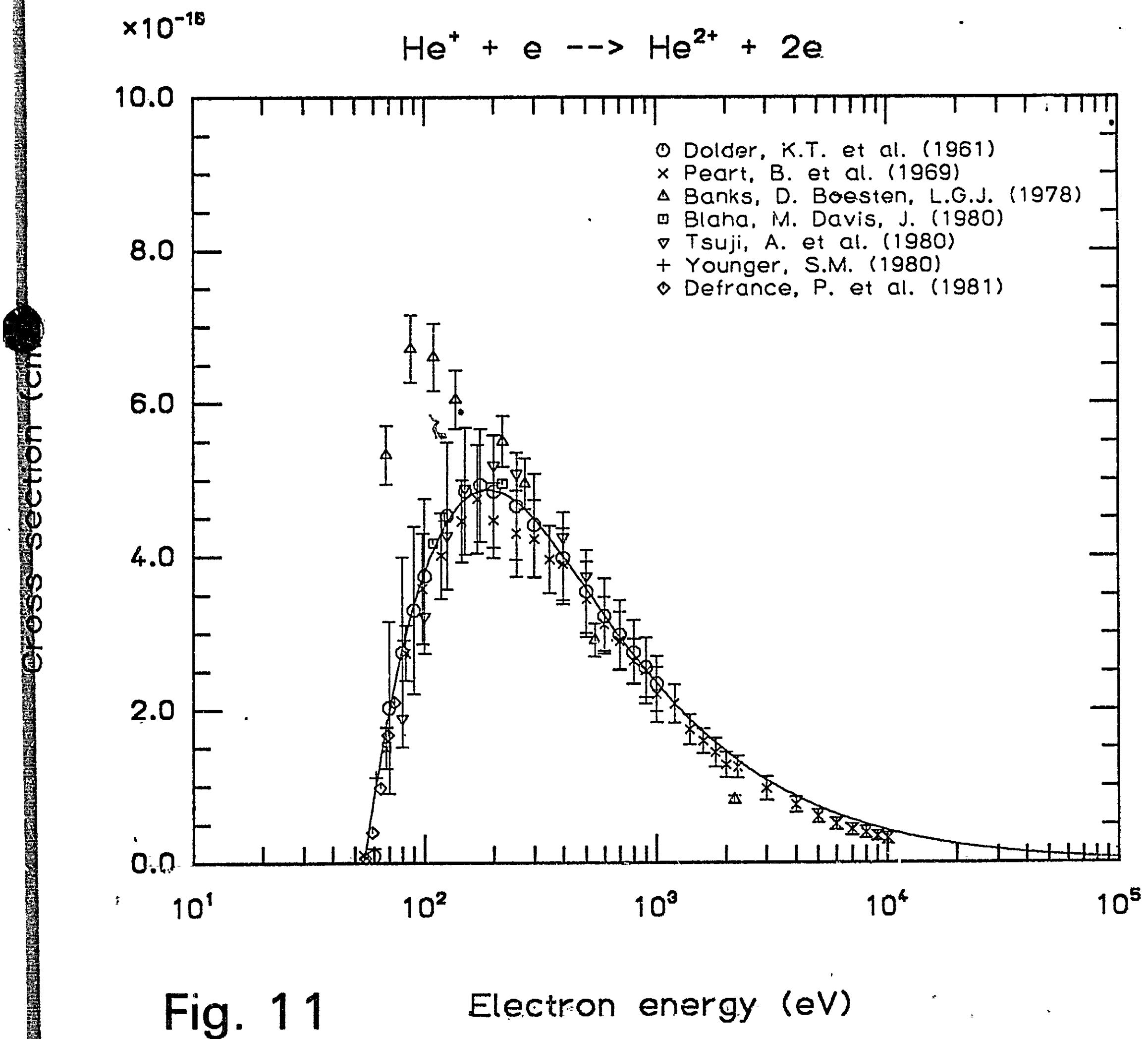
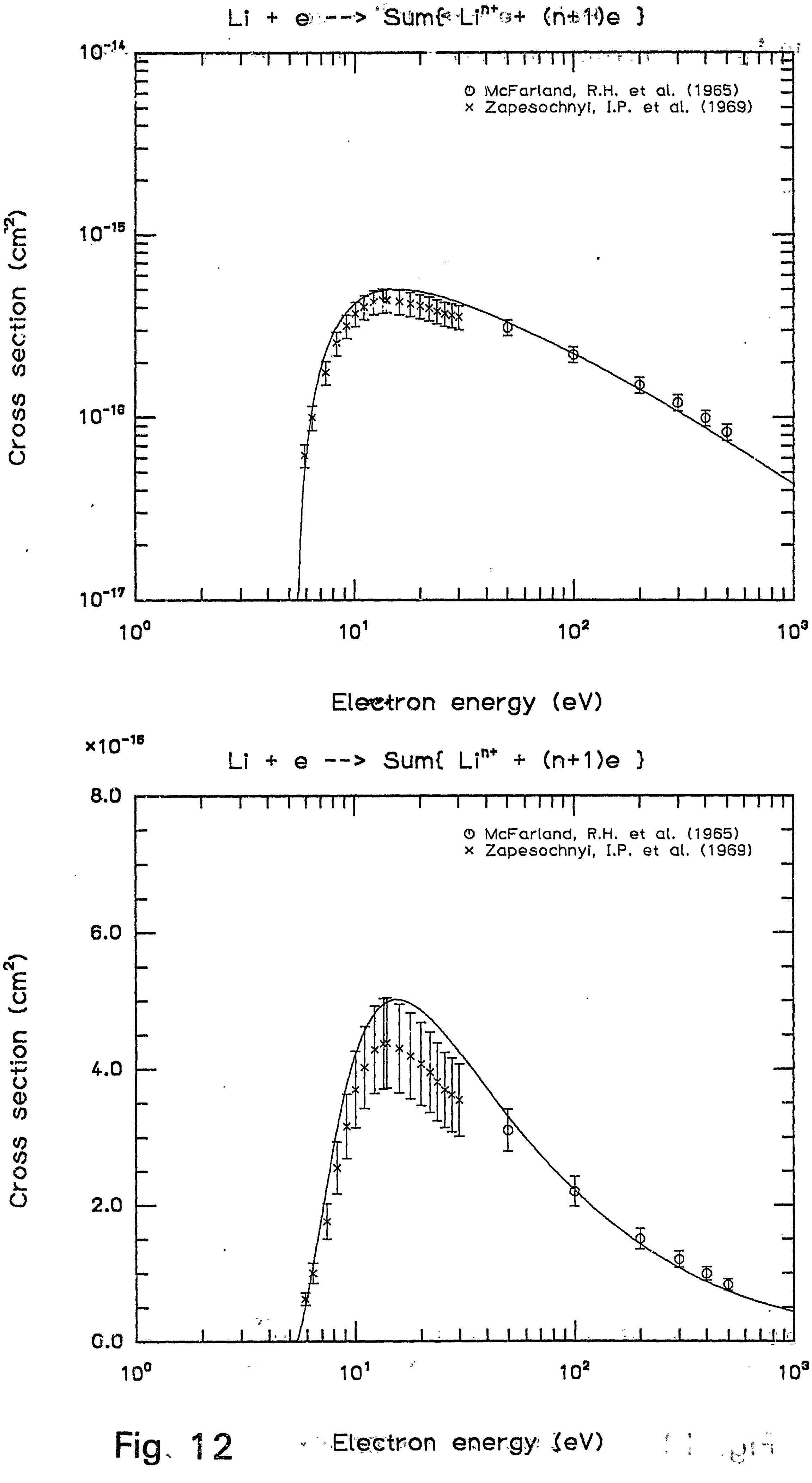
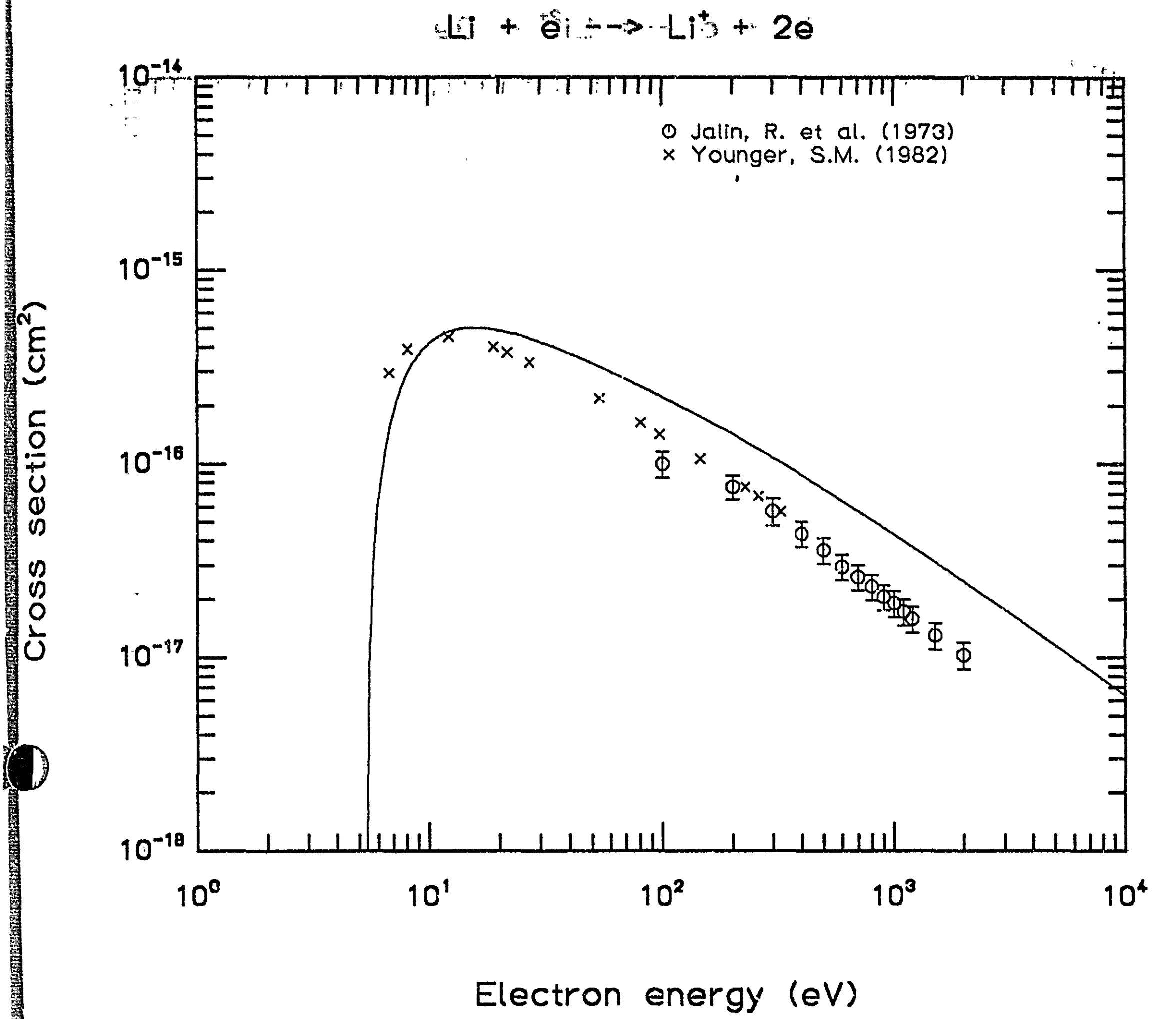

×10-18
He+ + e --> He2+ + 2e
Cross section (cm
10.0
8.0
6.0
4.0
2.0
0.0
Dolder, K.T. et al. (1961)
Peart, B. et al. (1969)
Banks, D. Boesten, L.G.J. (1978)
Blaha, M. Davis, J. (1980)
Tsuji, A. et al. (1980)
Younger, S.M. (1980)
Defrance, P. et al. (1981)
101
102
103
104
105
Electron energy (eV)

Fig. 11



Li + e --> Sum{ Li^{n+} + (n+1)e }
10^{-14}
10^{-15}
10^{-16}
10^{-17}
Cross section (cm^2)
O McFarland, R.H. et al. (1965)
× Zapesochnyi, I.P. et al. (1969)
10^0
10^1
10^2
10^3
Electron energy (eV)
$\times 10^{-16}$
Li + e --> Sum{ Li^{n+} + (n+1)e }
8.0
6.0
4.0
2.0
0.0
Cross section (cm^2)
O McFarland, R.H. et al. (1965)
× Zapesochnyi, I.P. et al. (1969)
10^0
10^1
10^2
10^3
Electron energy (eV)

Fig. 12


Li + e --> Li+ + 2e
Cross section (cm2)
10-14
10-15
10-16
10-17
10-18
Jalin, R. et al. (1973)
Younger, S.M. (1982)
10^0
10^1
10^2
10^3
10^4
Electron energy (eV)

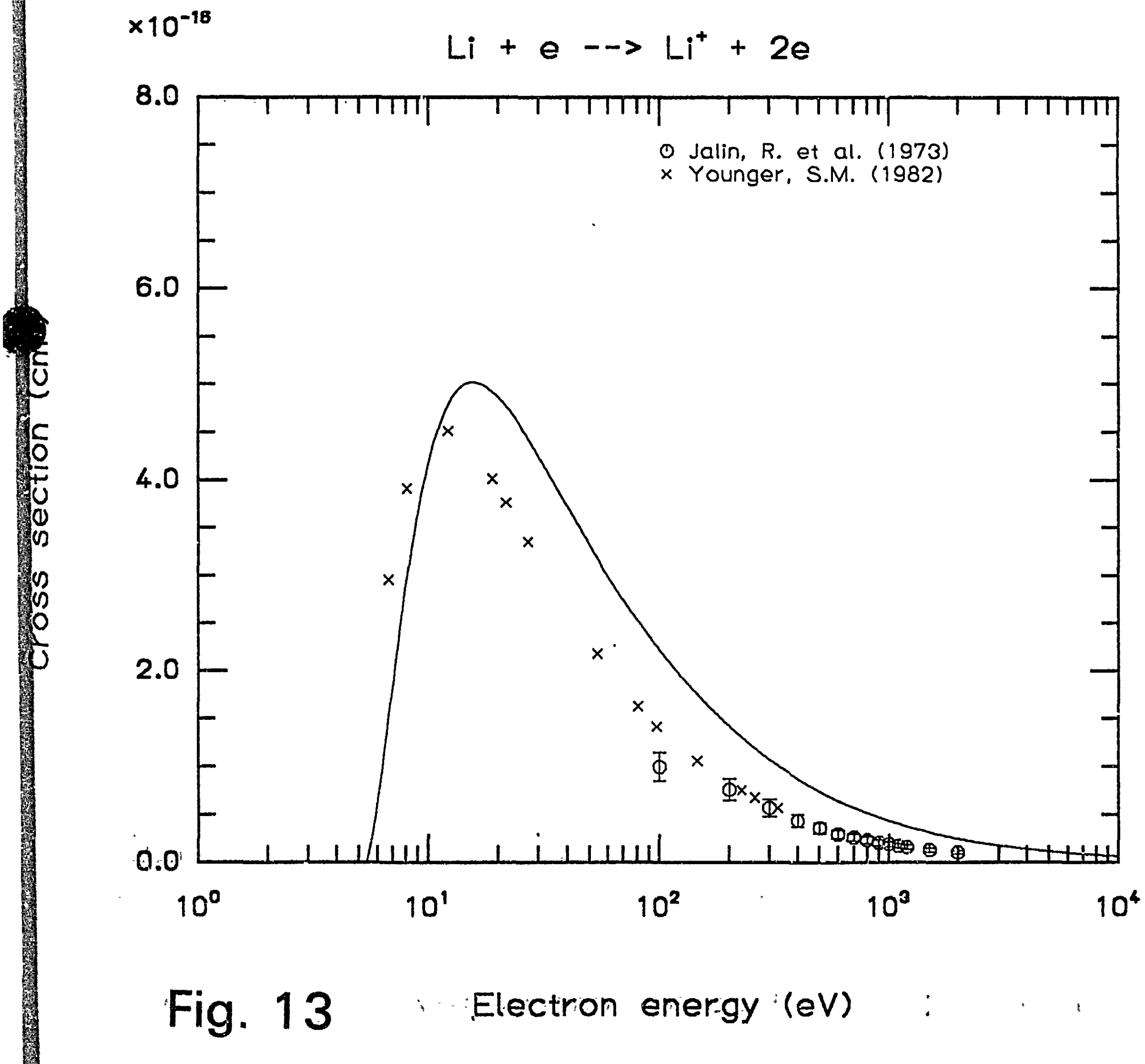

×10-16
Li + e --> Li+ + 2e
Cross section (cm
8.0
6.0
4.0
2.0
0.0
Jalin, R. et al. (1973)
Younger, S.M. (1982)
10^0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 13

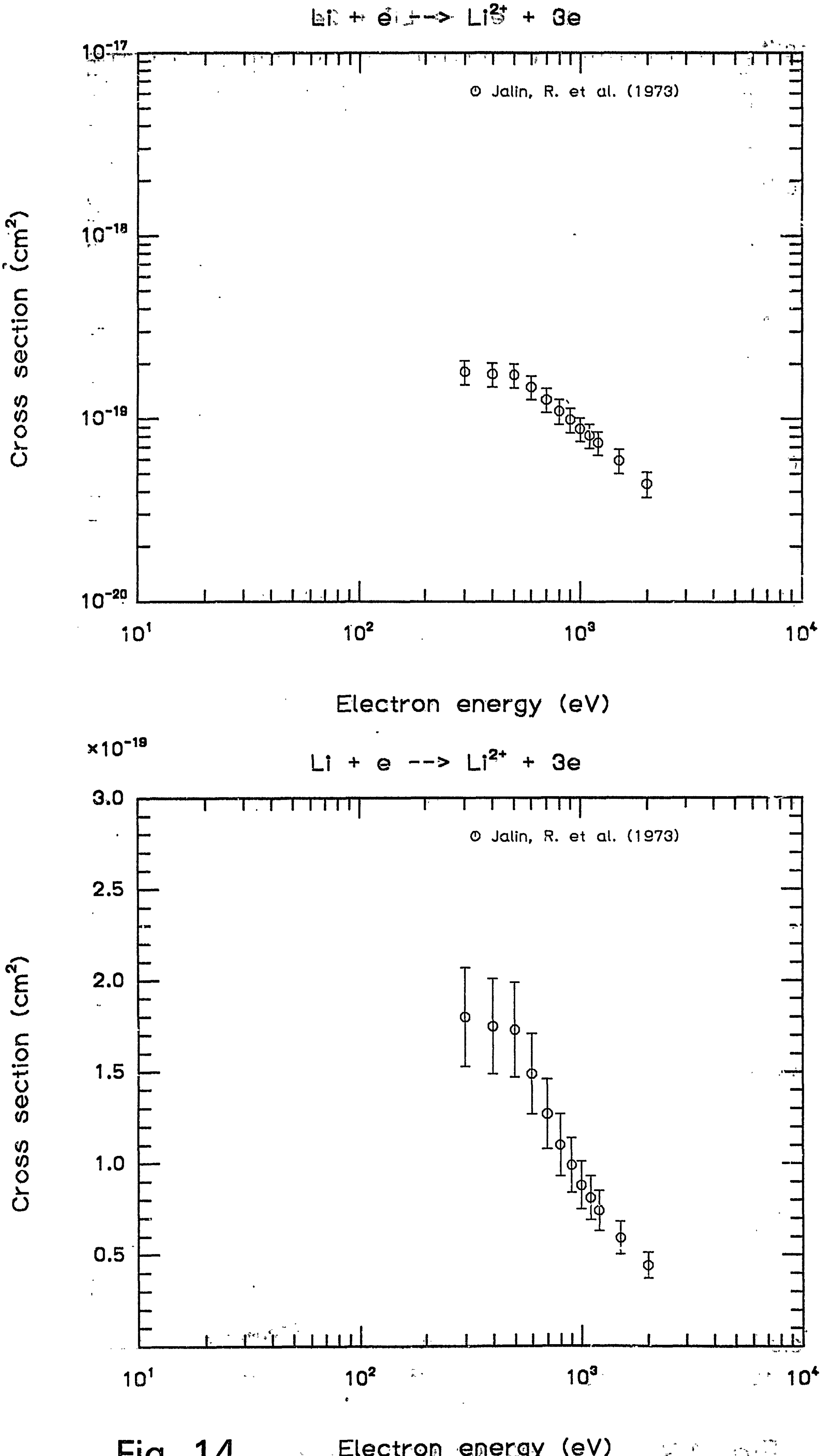
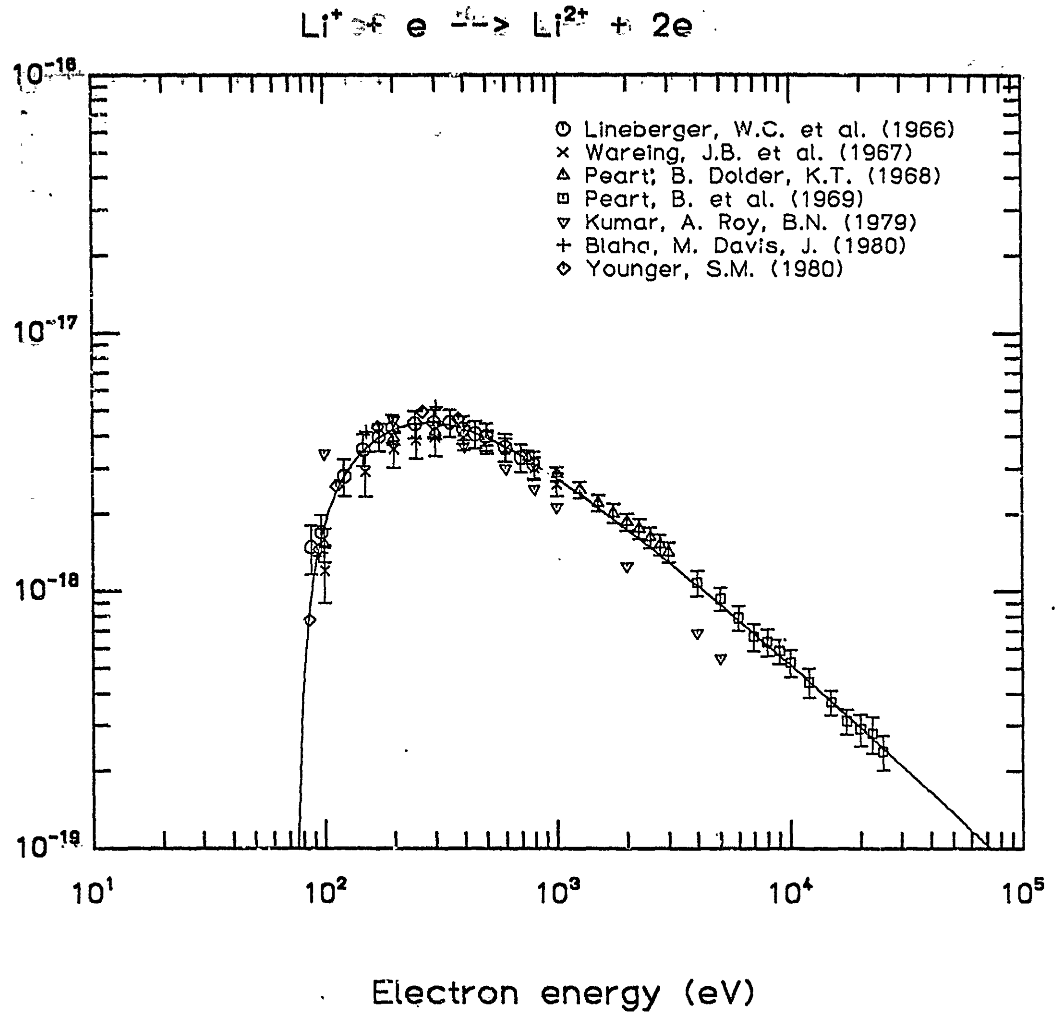

Li + e --> Li^{2+} + 3e
Jalin, R. et al. (1973)
Cross section (cm^2)
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^1
10^2
10^3
10^4
Electron energy (eV)
×10^{-19}
Li + e --> Li^{2+} + 3e
Jalin, R. et al. (1973)
Cross section (cm^2)
3.0
2.5
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 14



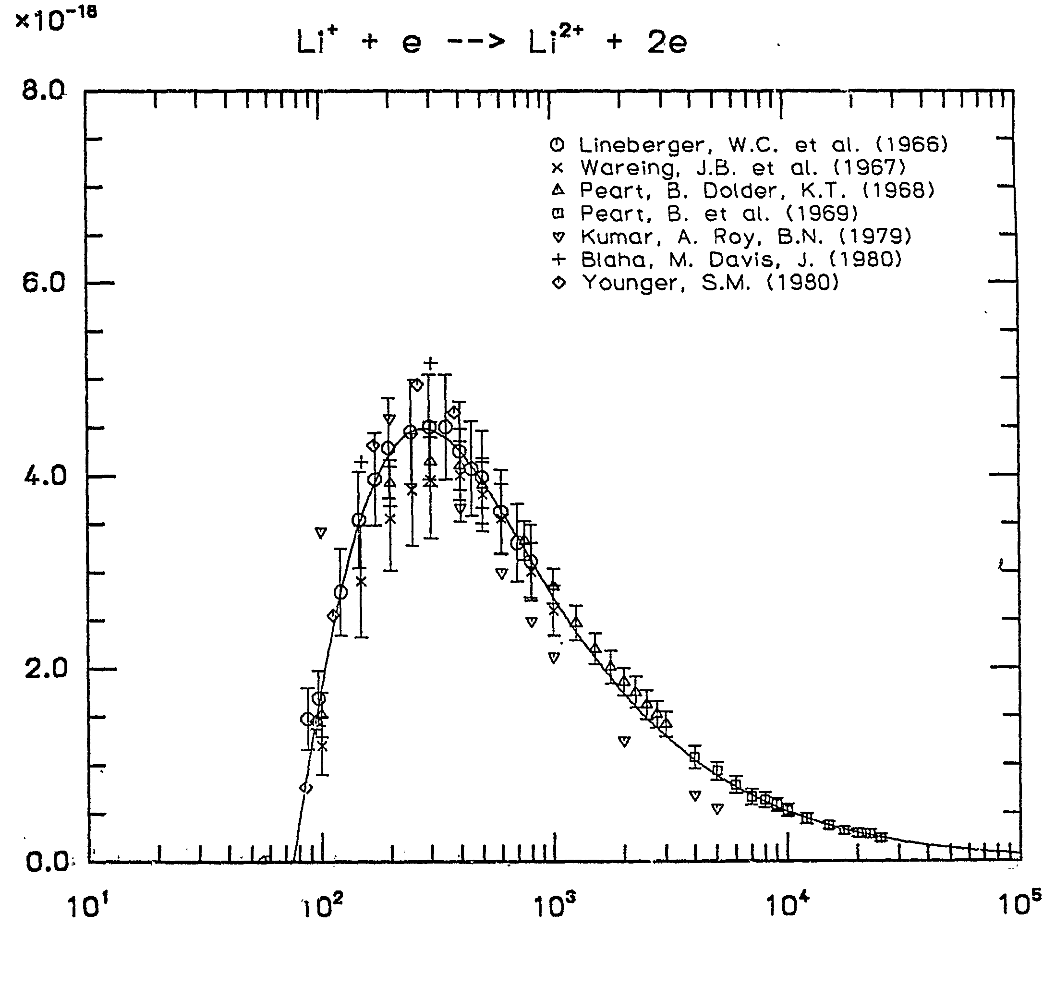
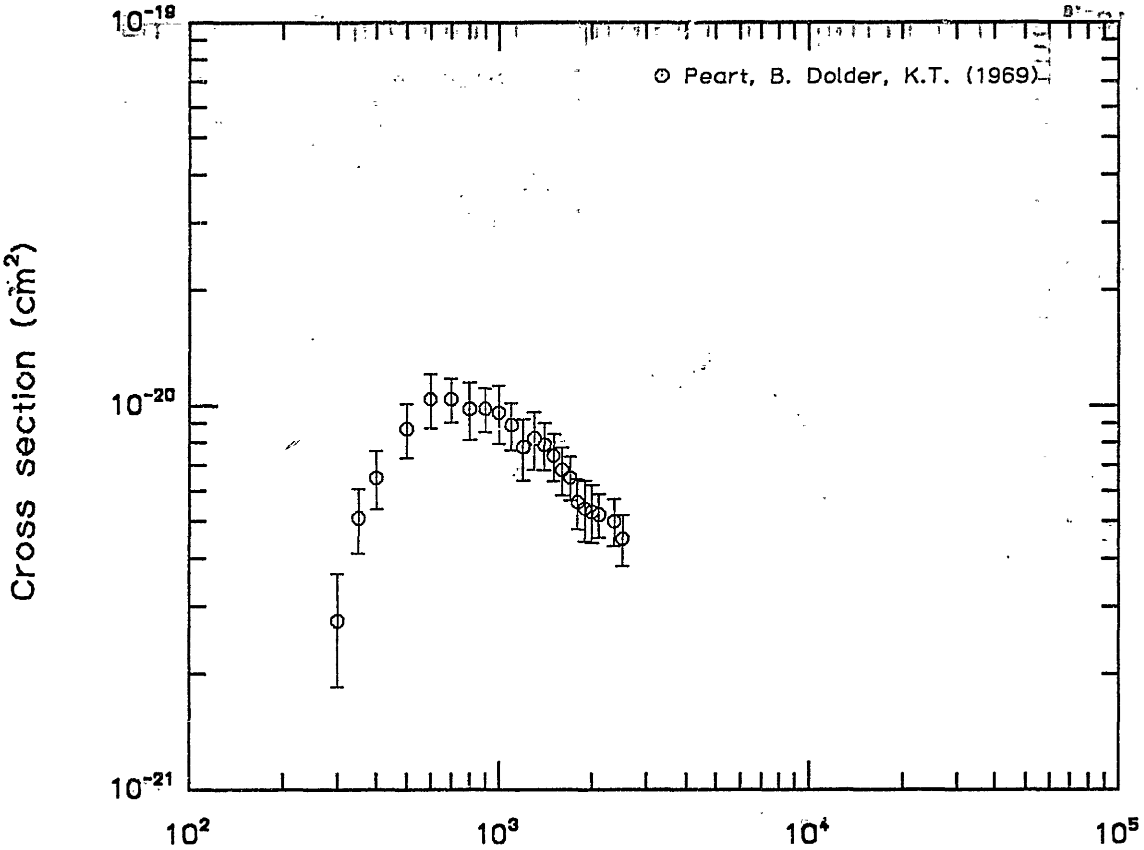


Fig. 15 Electron energy (eV)

$Li^{+} + e \to Li^{3+} + 3e$



Electron energy (eV)

$Li^{+} + e \to Li^{3+} + 3e$

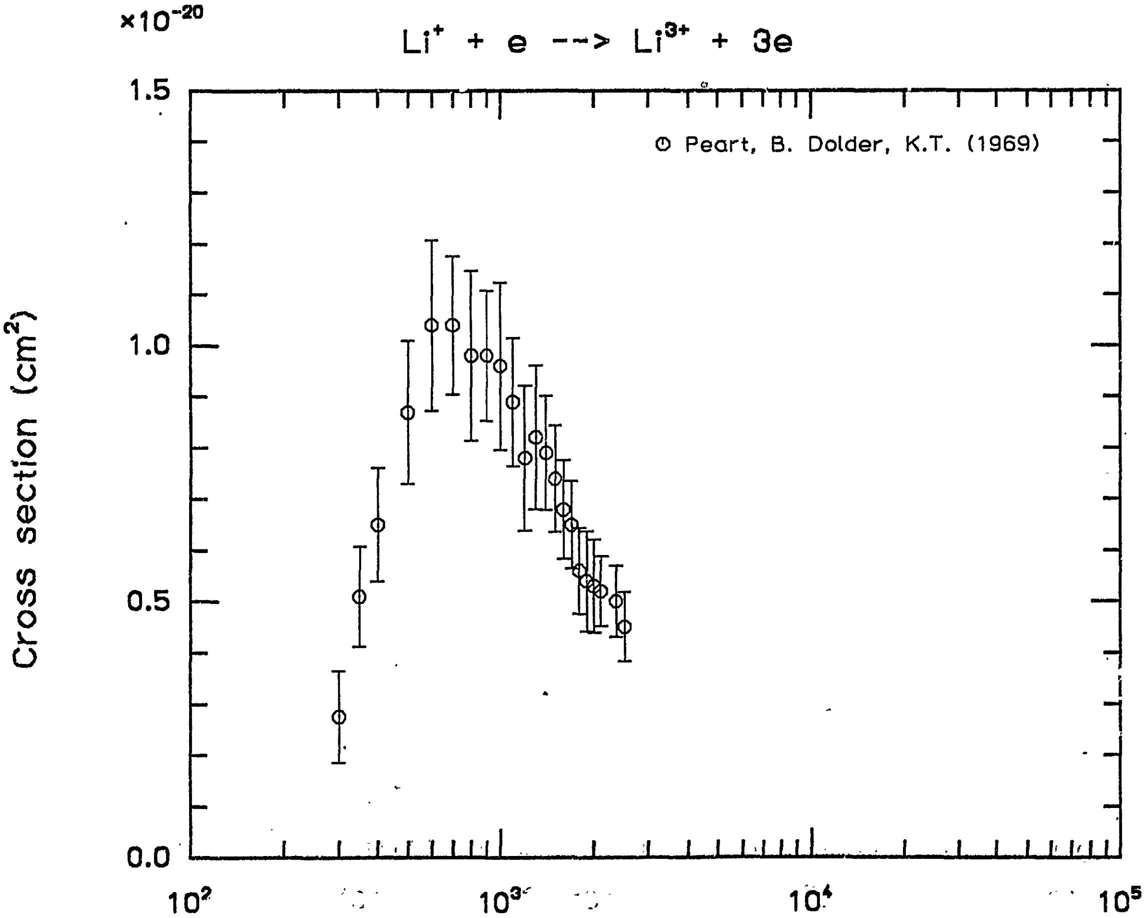
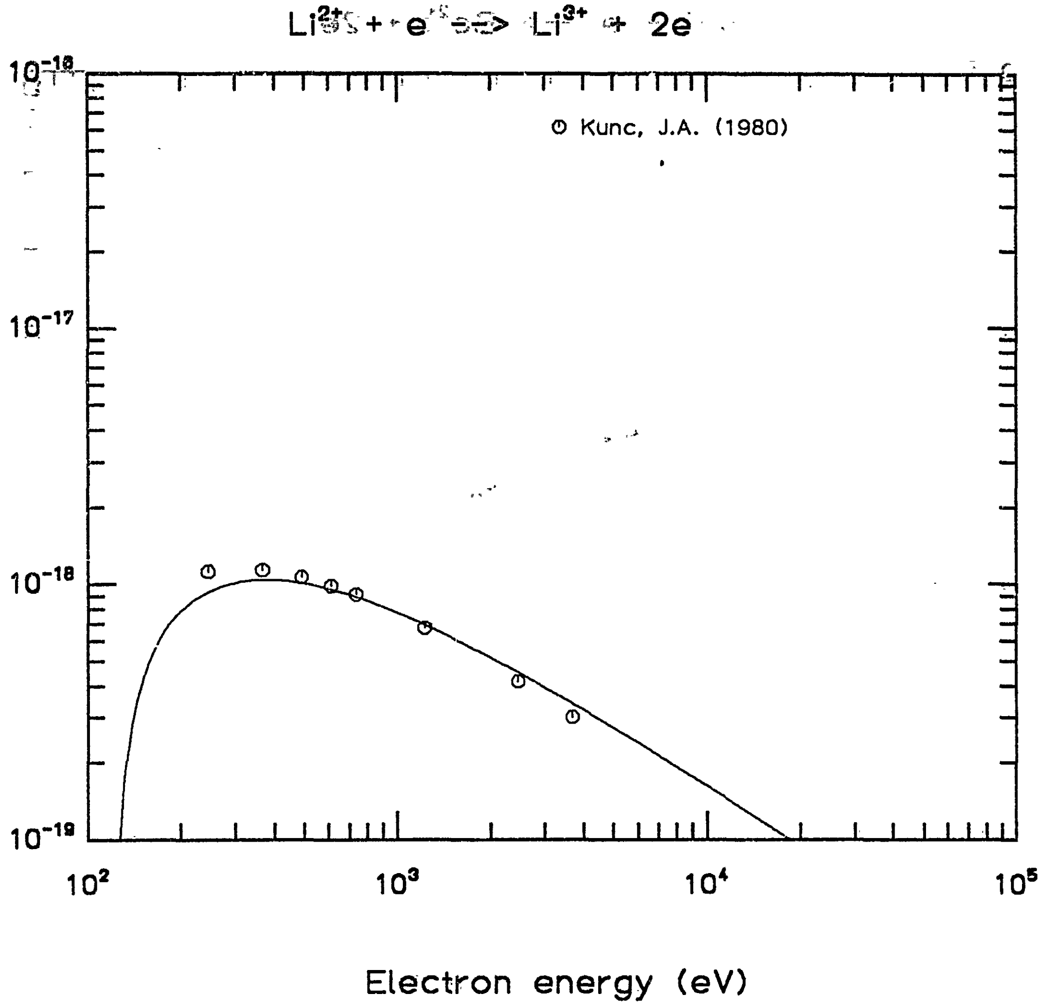
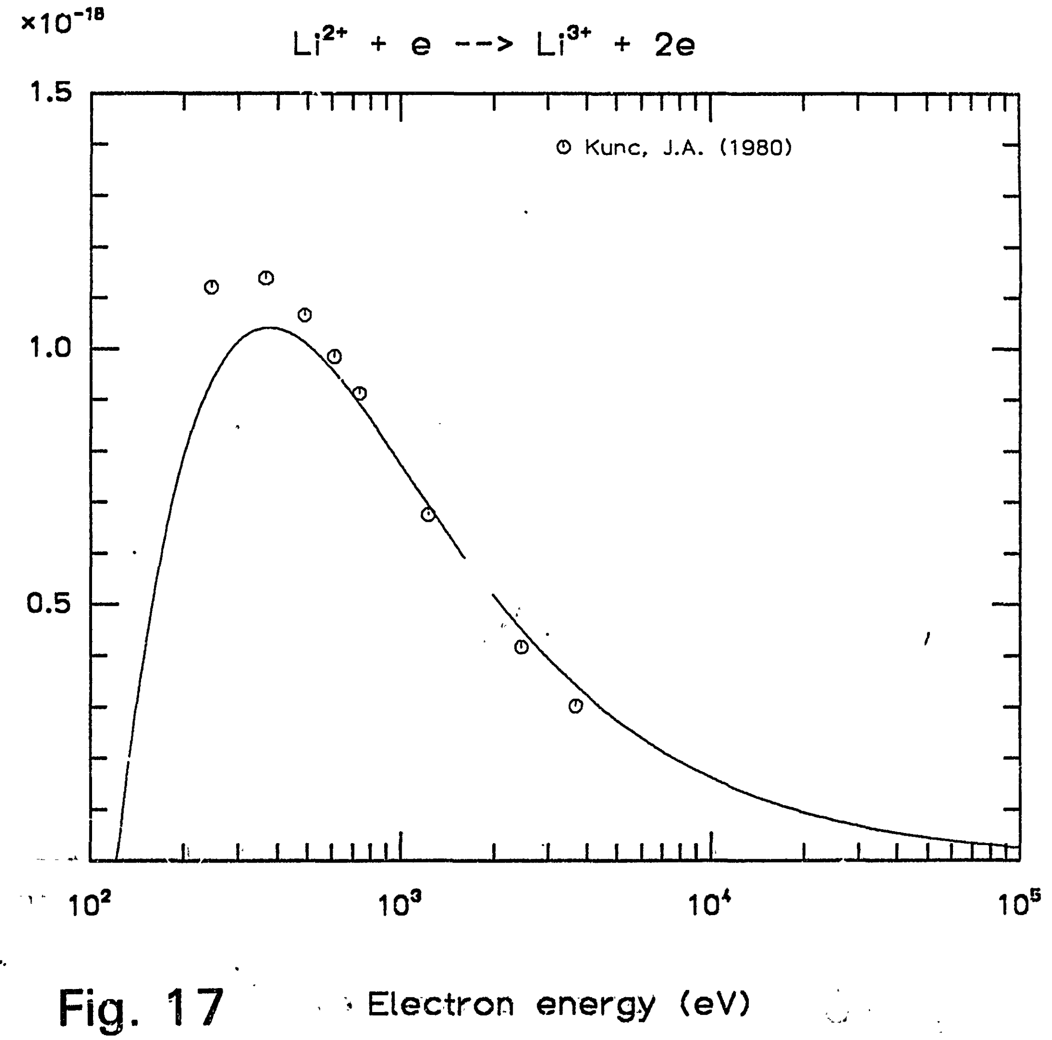


Fig. 16 Electron energy (eV)

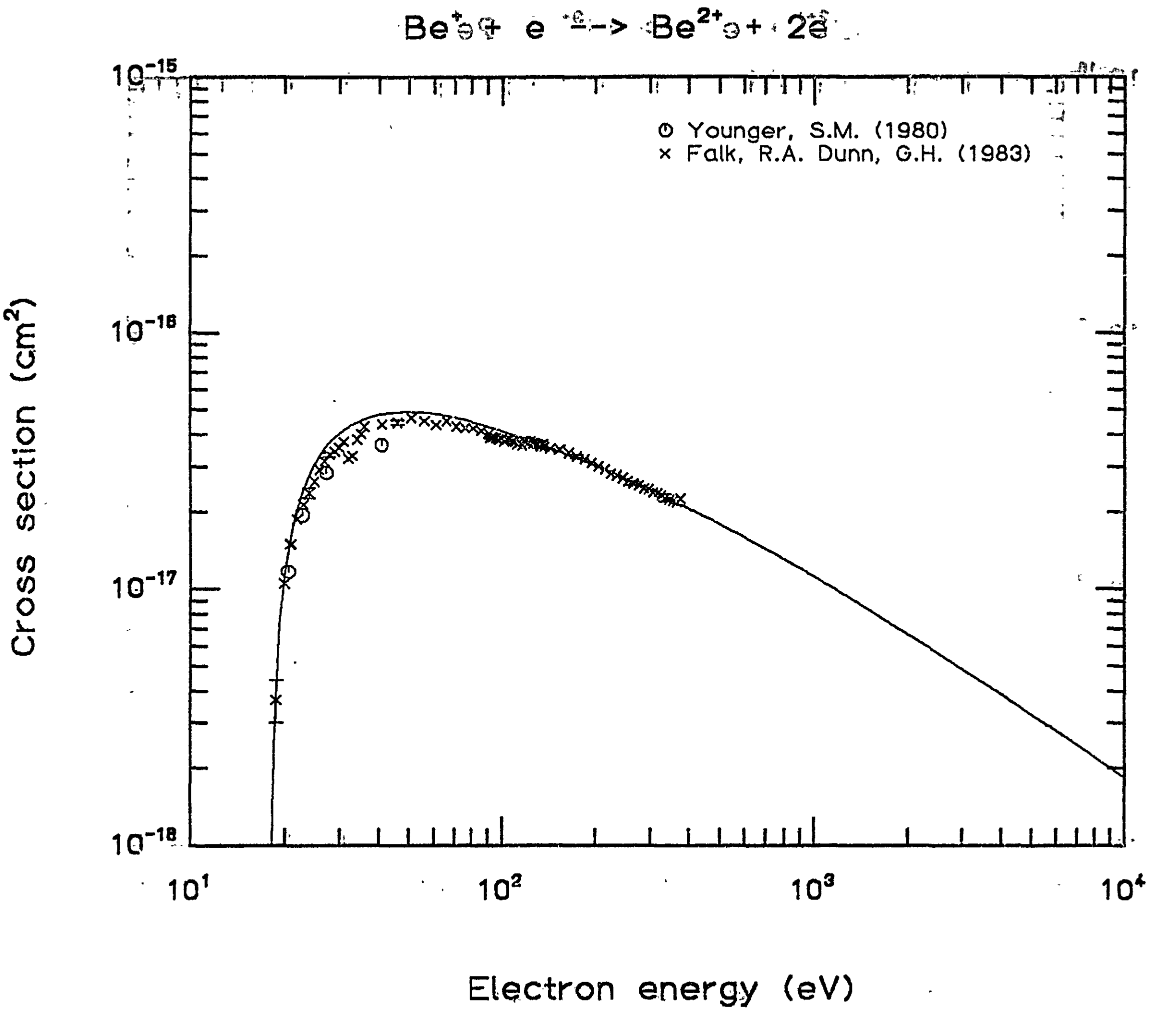


Li2+ + e --> Li3+ + 2e
Kunc, J.A. (1980)
10-16
10-17
10-18
10-19
10^2
10^3
10^4
10^5
Electron energy (eV)



×10-18
Li2+ + e --> Li3+ + 2e
Kunc, J.A. (1980)
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 17


Be⁺ + e --> Be²⁺ + 2e
Younger, S.M. (1980)
Falk, R.A. Dunn, G.H. (1983)
Cross section (cm²)
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10¹
10²
10³
10⁴
Electron energy (eV)

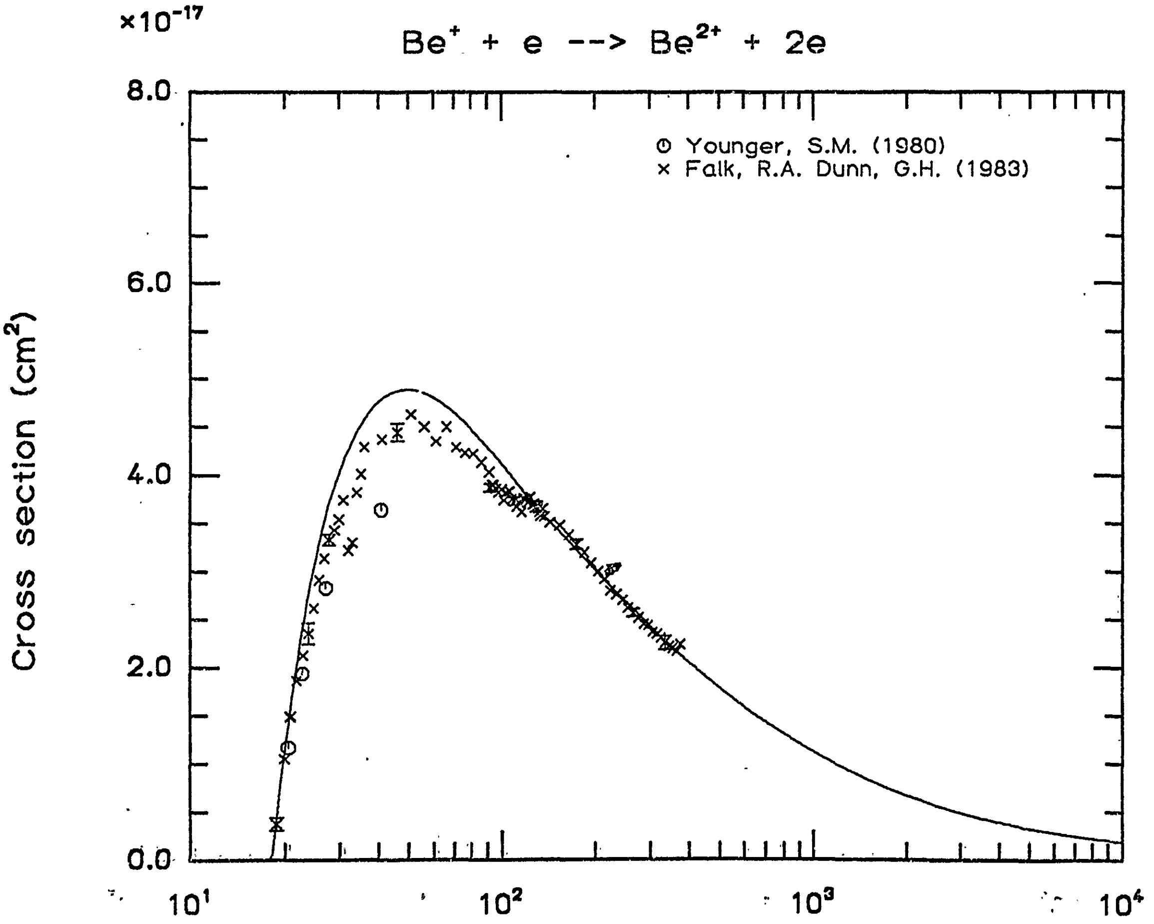
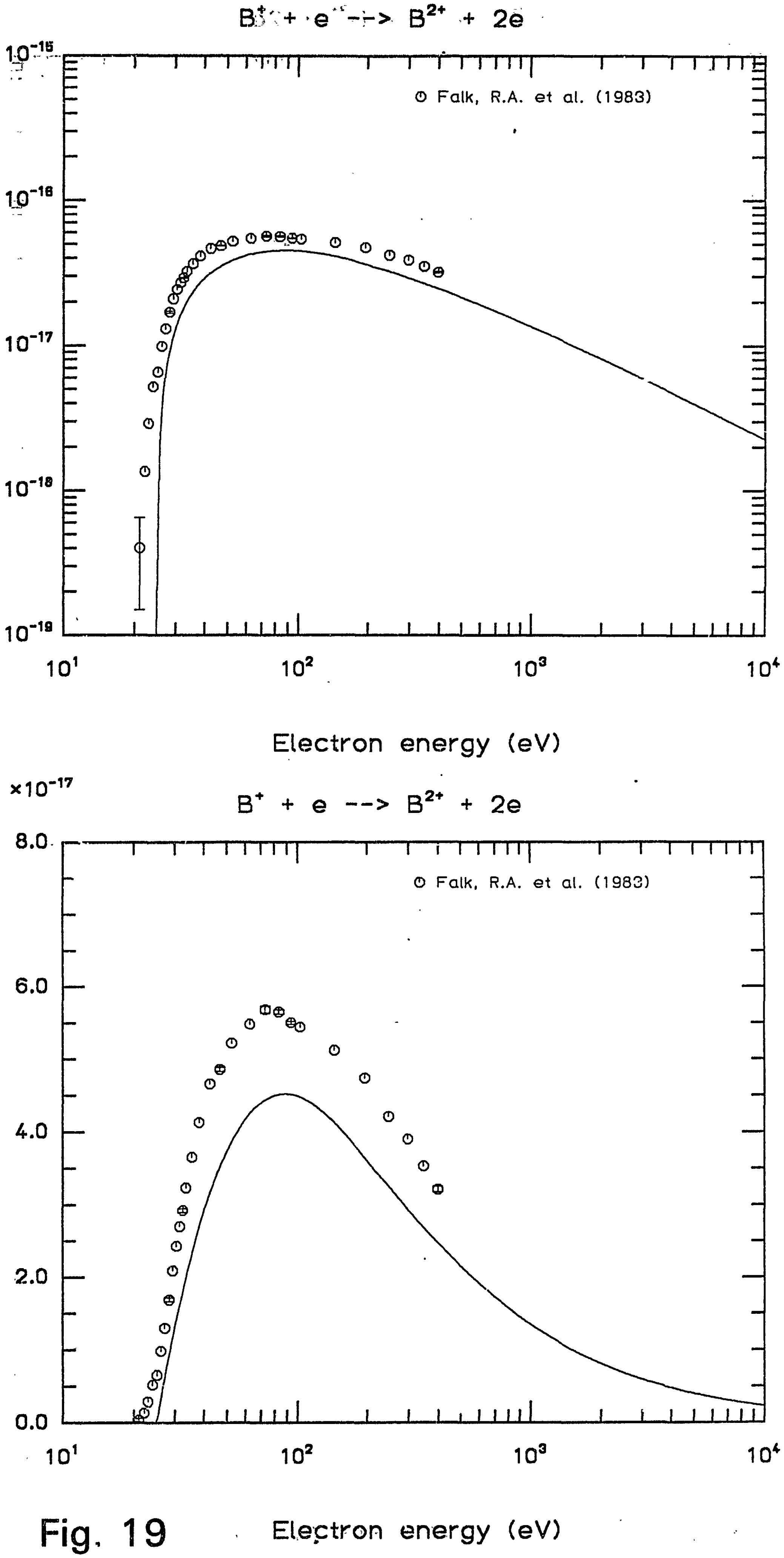
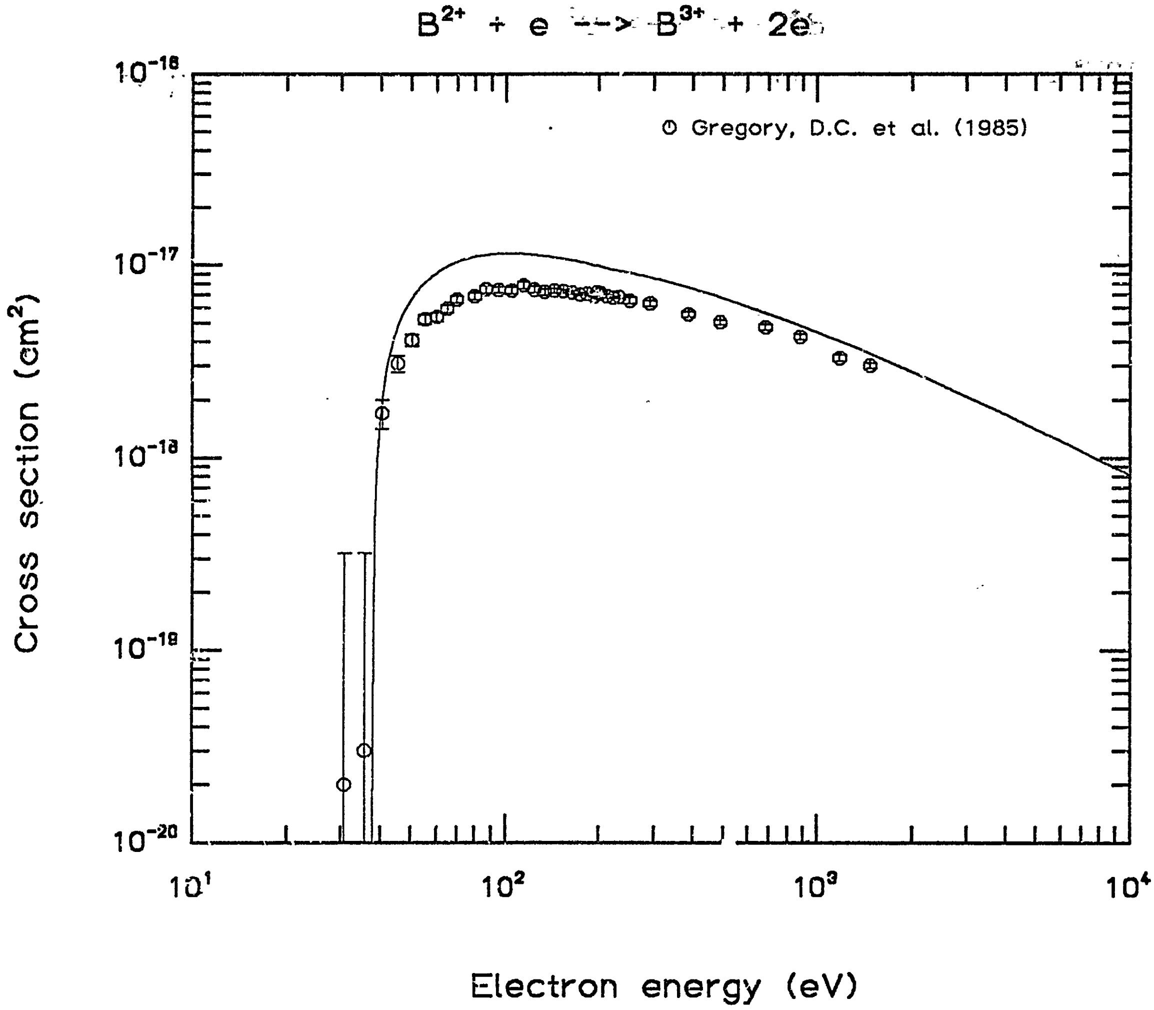

×10⁻¹⁷
Be⁺ + e --> Be²⁺ + 2e
Younger, S.M. (1980)
Falk, R.A. Dunn, G.H. (1983)
Cross section (cm²)
8.0
6.0
4.0
2.0
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 18



B⁺ + e --> B²⁺ + 2e
Falk, R.A. et al. (1983)
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10⁻¹⁹
10¹
10²
10³
10⁴
Electron energy (eV)
×10⁻¹⁷
B⁺ + e --> B²⁺ + 2e
Falk, R.A. et al. (1983)
8.0
6.0
4.0
2.0
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 19



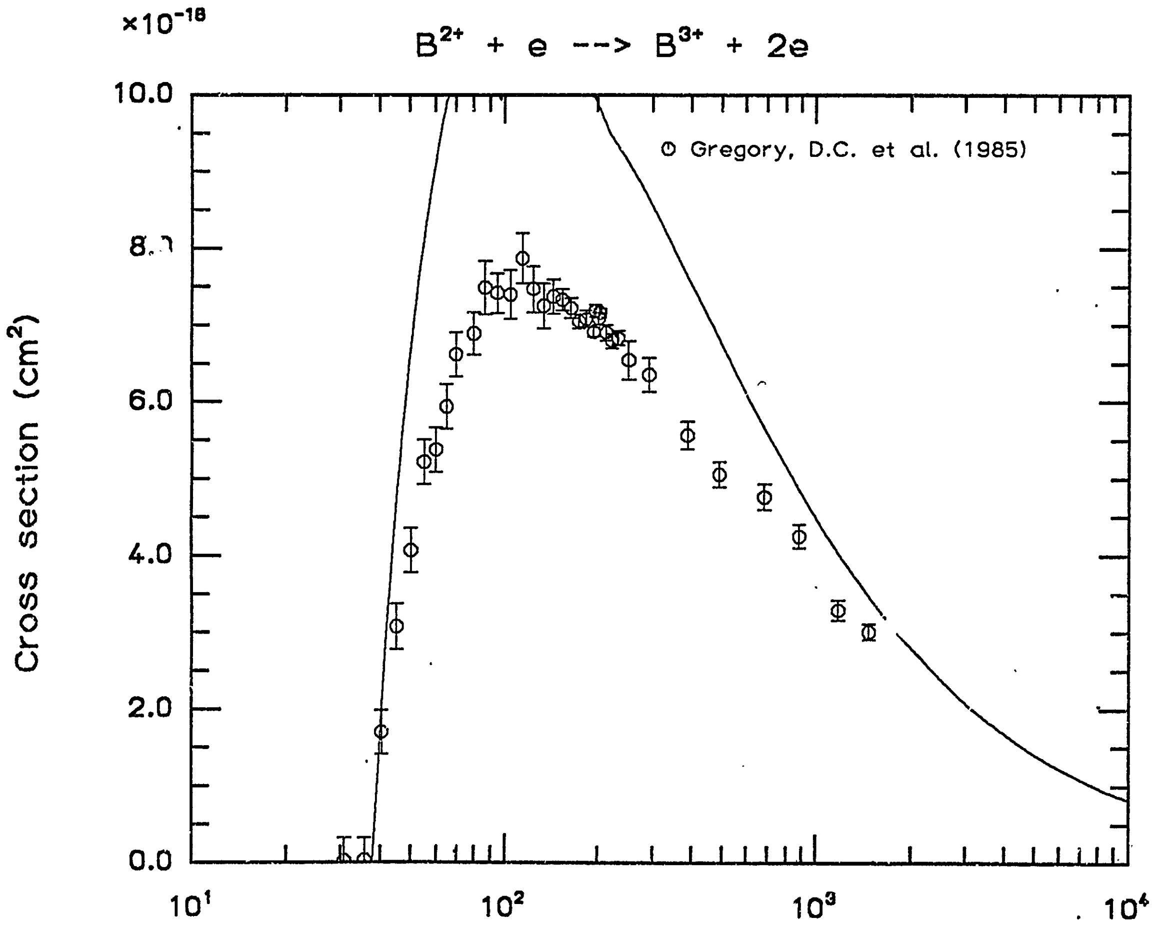
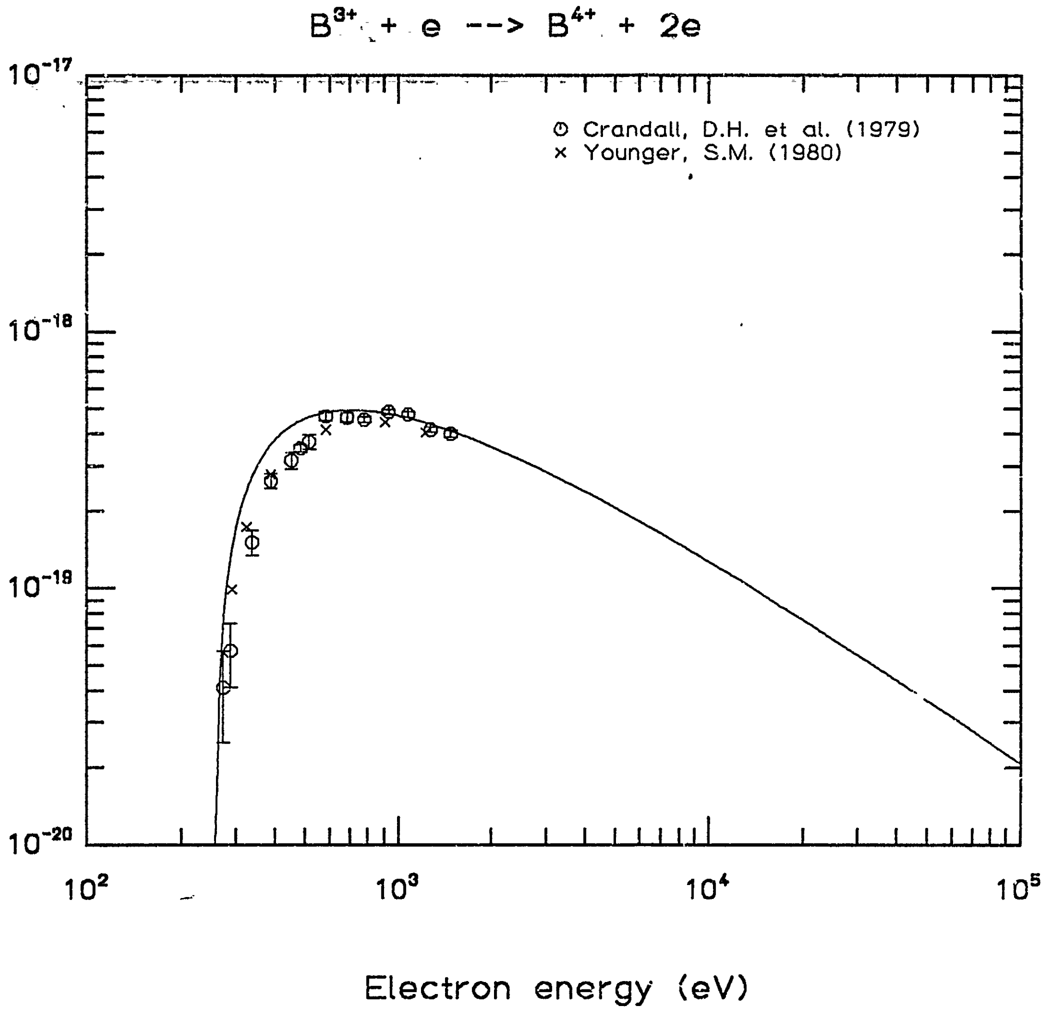


Fig. 20

Electron energy (eV)



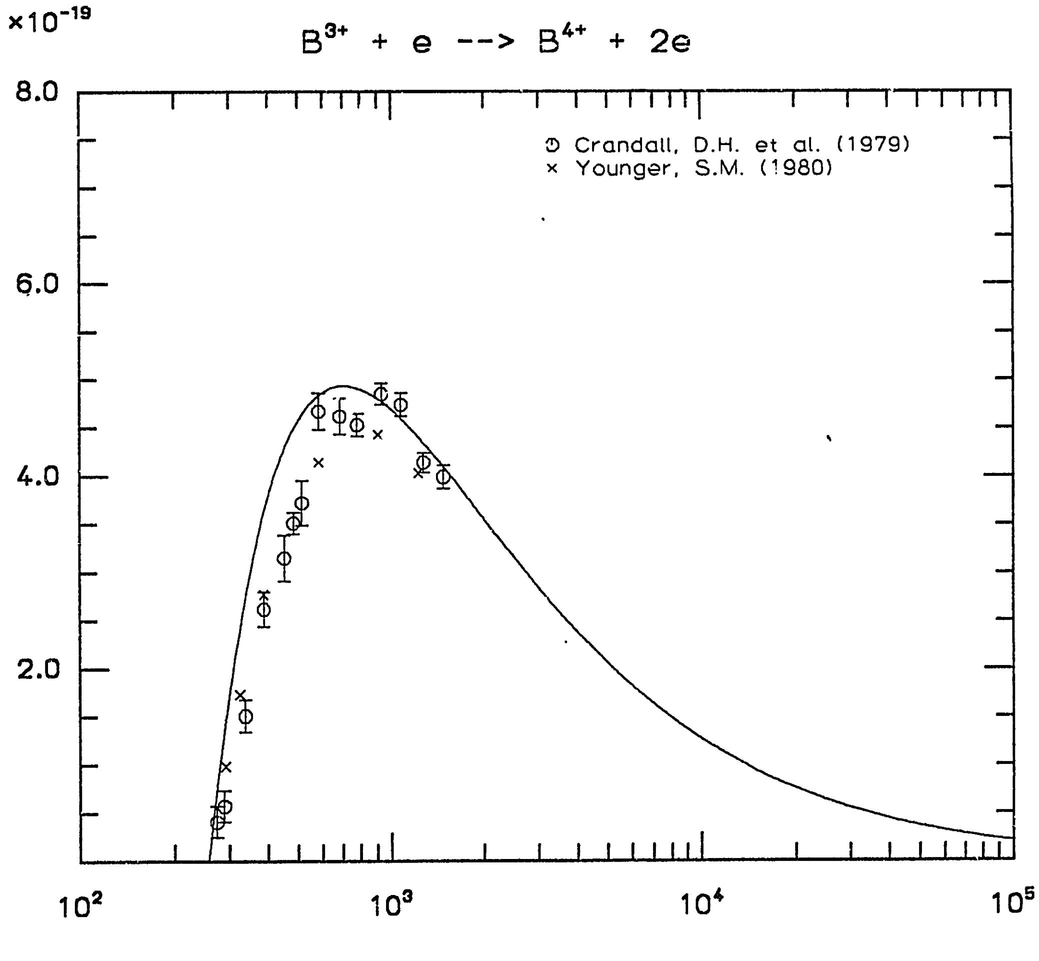
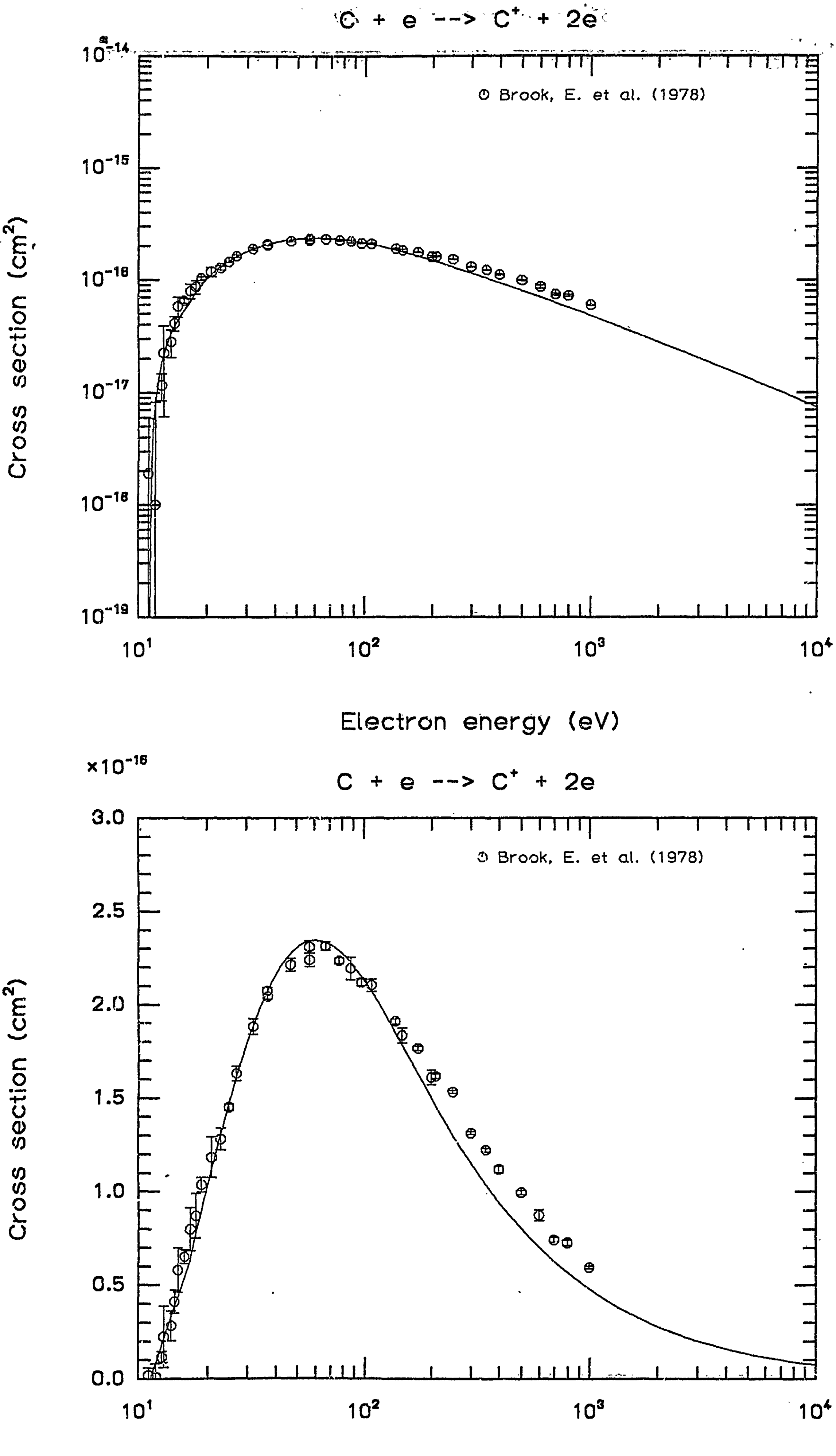
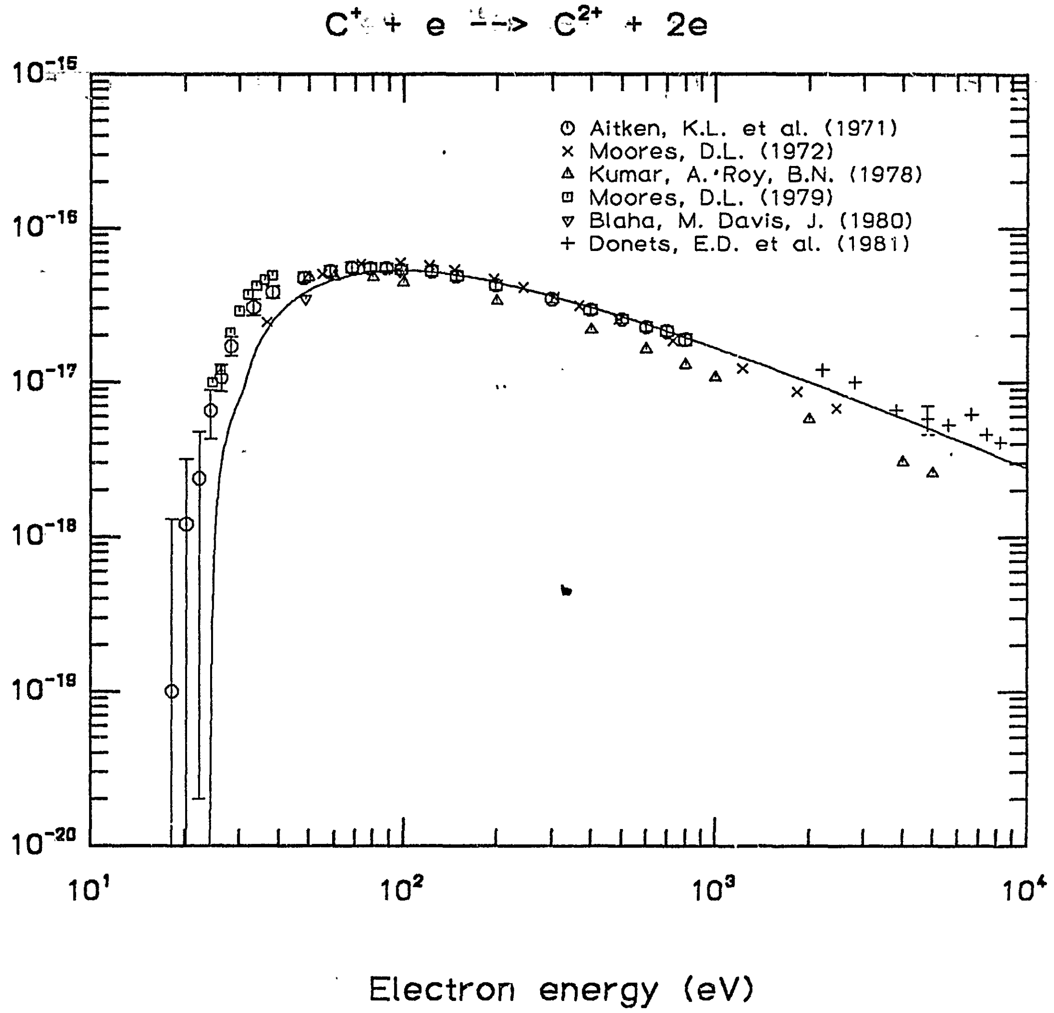


Fig. 21 Electron energy (eV)



C + e --> C+ + 2e
Brook, E. et al. (1978)
Cross section (cm2)
Electron energy (eV)
×10-16
C + e --> C+ + 2e
Brook, E. et al. (1978)
Cross section (cm2)
Electron energy (eV)

Fig. 22


C+ + e --> C2+ + 2e
Aitken, K.L. et al. (1971)
Moores, D.L. (1972)
Kumar, A.·Roy, B.N. (1978)
Moores, D.L. (1979)
Blaha, M. Davis, J. (1980)
Donets, E.D. et al. (1981)
10-15
10-16
10-17
10-18
10-19
10-20
10¹
10²
10³
10⁴
Electron energy (eV)

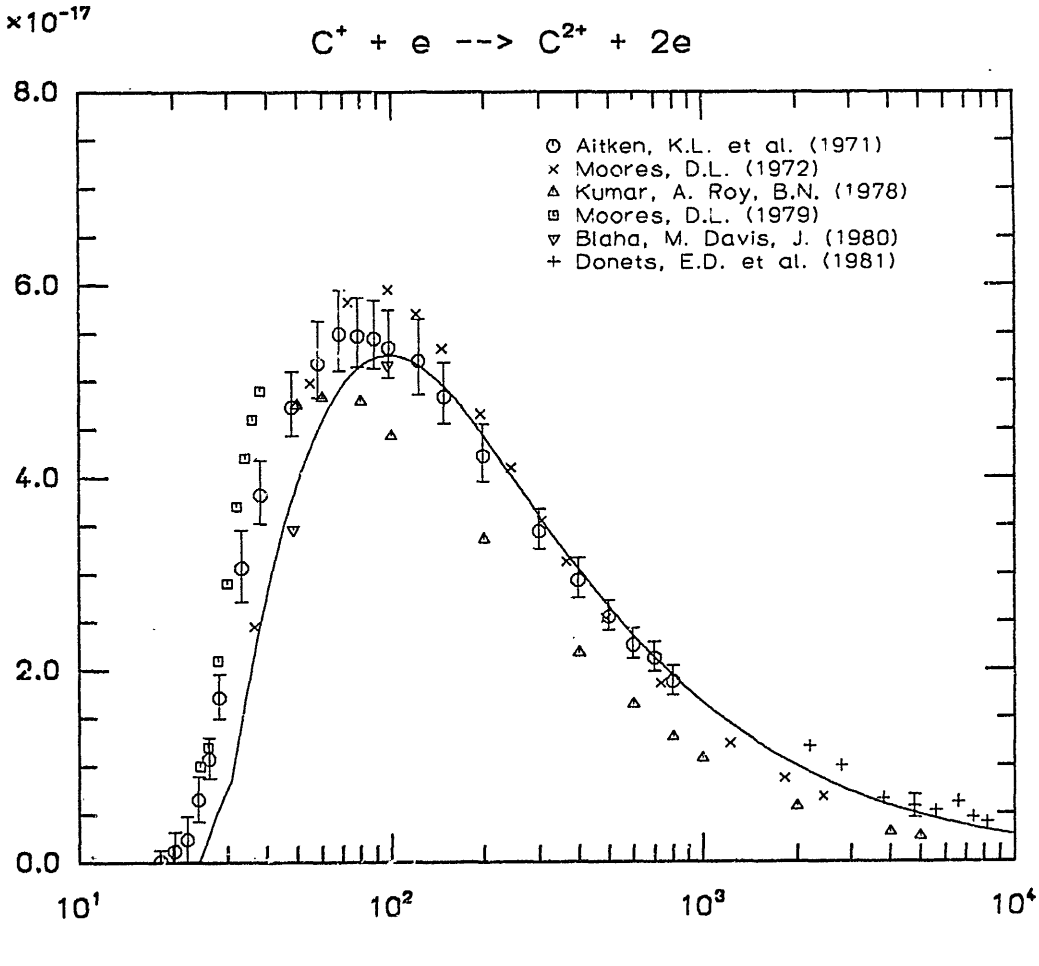

×10-17
C+ + e --> C2+ + 2e
Aitken, K.L. et al. (1971)
Moores, D.L. (1972)
Kumar, A. Roy, B.N. (1978)
Moores, D.L. (1979)
Blaha, M. Davis, J. (1980)
Donets, E.D. et al. (1981)
8.0
6.0
4.0
2.0
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 23

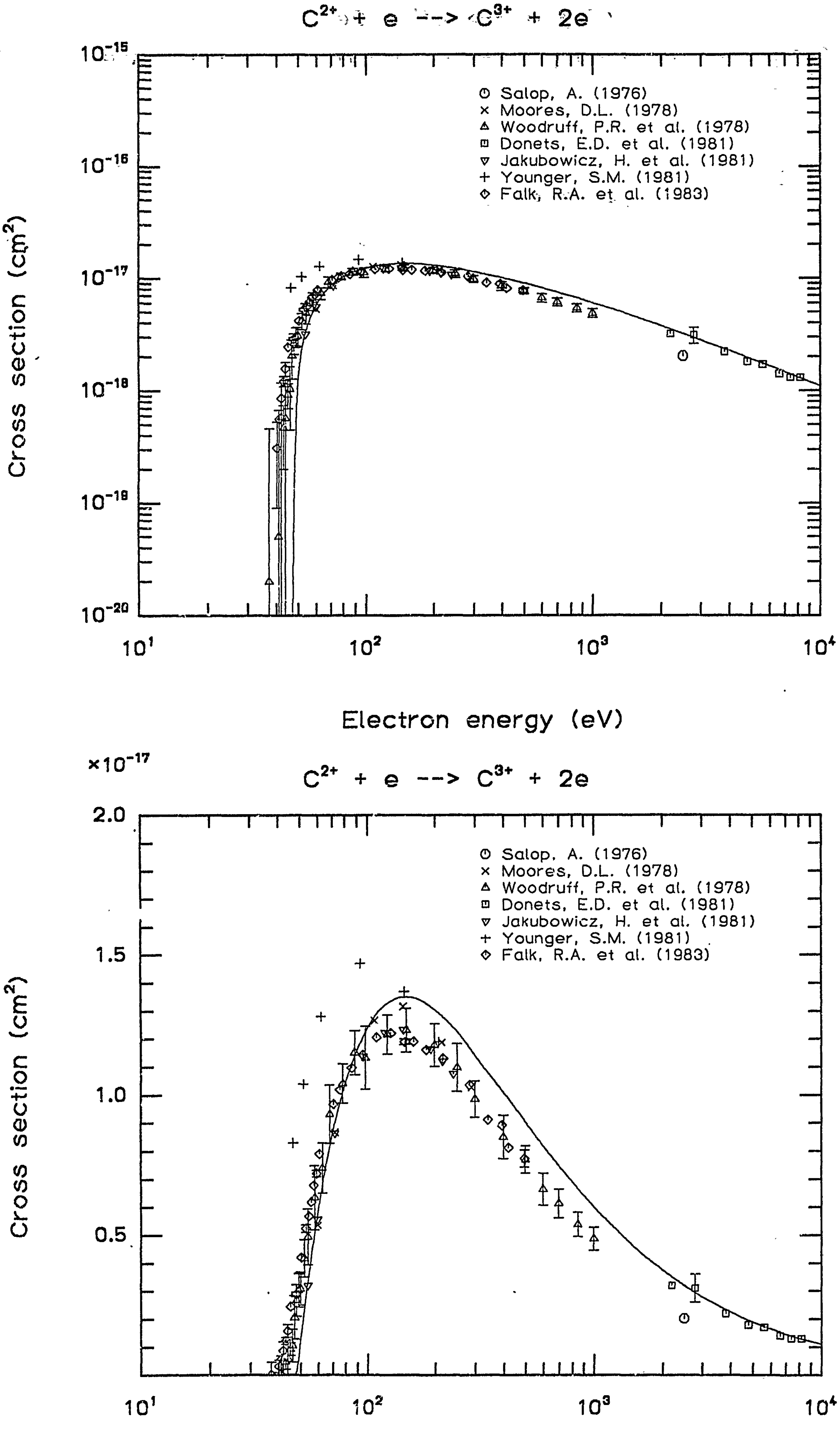
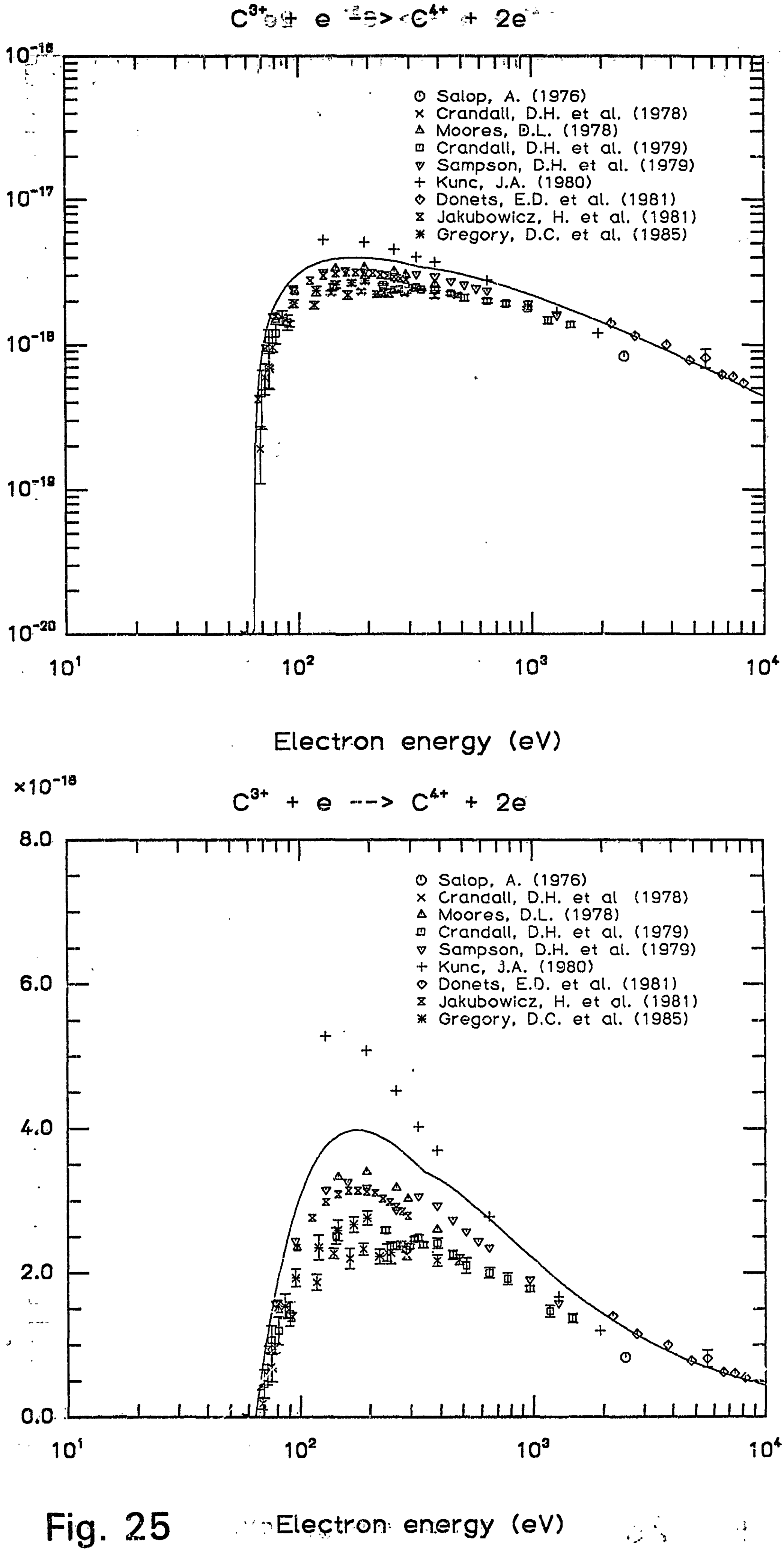
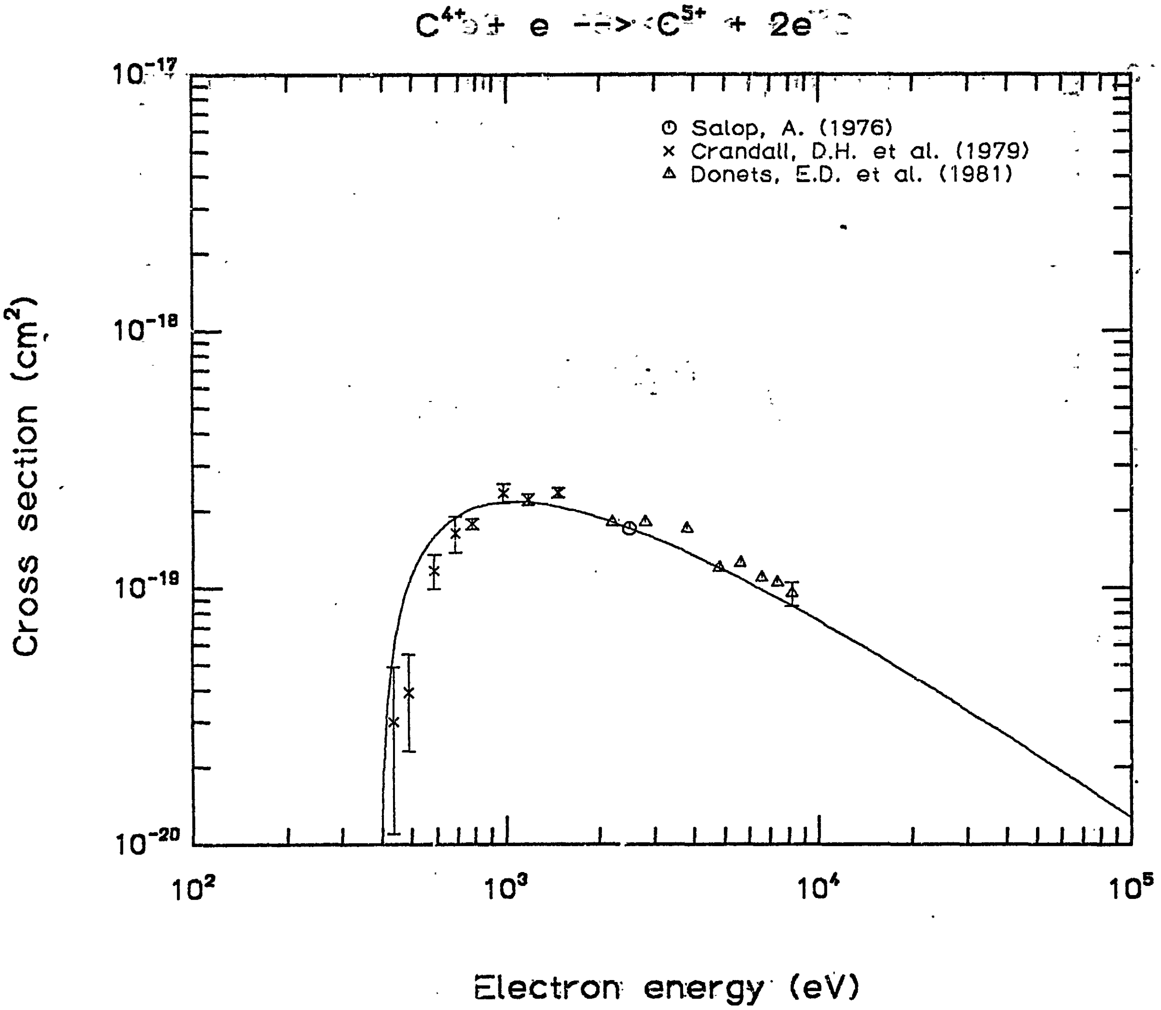


Fig. 24 Electron energy (eV)

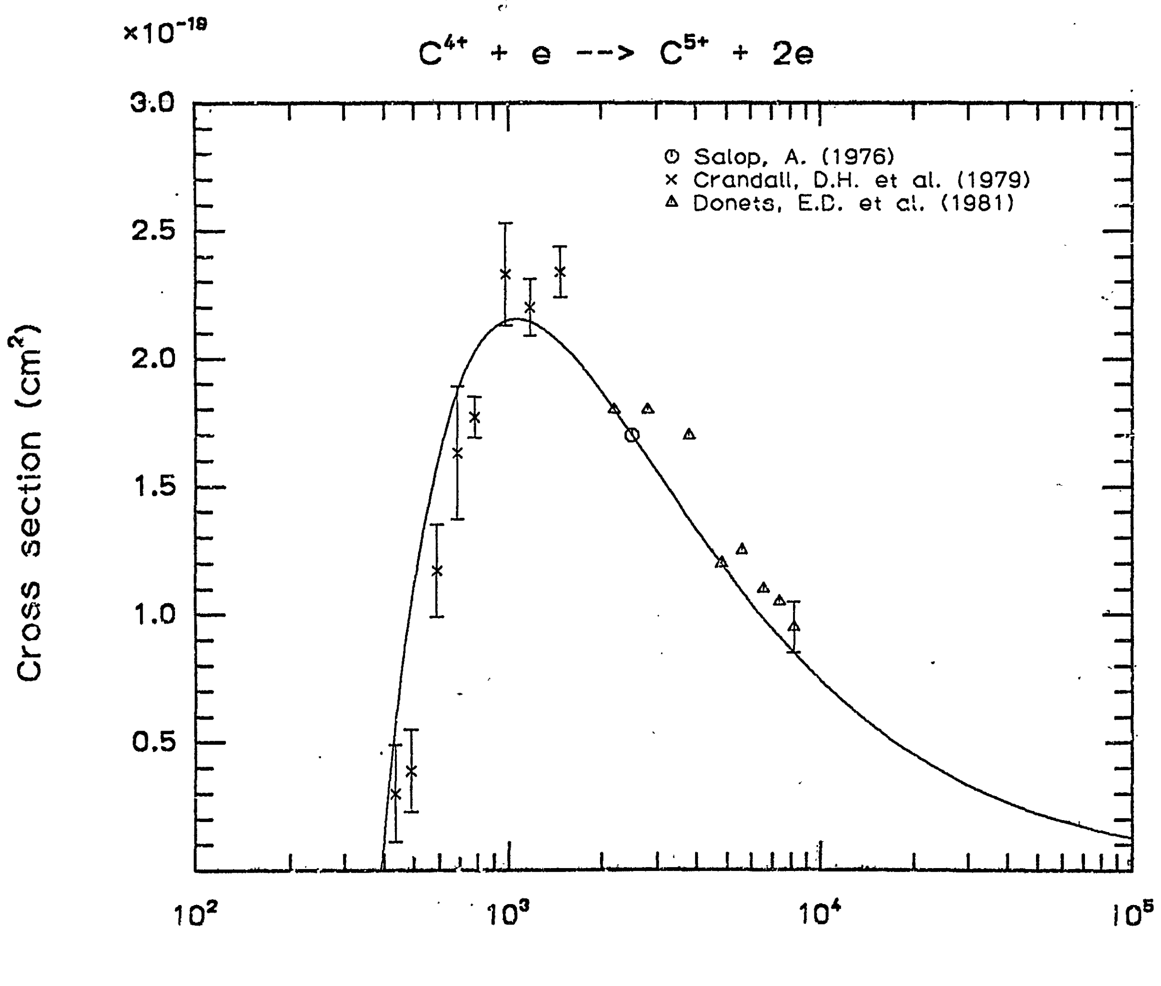


C3+ + e --> C4+ + 2e
Salop, A. (1976)
Crandall, D.H. et al. (1978)
Moores, D.L. (1978)
Crandall, D.H. et al. (1979)
Sampson, D.H. et al. (1979)
Kunc, J.A. (1980)
Donets, E.D. et al. (1981)
Jakubowicz, H. et al. (1981)
Gregory, D.C. et al. (1985)
10-16
10-17
10-18
10-19
10-20
10^1
10^2
10^3
10^4
Electron energy (eV)
×10-18
C3+ + e --> C4+ + 2e
8.0
6.0
4.0
2.0
0.0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 25

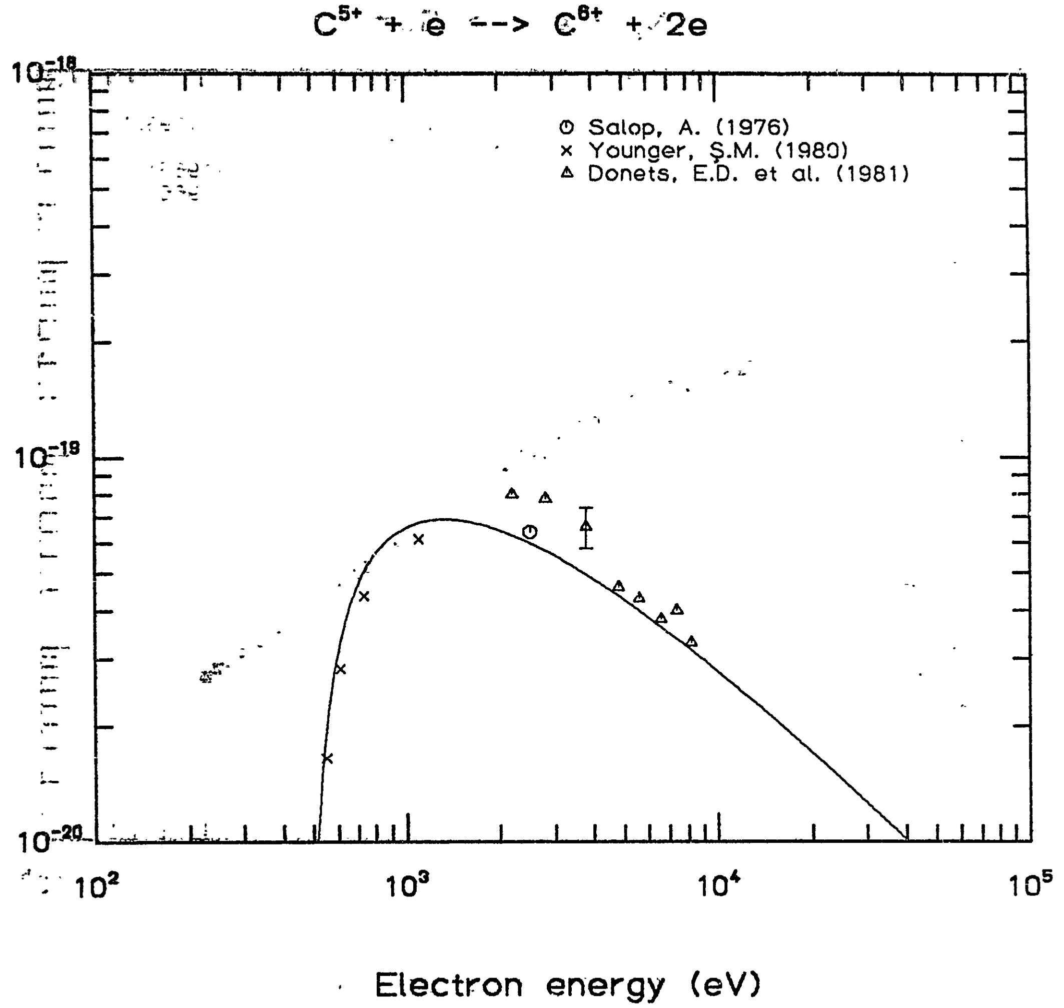


C4+ + e --> C5+ + 2e
Salop, A. (1976)
Crandall, D.H. et al. (1979)
Donets, E.D. et al. (1981)
Cross section (cm2)
10-17
10-18
10-19
10-20
10²
10³
10⁴
10⁵
Electron energy (eV)

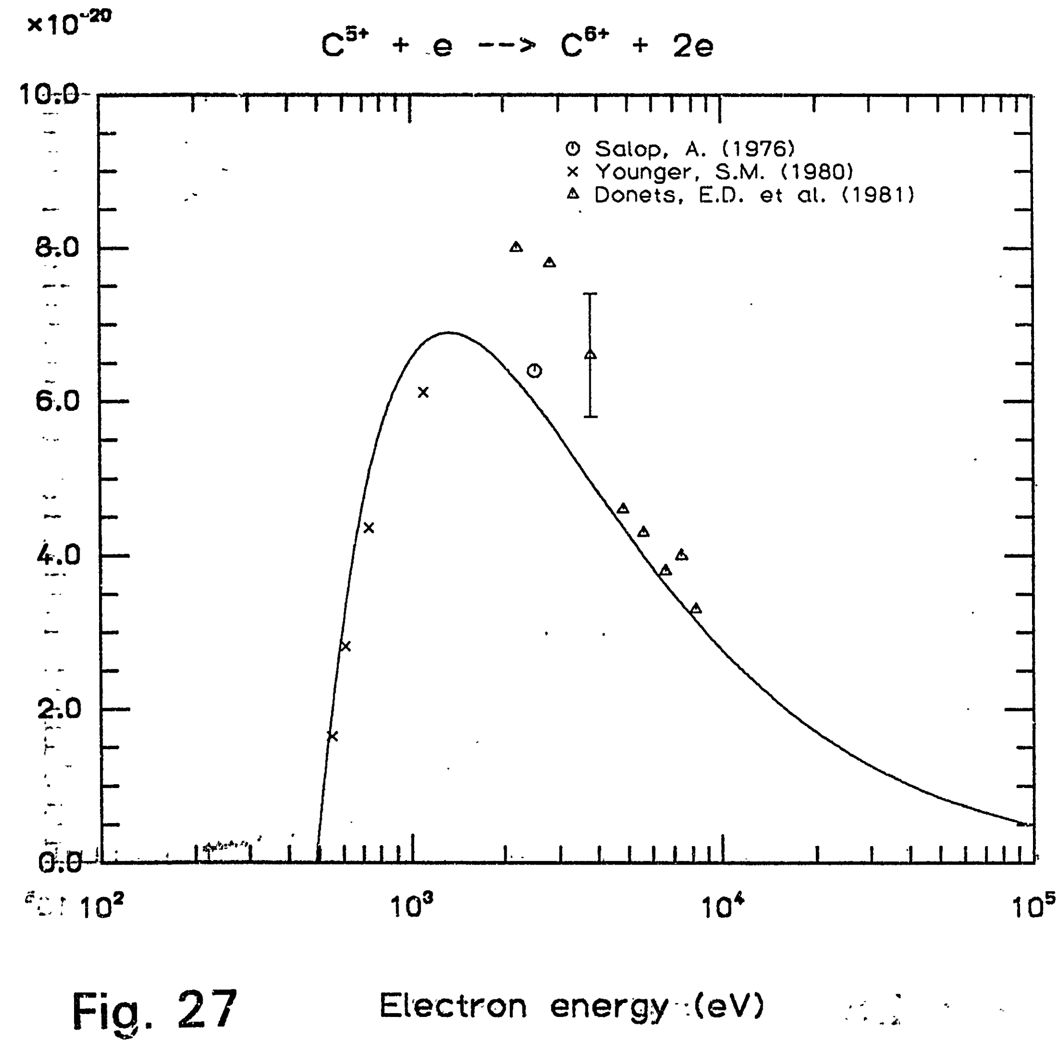


×10-19
C4+ + e --> C5+ + 2e
Salop, A. (1976)
Crandall, D.H. et al. (1979)
Donets, E.D. et al. (1981)
Cross section (cm2)
3.0
2.5
2.0
1.5
1.0
0.5
10²
10³
10⁴
10⁵
Electron energy (eV)

Fig. 26

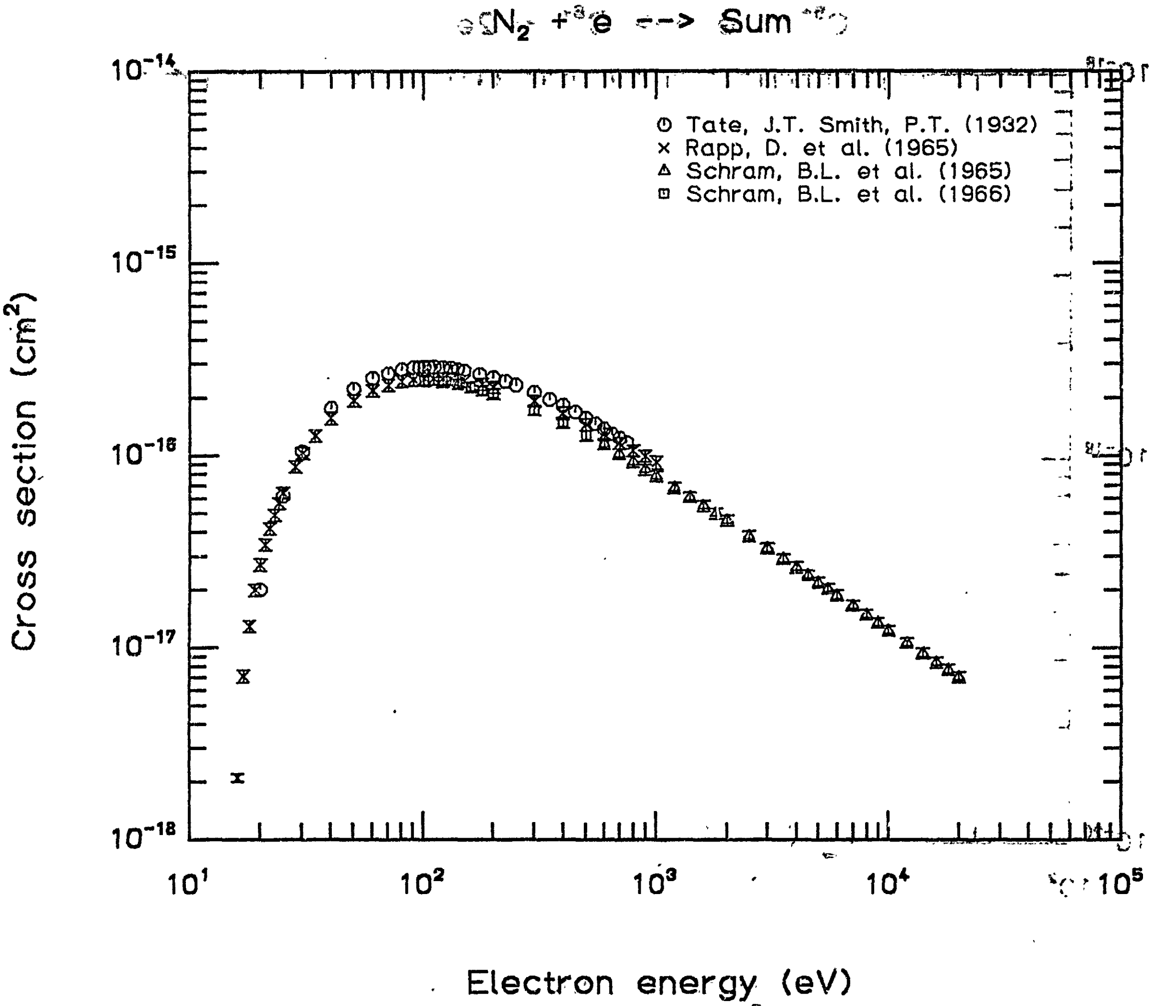


C^{5+} + e --> C^{6+} + 2e
10^{-18}
10^{-19}
10^{-20}
Salop, A. (1976)
Younger, S.M. (1980)
Donets, E.D. et al. (1981)
10^2
10^3
10^4
10^5
Electron energy (eV)

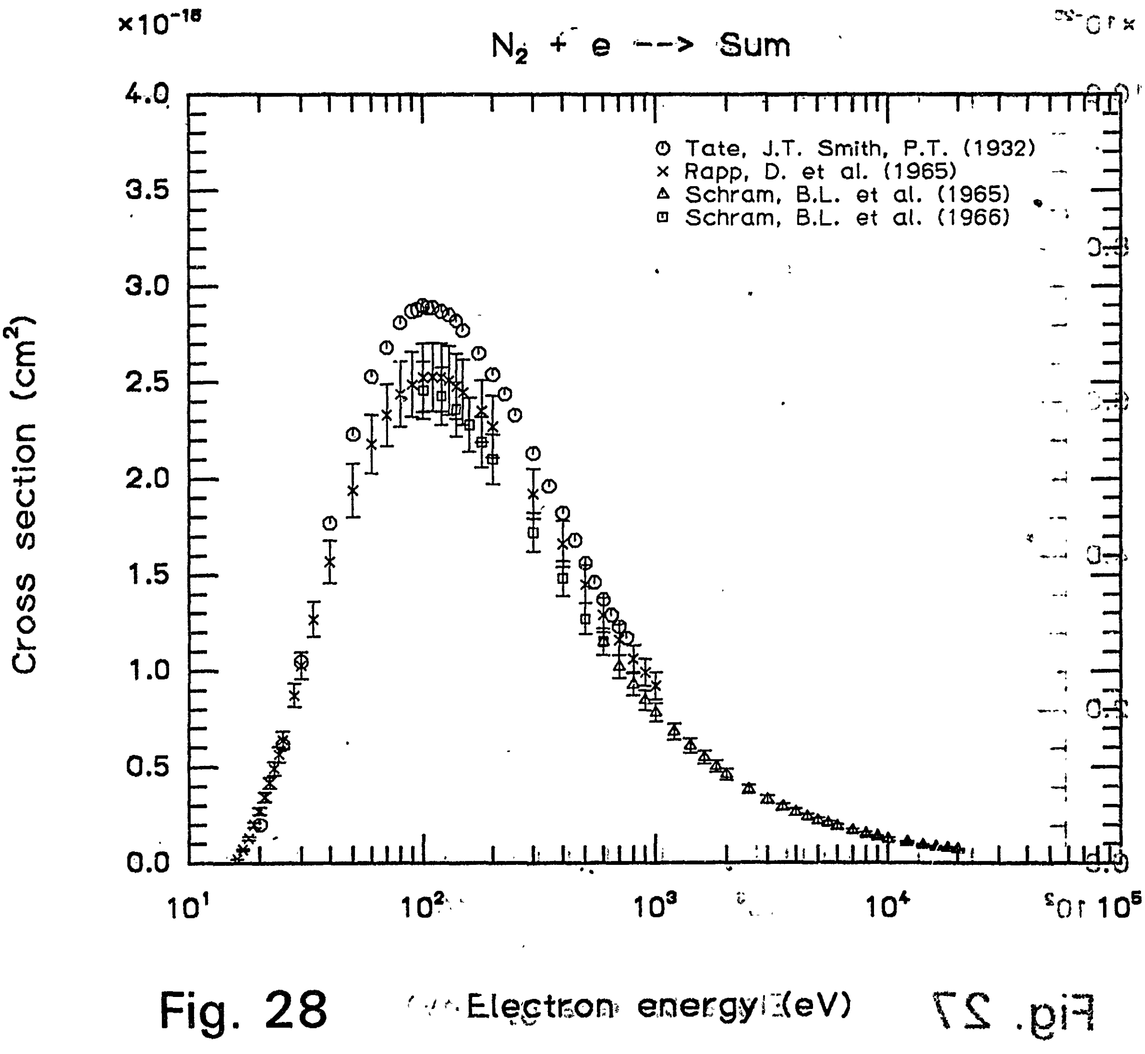


$\times 10^{-20}$
C^{5+} + e --> C^{6+} + 2e
10.0
8.0
6.0
4.0
2.0
0.0
Salop, A. (1976)
Younger, S.M. (1980)
Donets, E.D. et al. (1981)
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 27



N_2 + e --> Sum
Tate, J.T. Smith, P.T. (1932)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Cross section (cm^2)
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)



×10^{-16}
N_2 + e --> Sum
Tate, J.T. Smith, P.T. (1932)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Cross section (cm^2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 28

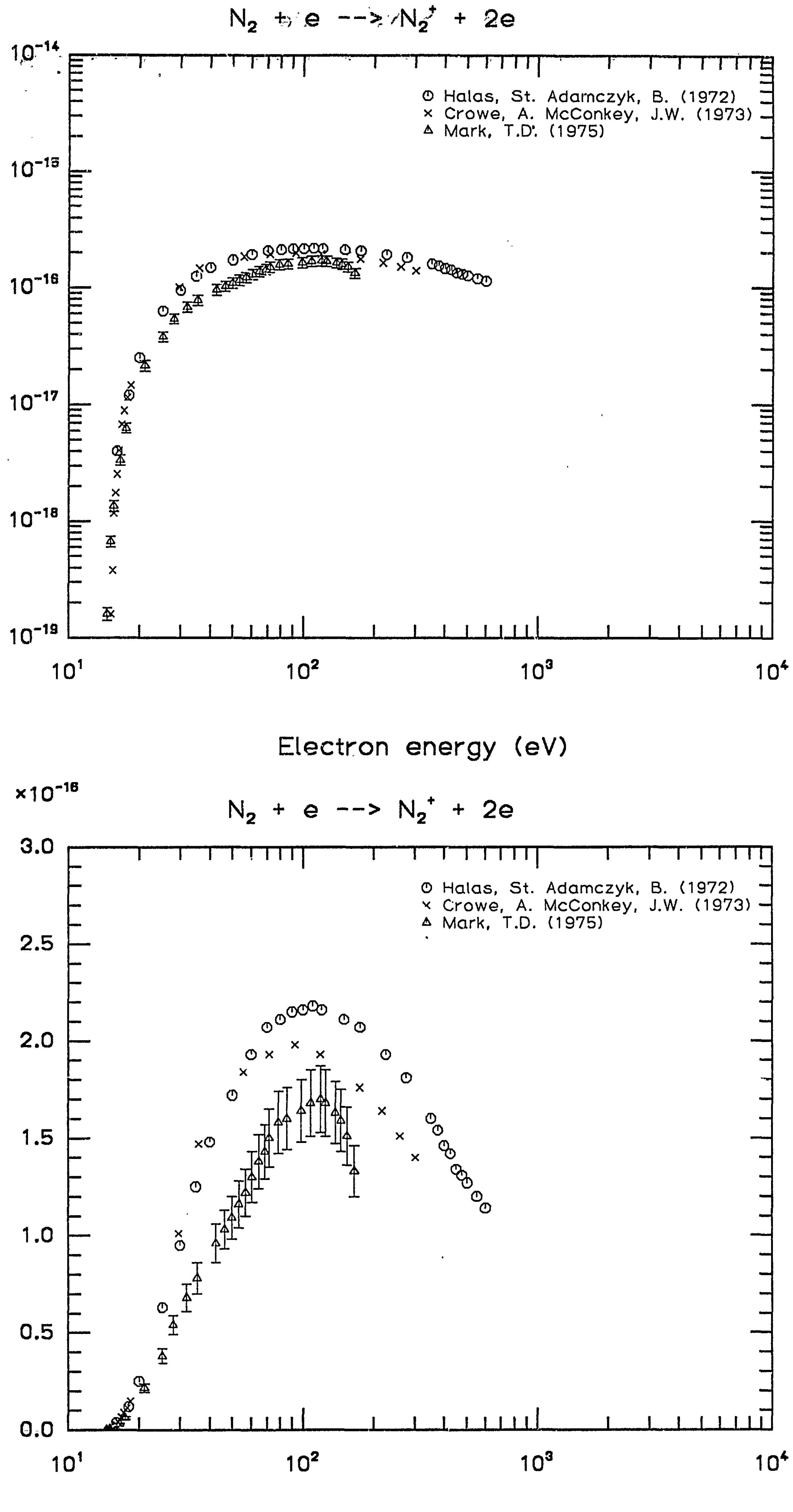
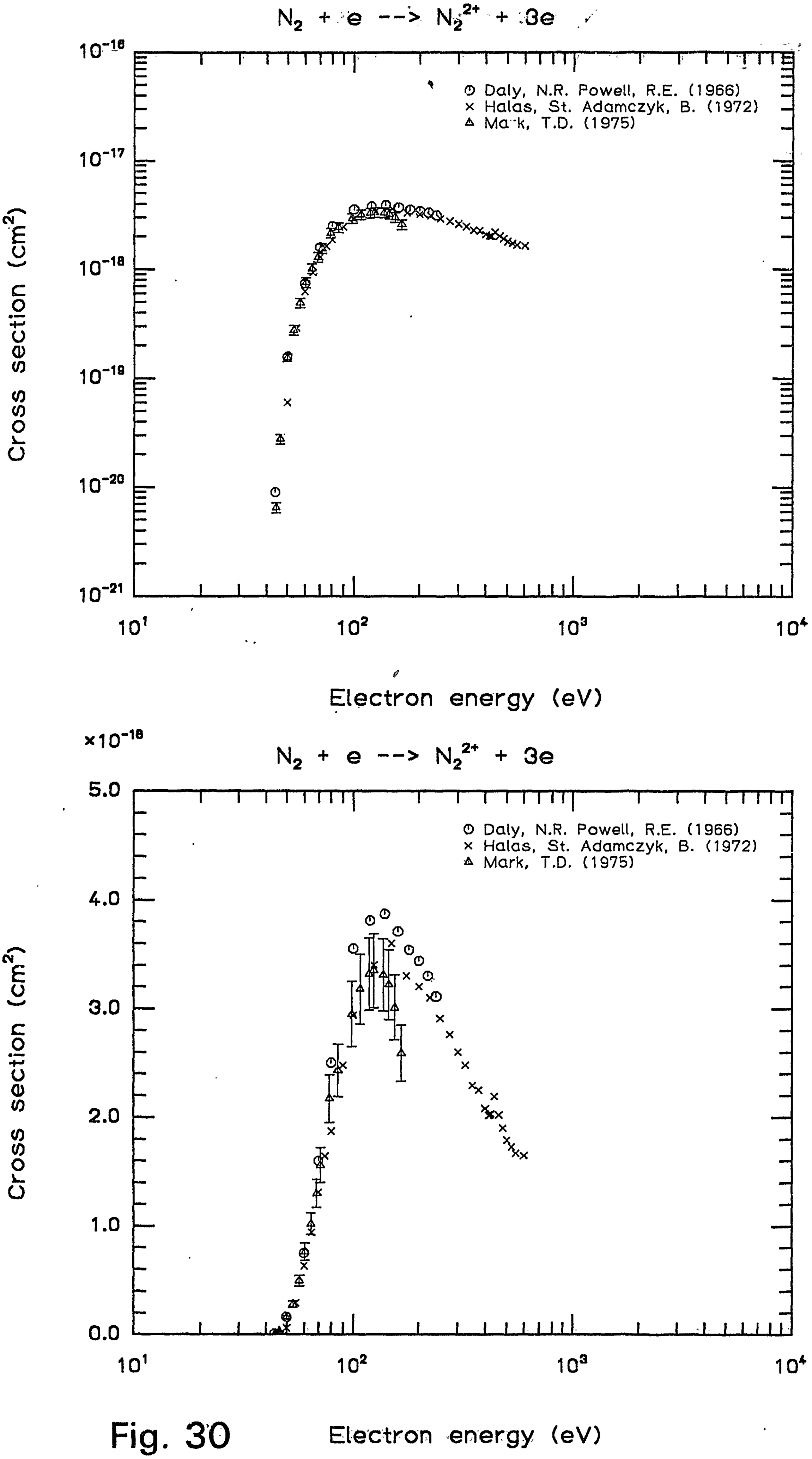
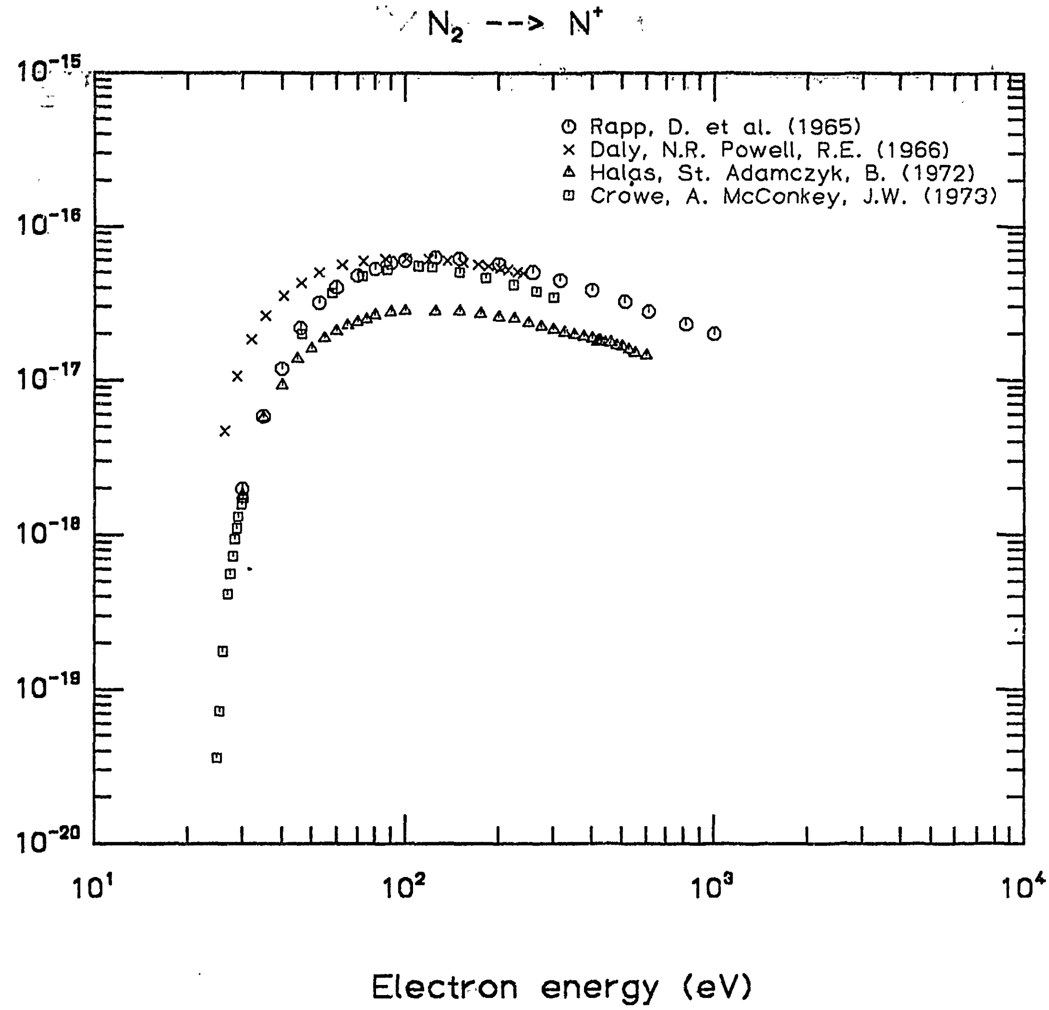


Fig. 29 Electron energy (eV)



$N_2 + e \rightarrow N_2^{2+} + 3e$
Daly, N.R. Powell, R.E. (1966)
Halas, St. Adamczyk, B. (1972)
Mark, T.D. (1975)
Cross section (cm^2)
Electron energy (eV)
$\times 10^{-18}$

Fig. 30



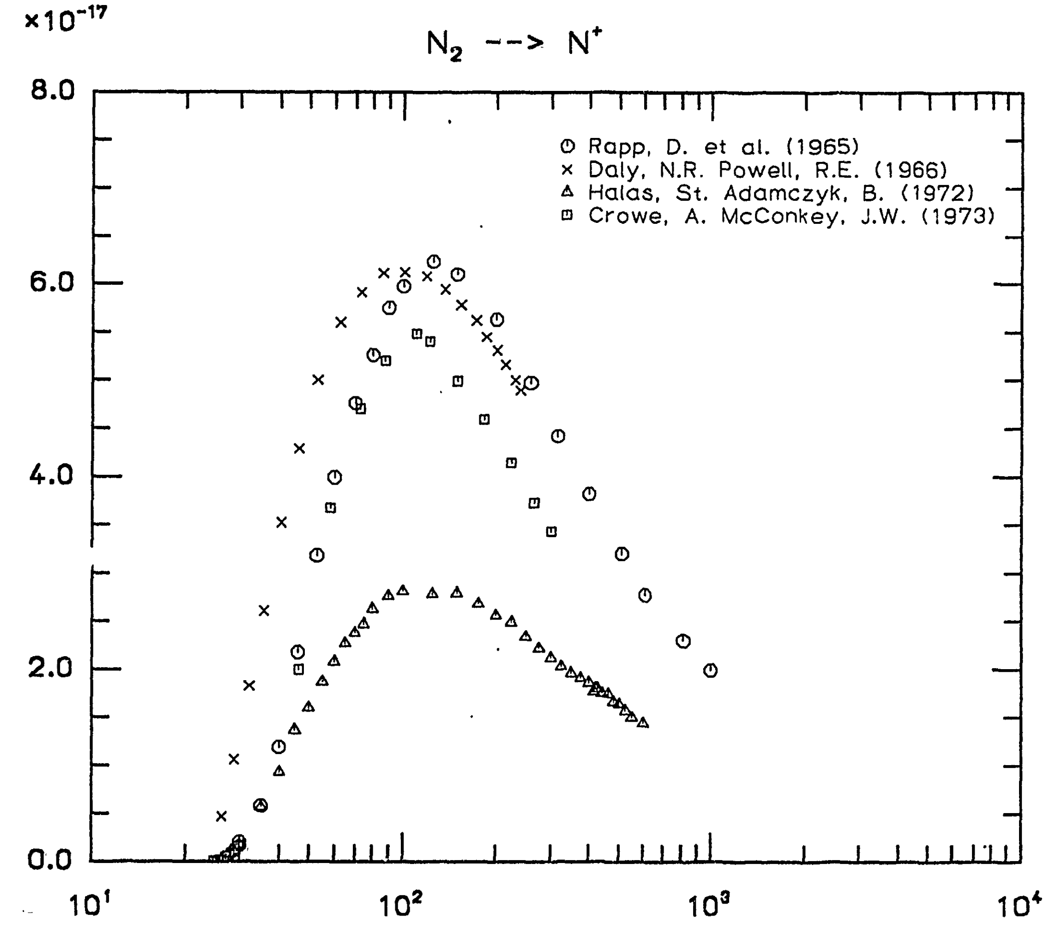
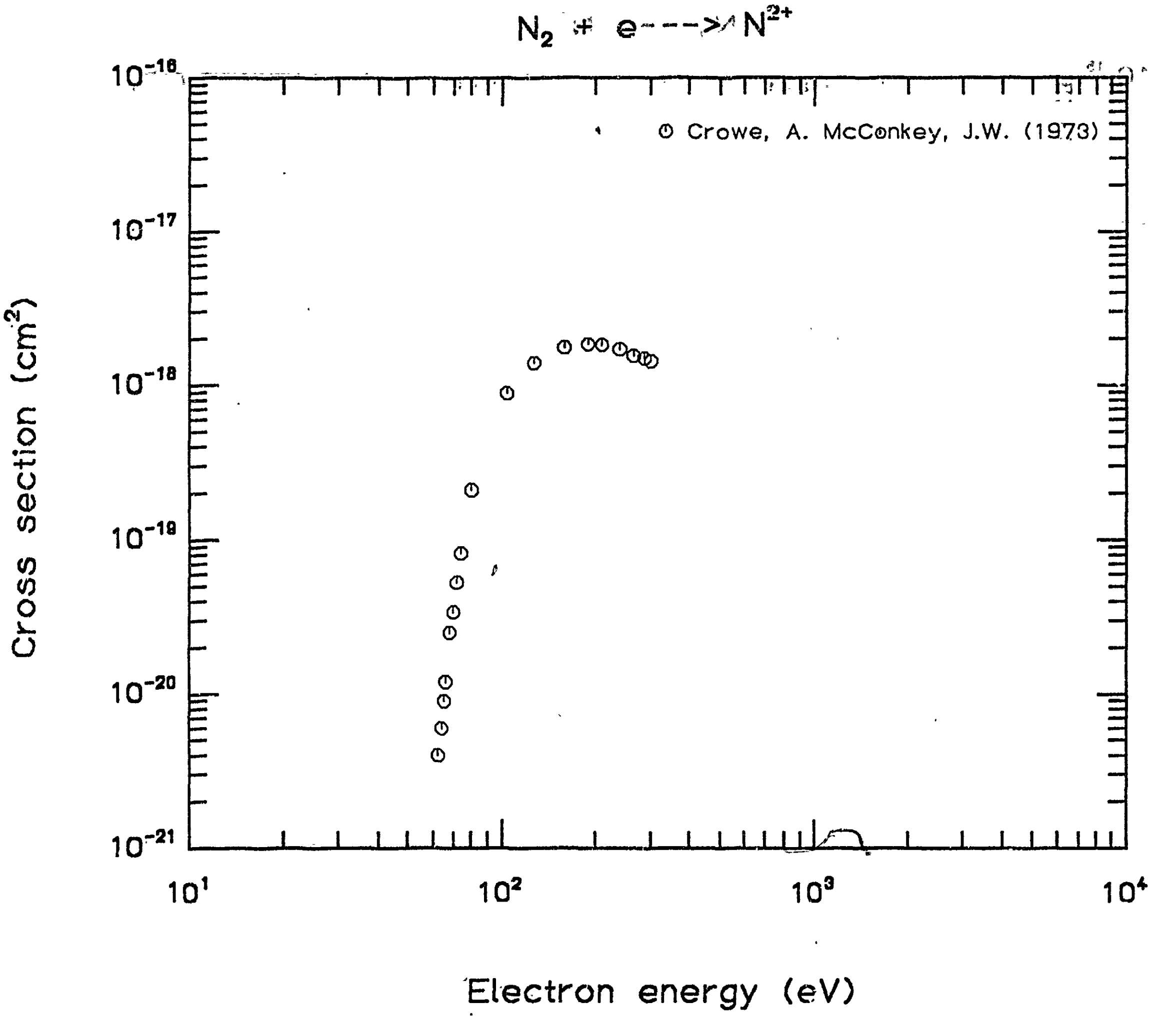
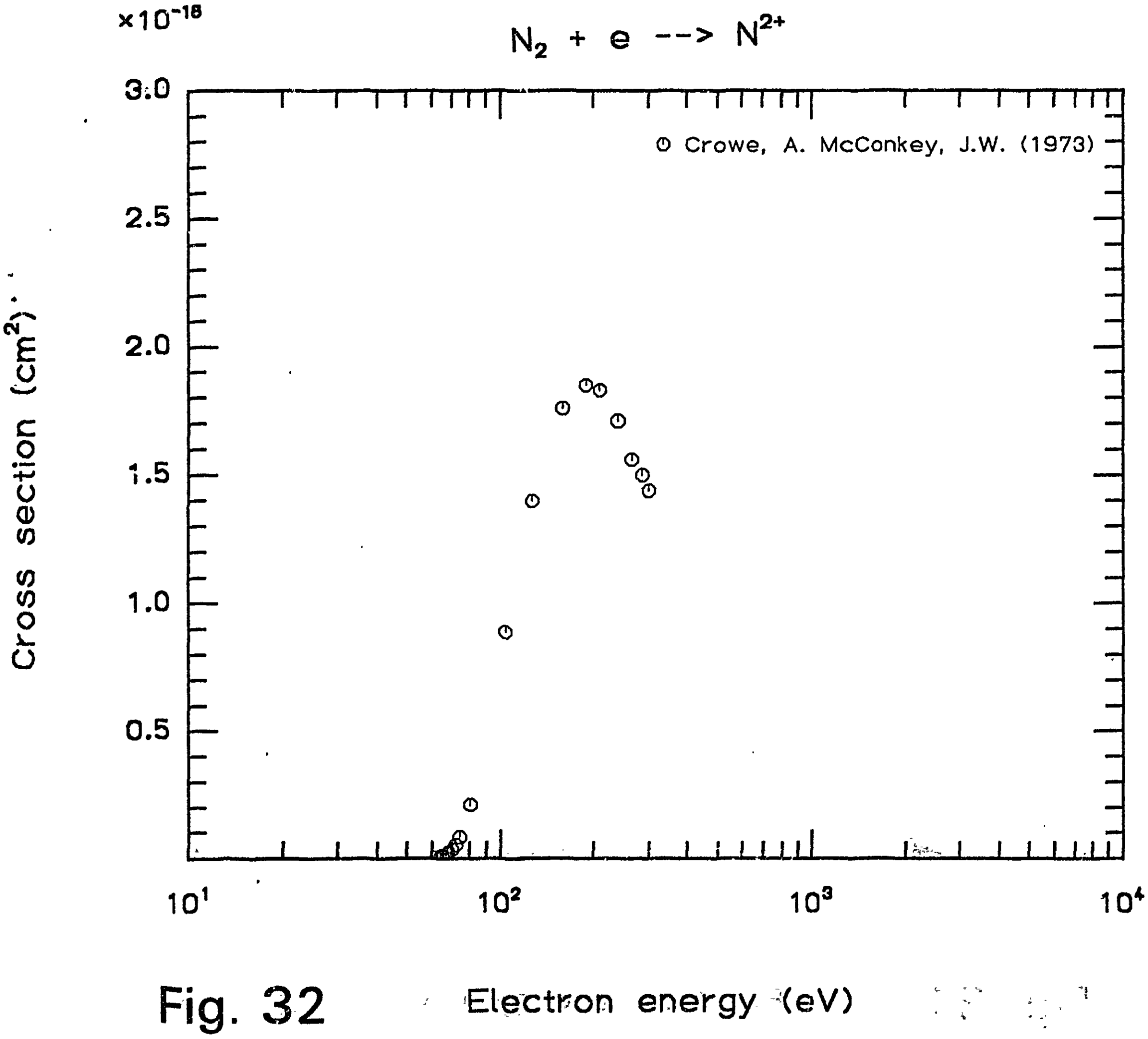


Fig. 31 Electron energy (eV)

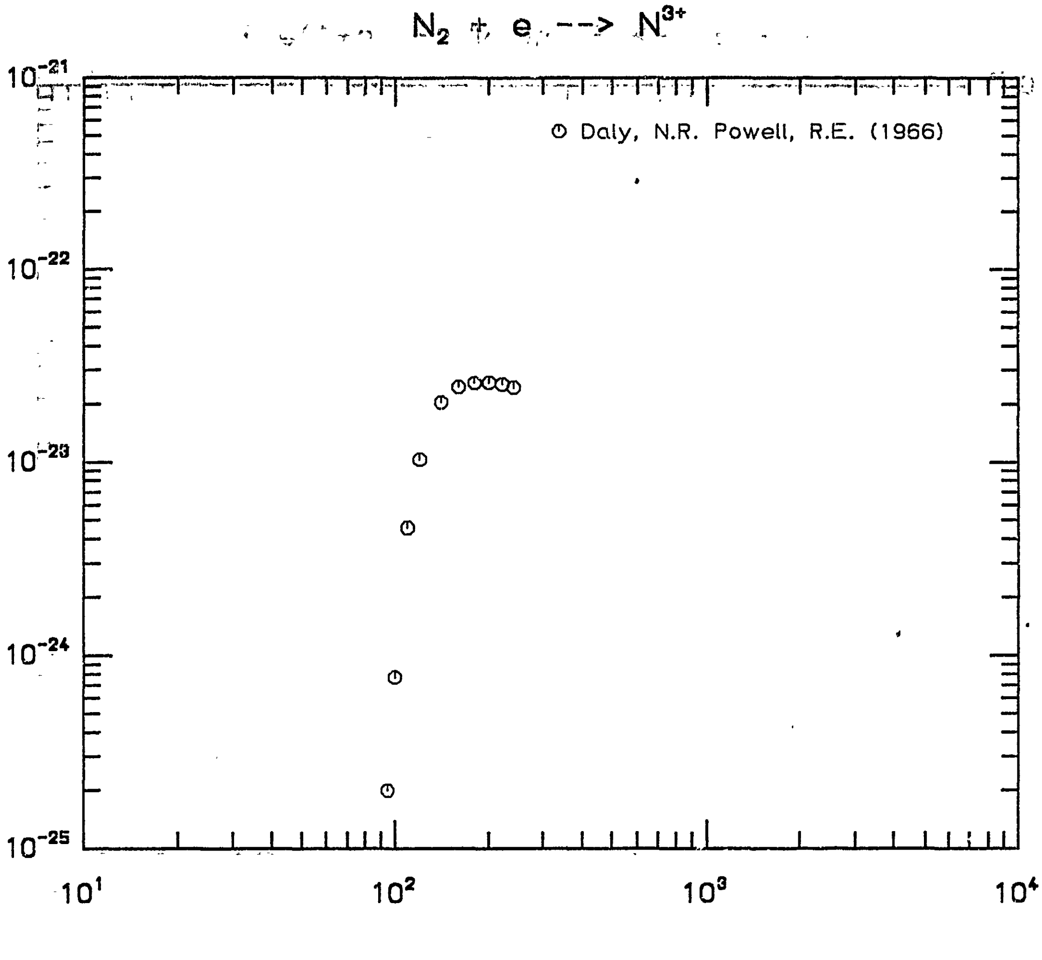


N_2 + e ---> N^{2+}
Crowe, A. McConkey, J.W. (1973)
Cross section (cm^2)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^1
10^2
10^3
10^4
Electron energy (eV)



$\times 10^{-18}$
N_2 + e --> N^{2+}
Crowe, A. McConkey, J.W. (1973)
Cross section (cm^2)
3.0
2.5
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 32



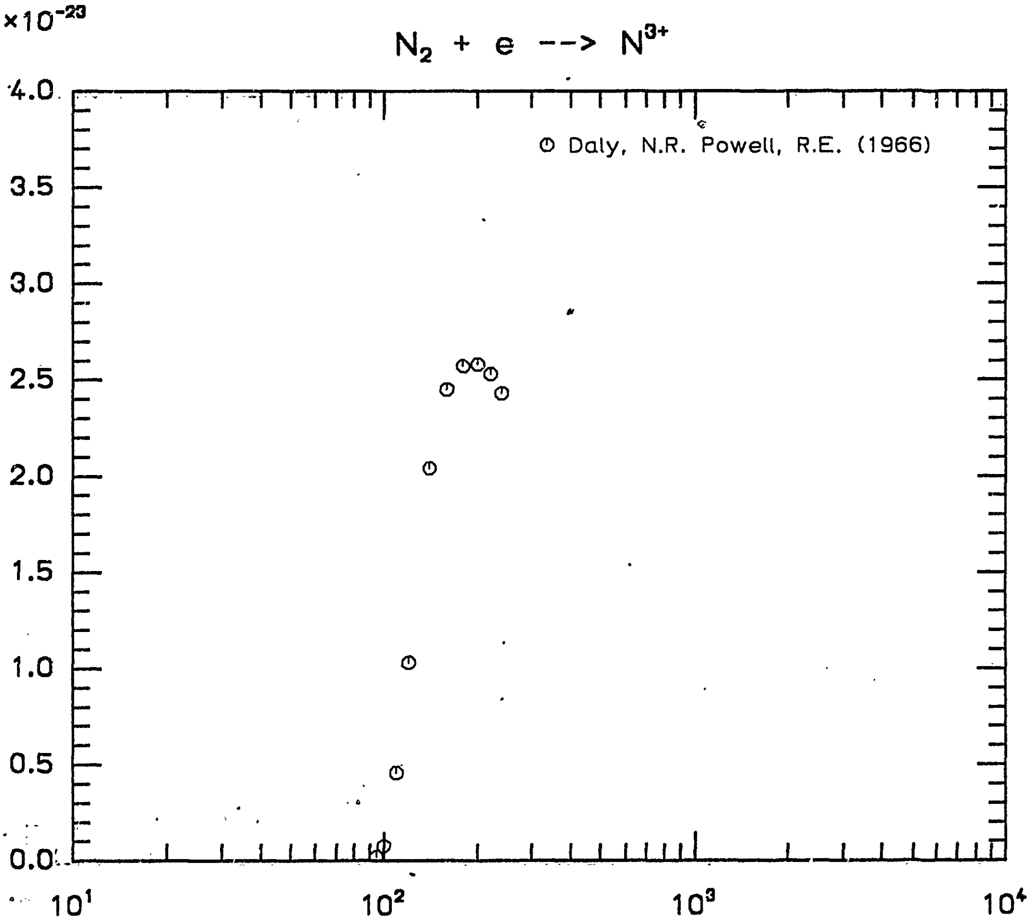
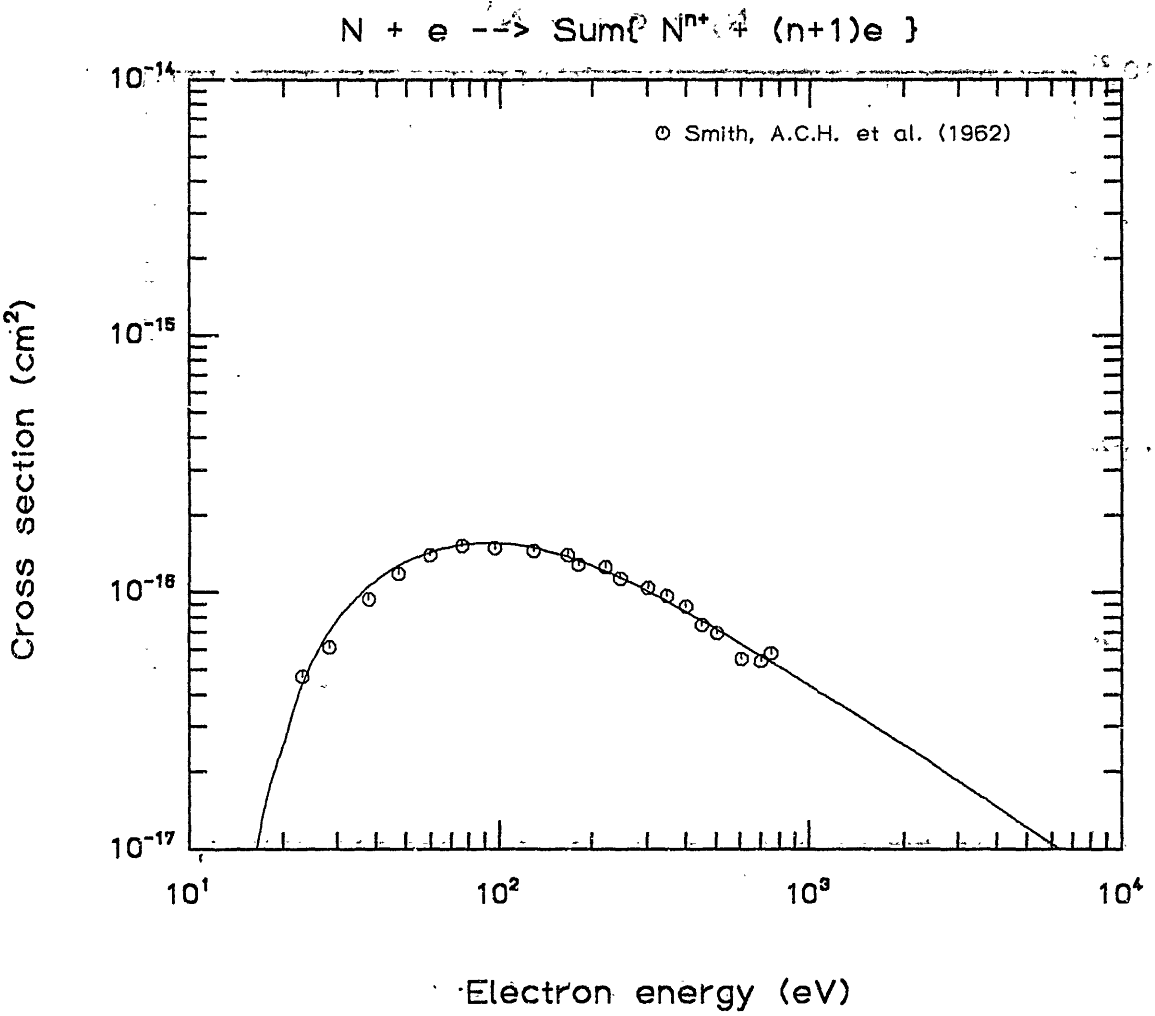


Fig. 33 Electron energy (eV)


N + e --> Sum{ N^n+ + (n+1)e }
Smith, A.C.H. et al. (1962)
Cross section (cm²)
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10¹
10²
10³
10⁴
Electron energy (eV)

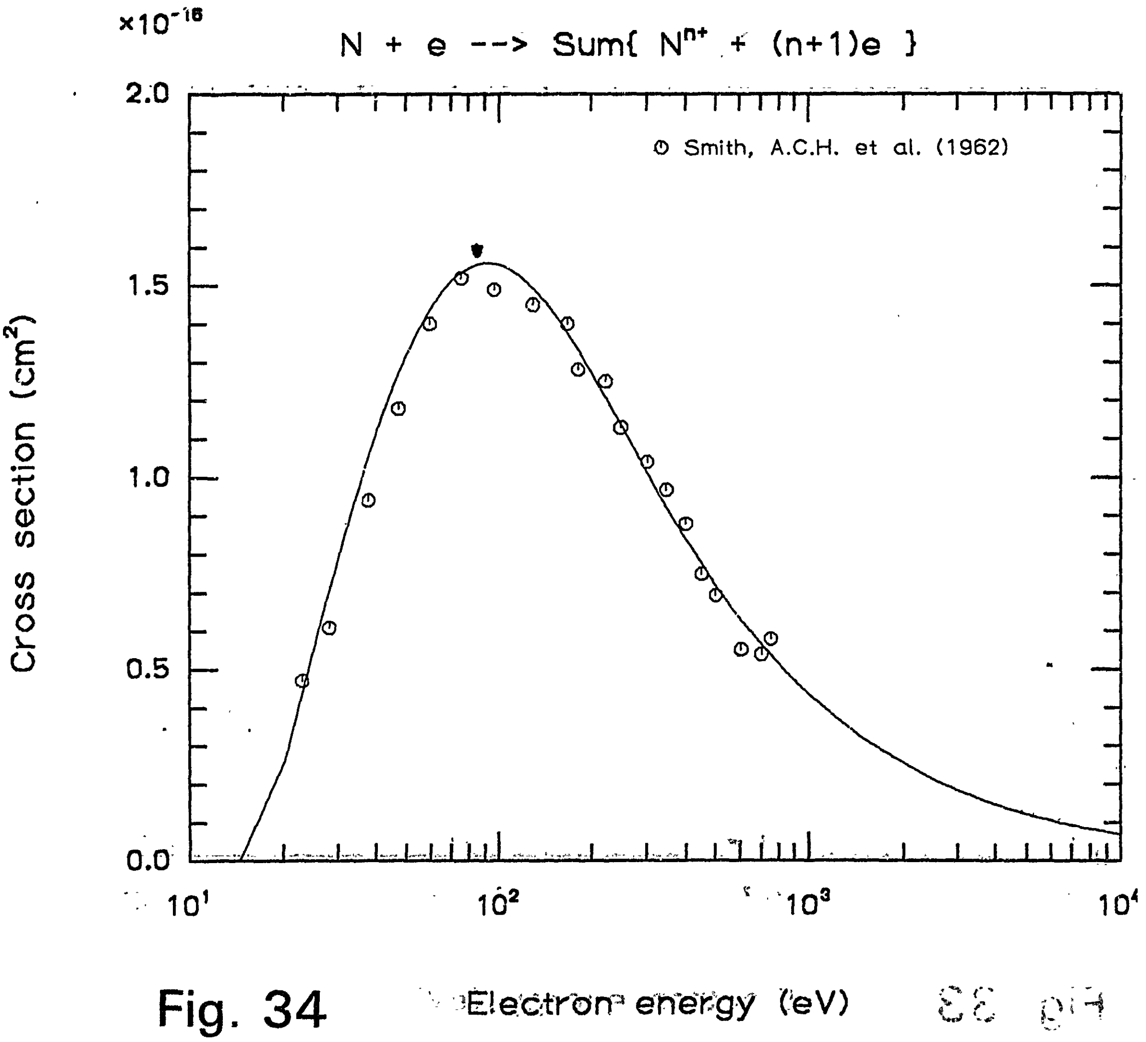
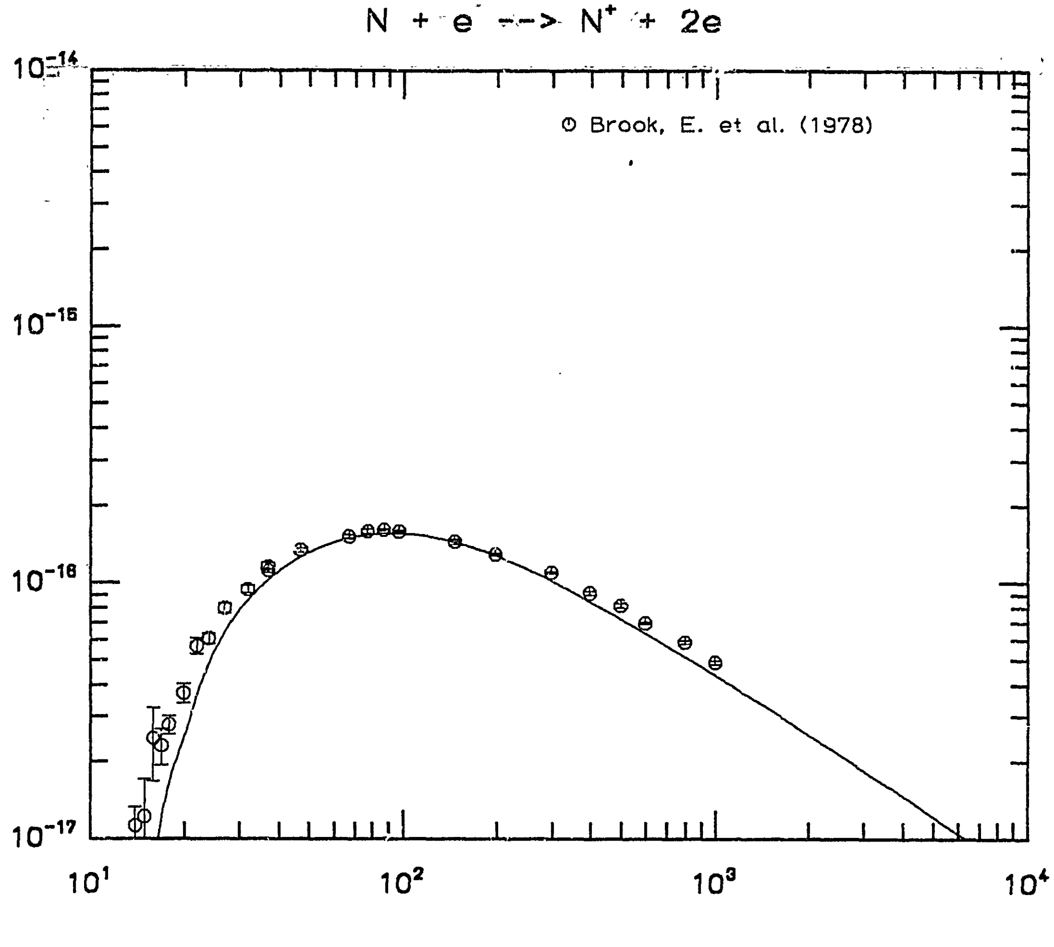

×10⁻¹⁶
N + e --> Sum{ N^n+ + (n+1)e }
Smith, A.C.H. et al. (1962)
Cross section (cm²)
2.0
1.5
1.0
0.5
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 34



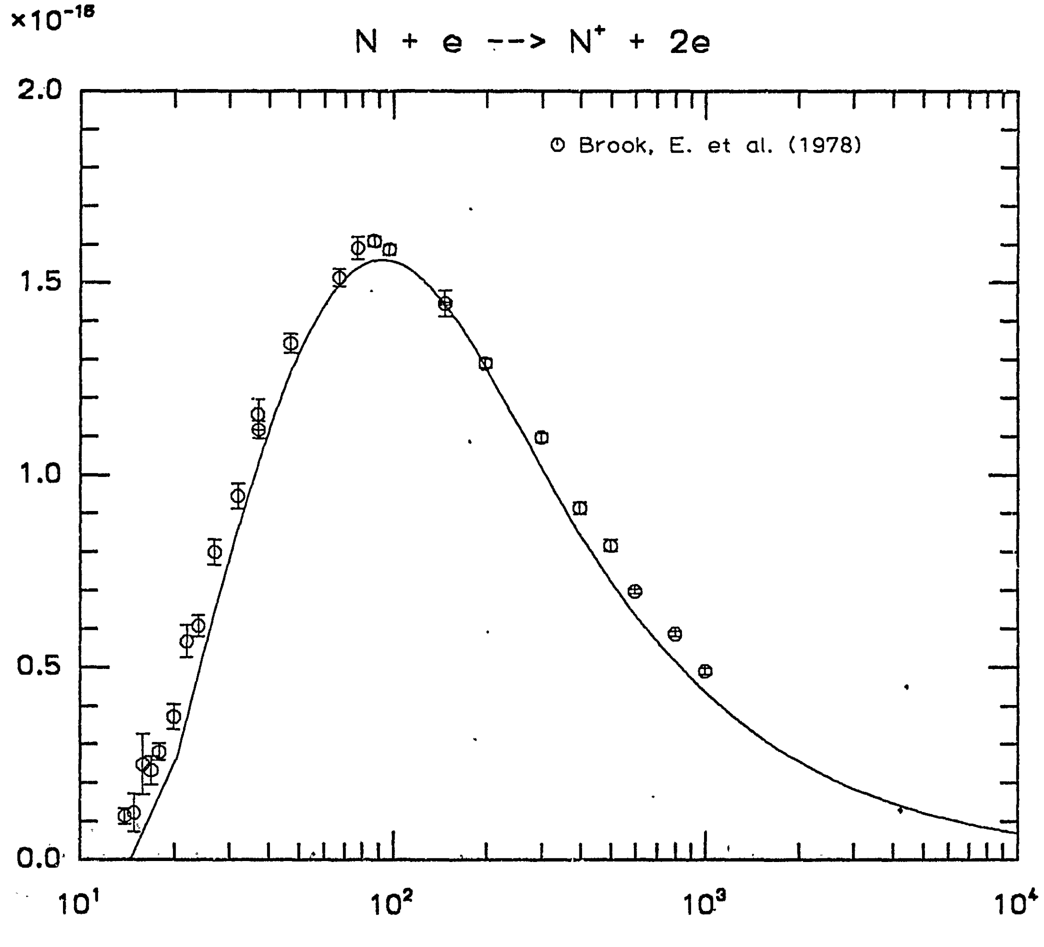
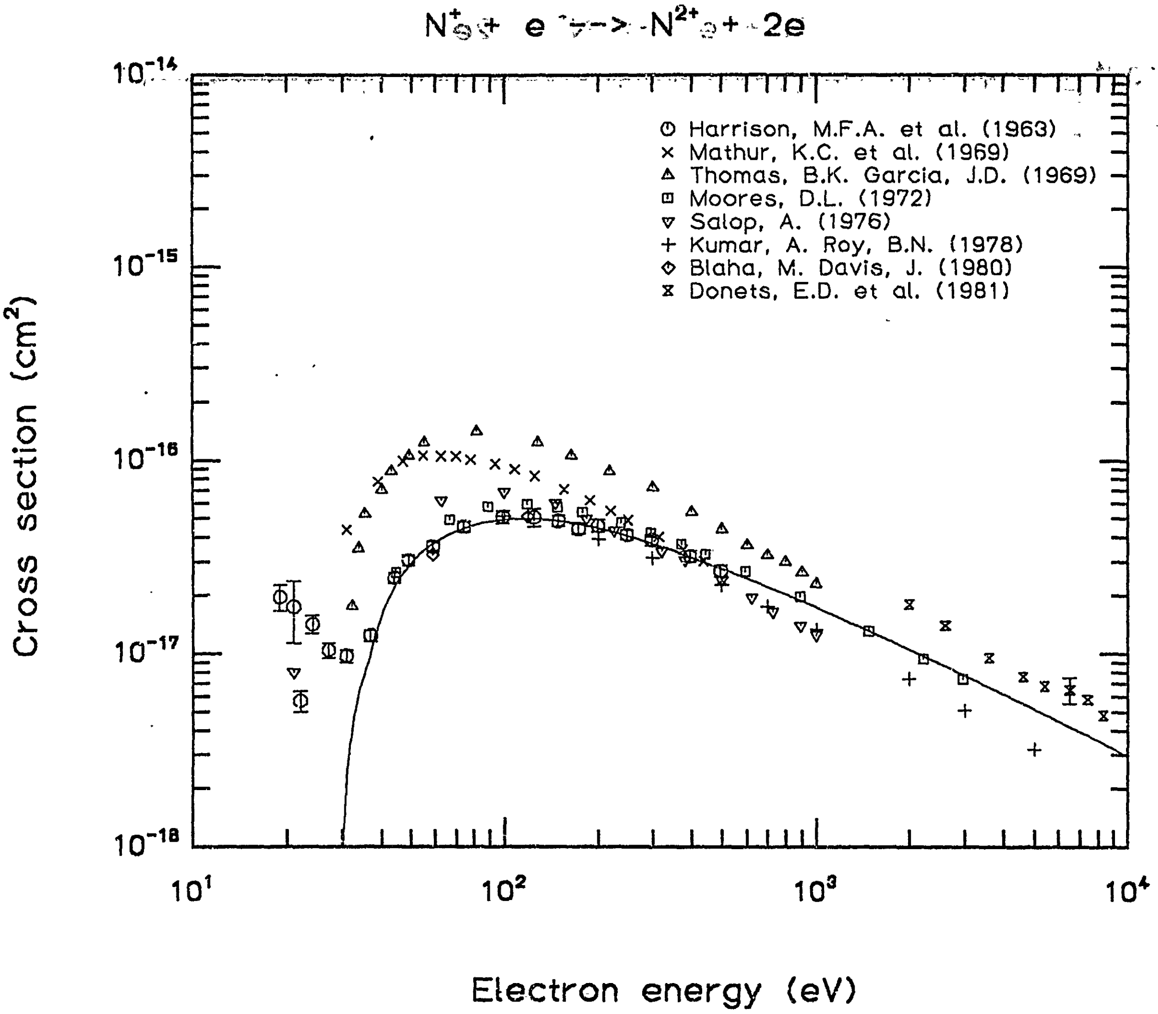
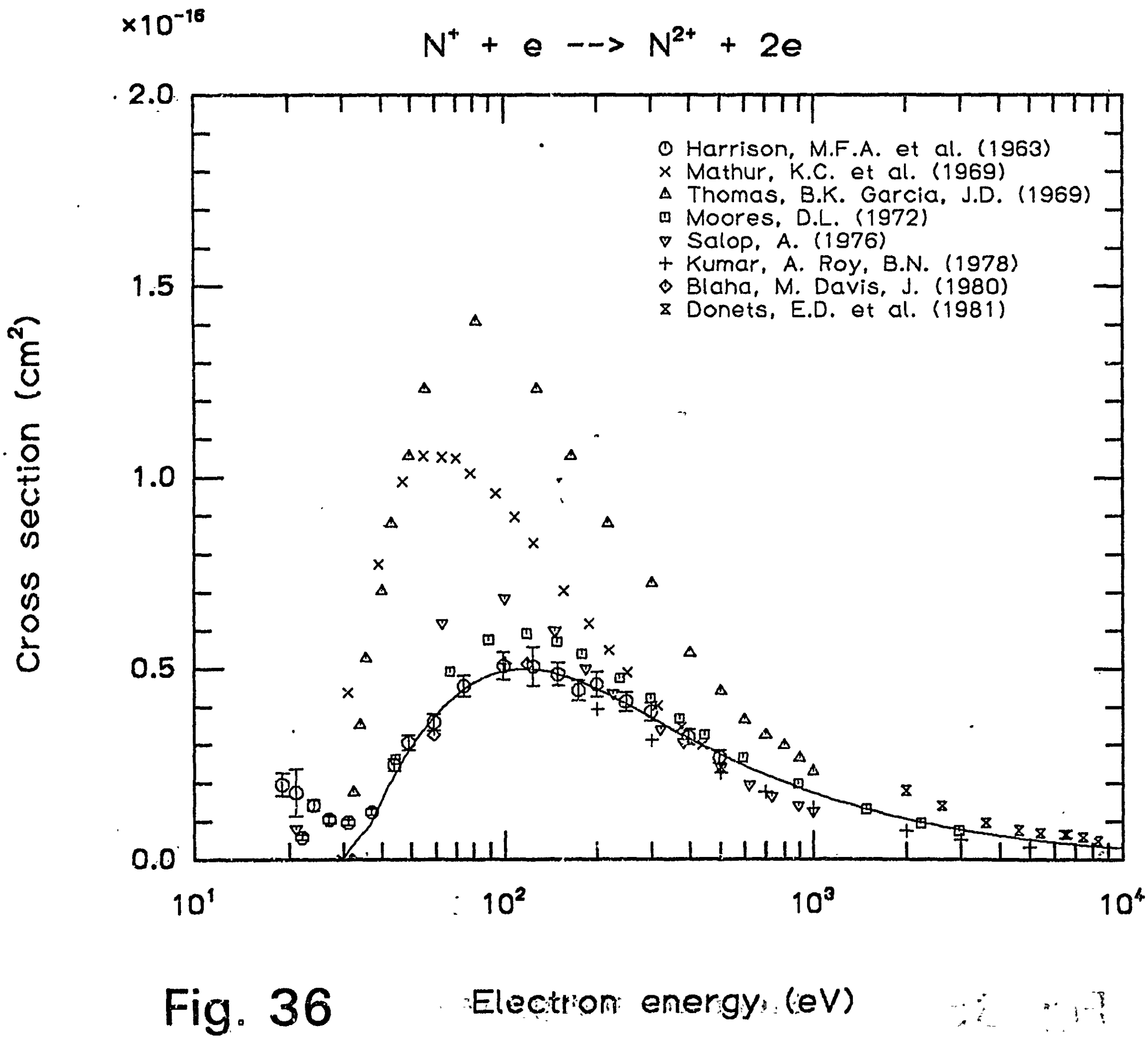


Fig. 35 Electron energy (eV)



N+ + e --> N2+ + 2e
Harrison, M.F.A. et al. (1963)
Mathur, K.C. et al. (1969)
Thomas, B.K. Garcia, J.D. (1969)
Moores, D.L. (1972)
Salop, A. (1976)
Kumar, A. Roy, B.N. (1978)
Blaha, M. Davis, J. (1980)
Donets, E.D. et al. (1981)
Cross section (cm2)
Electron energy (eV)



×10-16
N+ + e --> N2+ + 2e
Harrison, M.F.A. et al. (1963)
Mathur, K.C. et al. (1969)
Thomas, B.K. Garcia, J.D. (1969)
Moores, D.L. (1972)
Salop, A. (1976)
Kumar, A. Roy, B.N. (1978)
Blaha, M. Davis, J. (1980)
Donets, E.D. et al. (1981)
Cross section (cm2)
Electron energy (eV)

Fig. 36

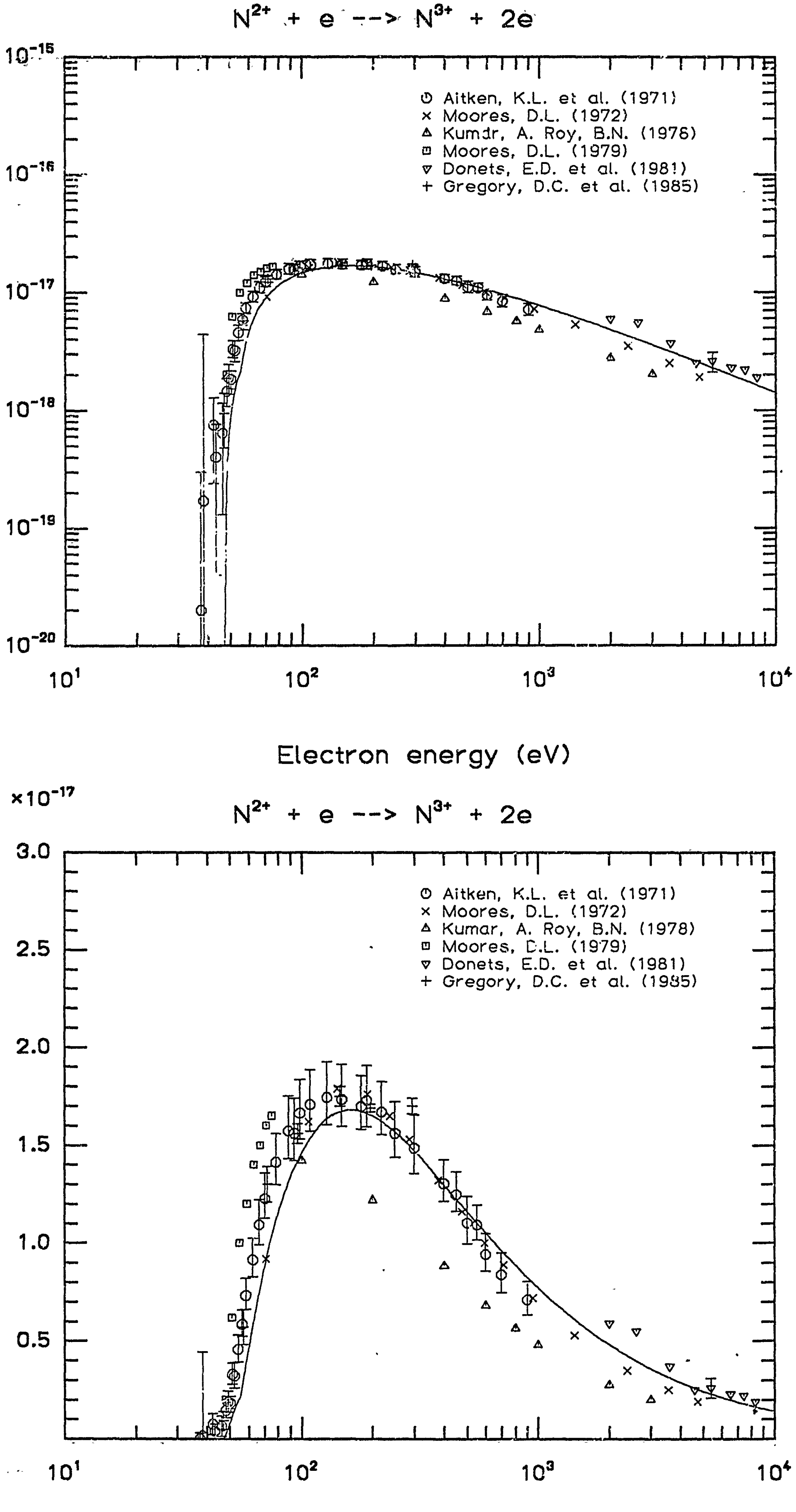
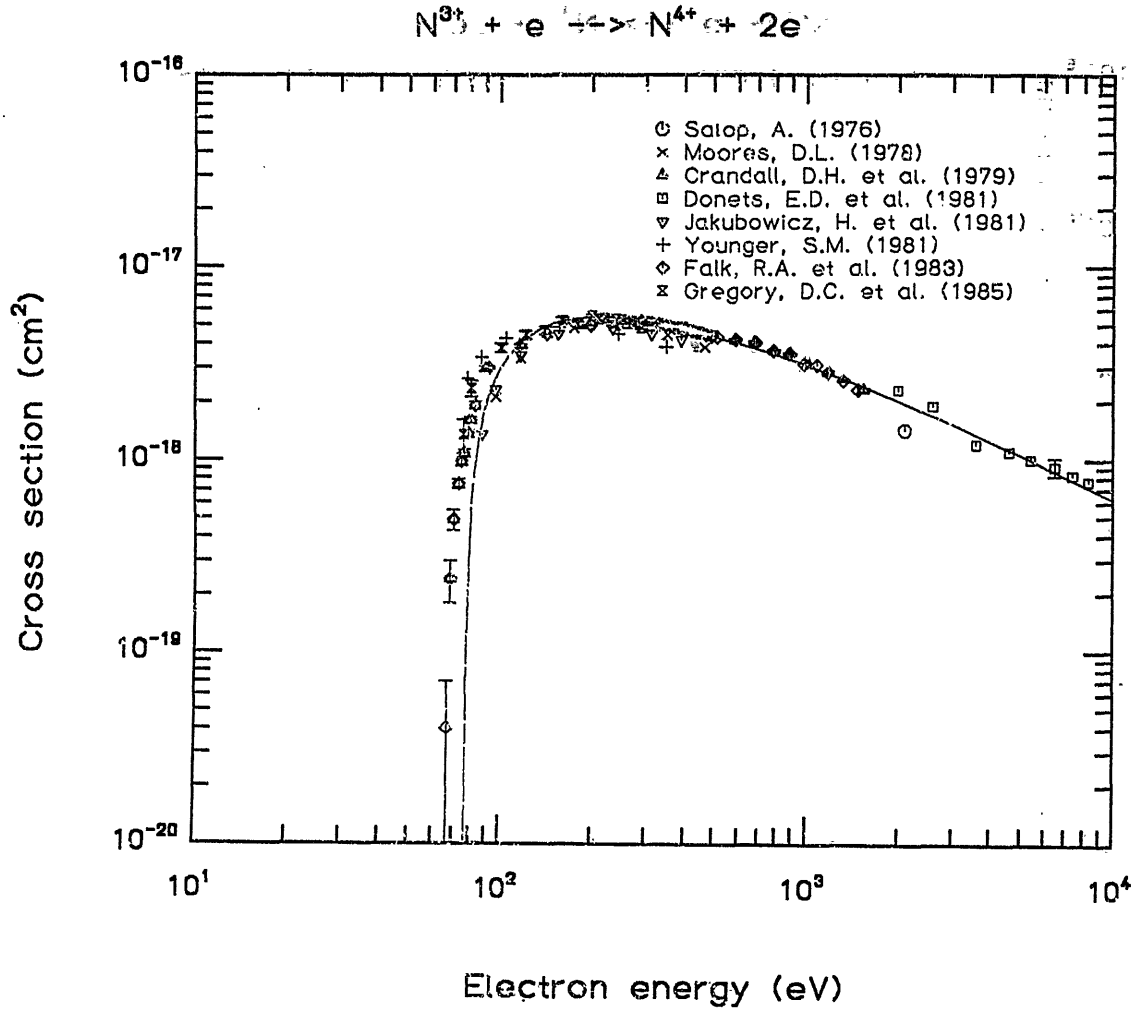
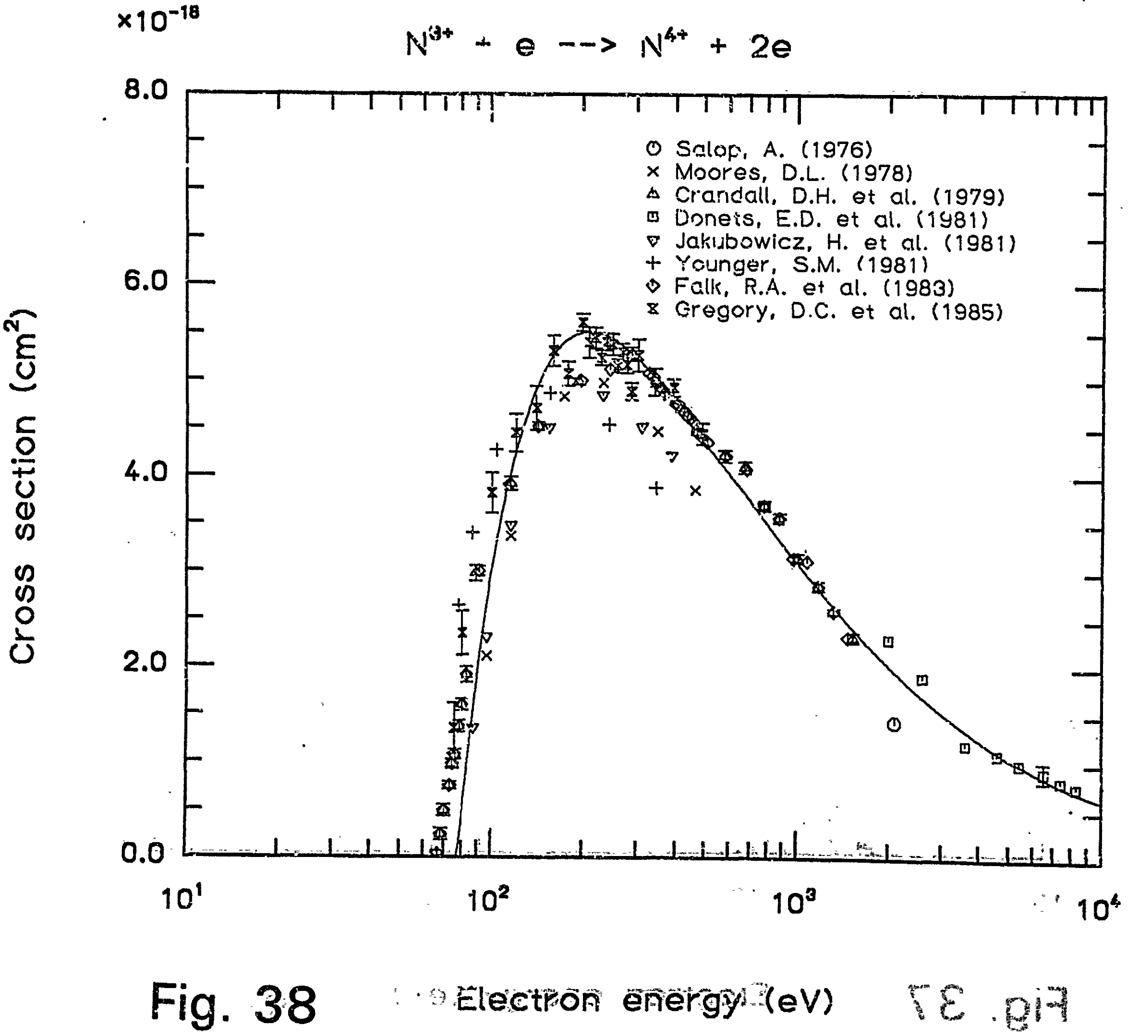


Fig. 37 Electron energy (eV)



N^{3+} + e --> N^{4+} + 2e
Salop, A. (1976)
Moores, D.L. (1978)
Crandall, D.H. et al. (1979)
Donets, E.D. et al. (1981)
Jakubowicz, H. et al. (1981)
Younger, S.M. (1981)
Falk, R.A. et al. (1983)
Gregory, D.C. et al. (1985)
Cross section (cm^2)
Electron energy (eV)



$\times 10^{-18}$
N^{3+} + e --> N^{4+} + 2e
Salop, A. (1976)
Moores, D.L. (1978)
Crandall, D.H. et al. (1979)
Donets, E.D. et al. (1981)
Jakubowicz, H. et al. (1981)
Younger, S.M. (1981)
Falk, R.A. et al. (1983)
Gregory, D.C. et al. (1985)
Cross section (cm^2)
Electron energy (eV)

Fig. 38

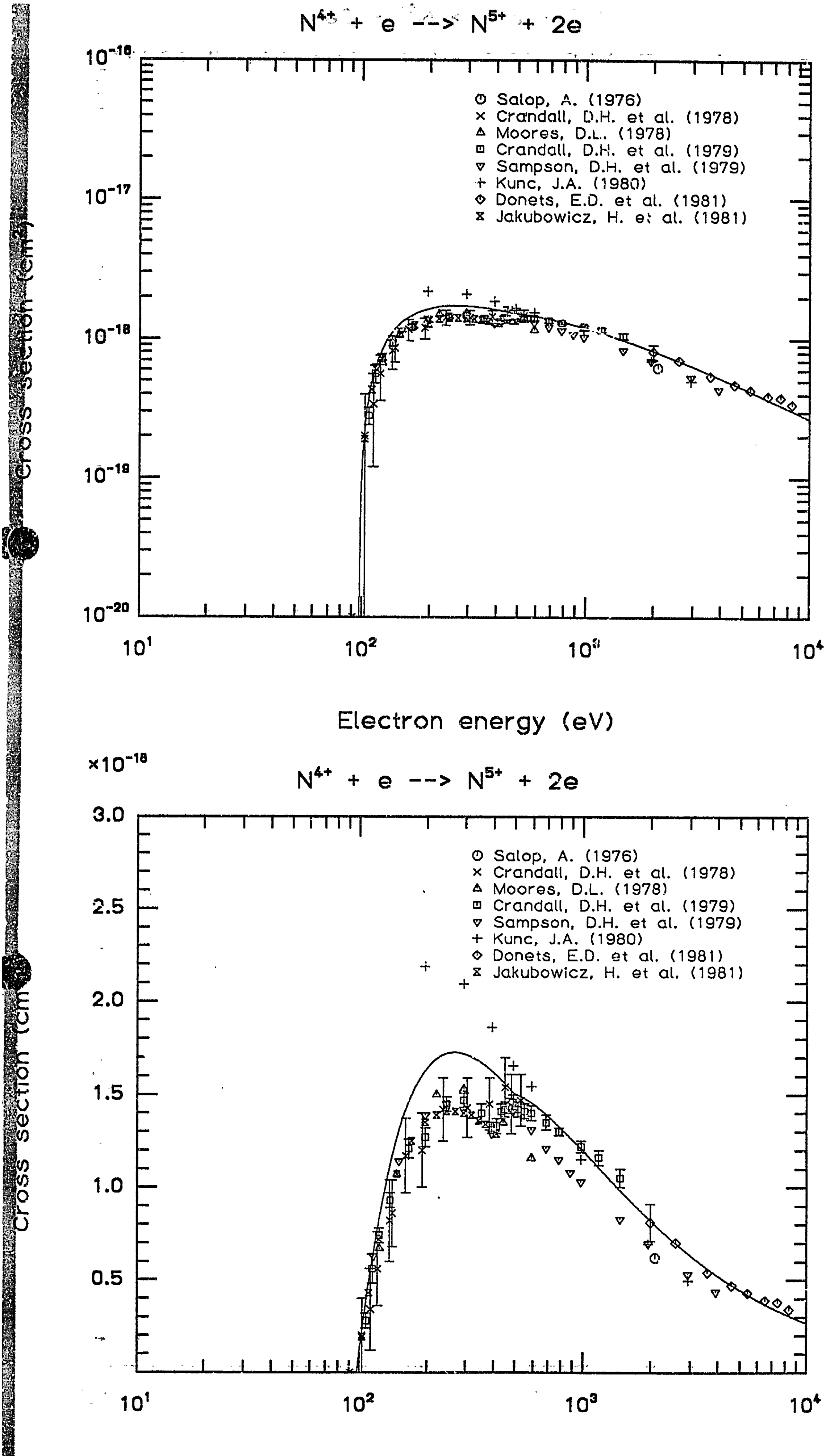
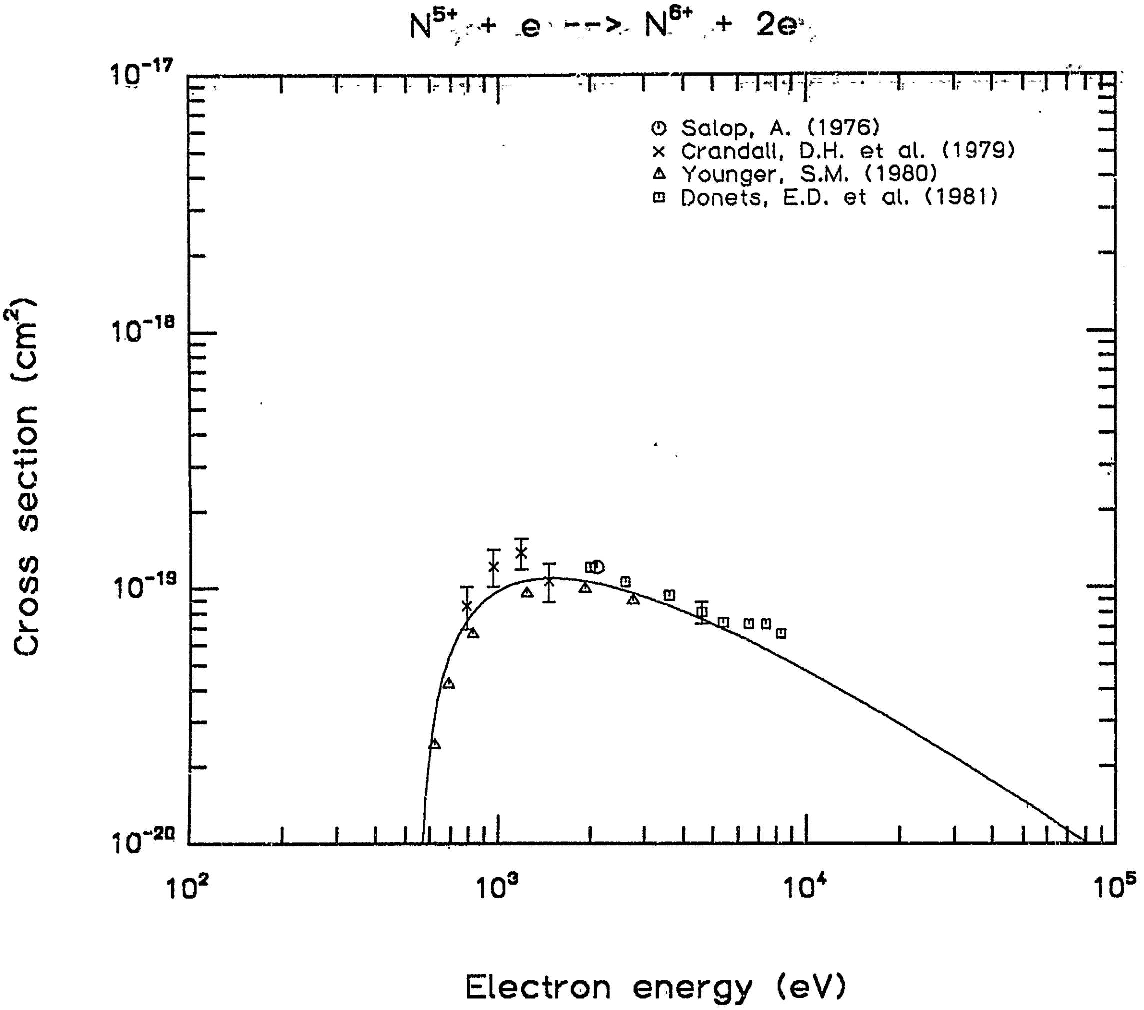
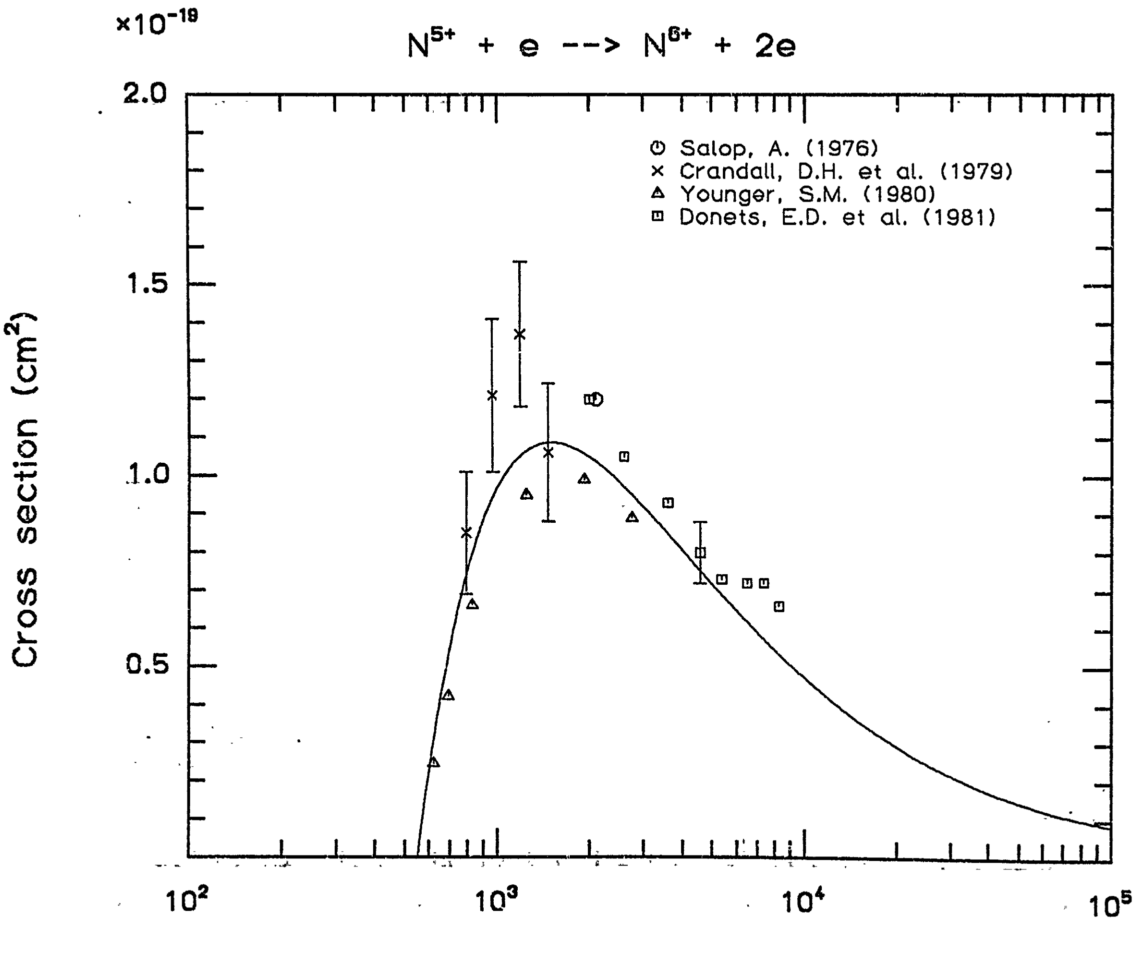

N4+ + e --> N5+ + 2e
Salop, A. (1976)
Crandall, D.H. et al. (1978)
Moores, D.L. (1978)
Crandall, D.H. et al. (1979)
Sampson, D.H. et al. (1979)
Kunc, J.A. (1980)
Donets, E.D. et al. (1981)
Jakubowicz, H. et al. (1981)
Cross section (cm2)
Electron energy (eV)
×10−18
N4+ + e --> N5+ + 2e
3.0
2.5
2.0
1.5
1.0
0.5
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 39

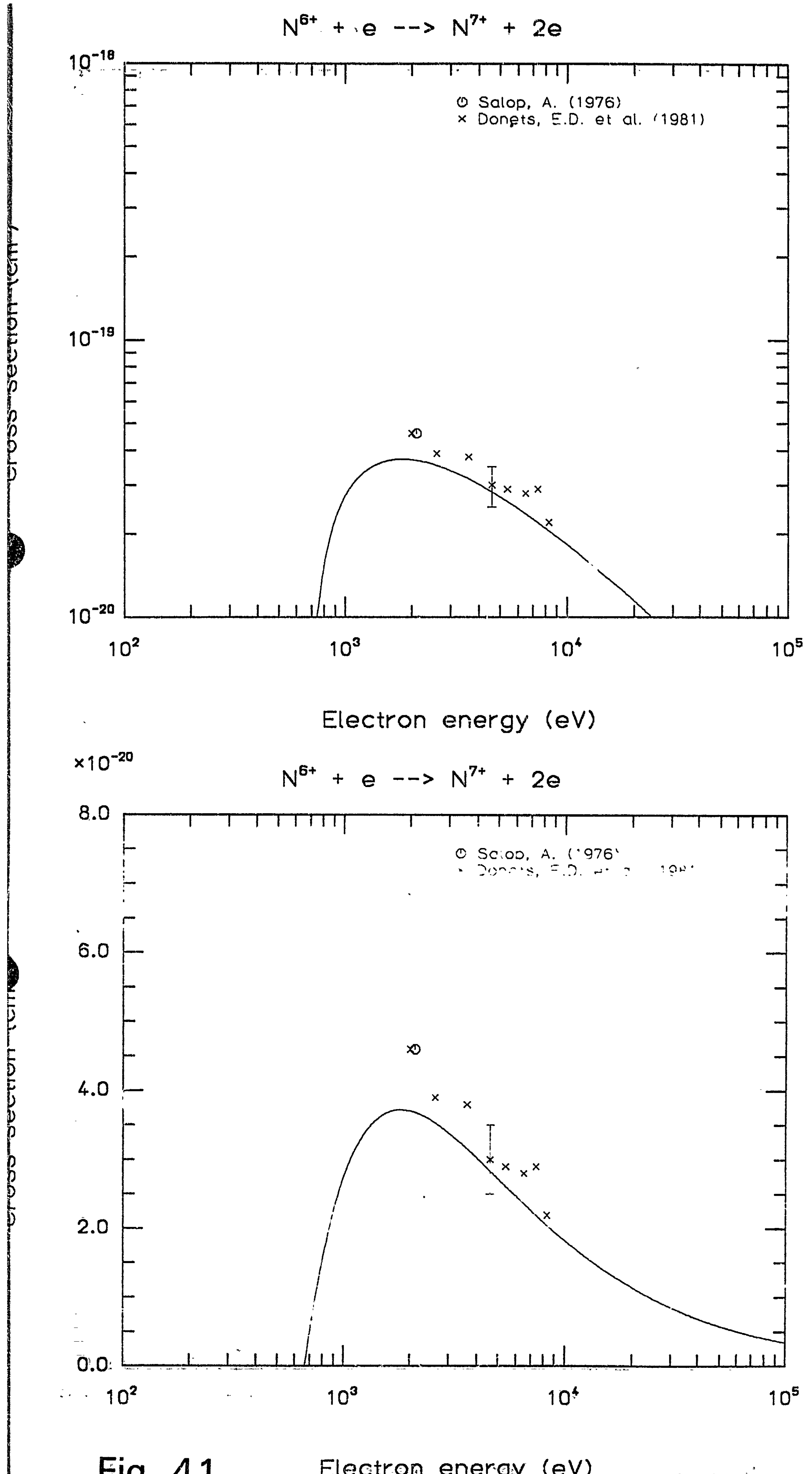


N5+ + e --> N6+ + 2e
10-17
10-18
10-19
10-20
Cross section (cm2)
Salop, A. (1976)
Crandall, D.H. et al. (1979)
Younger, S.M. (1980)
Donets, E.D. et al. (1981)
10^2
10^3
10^4
10^5
Electron energy (eV)



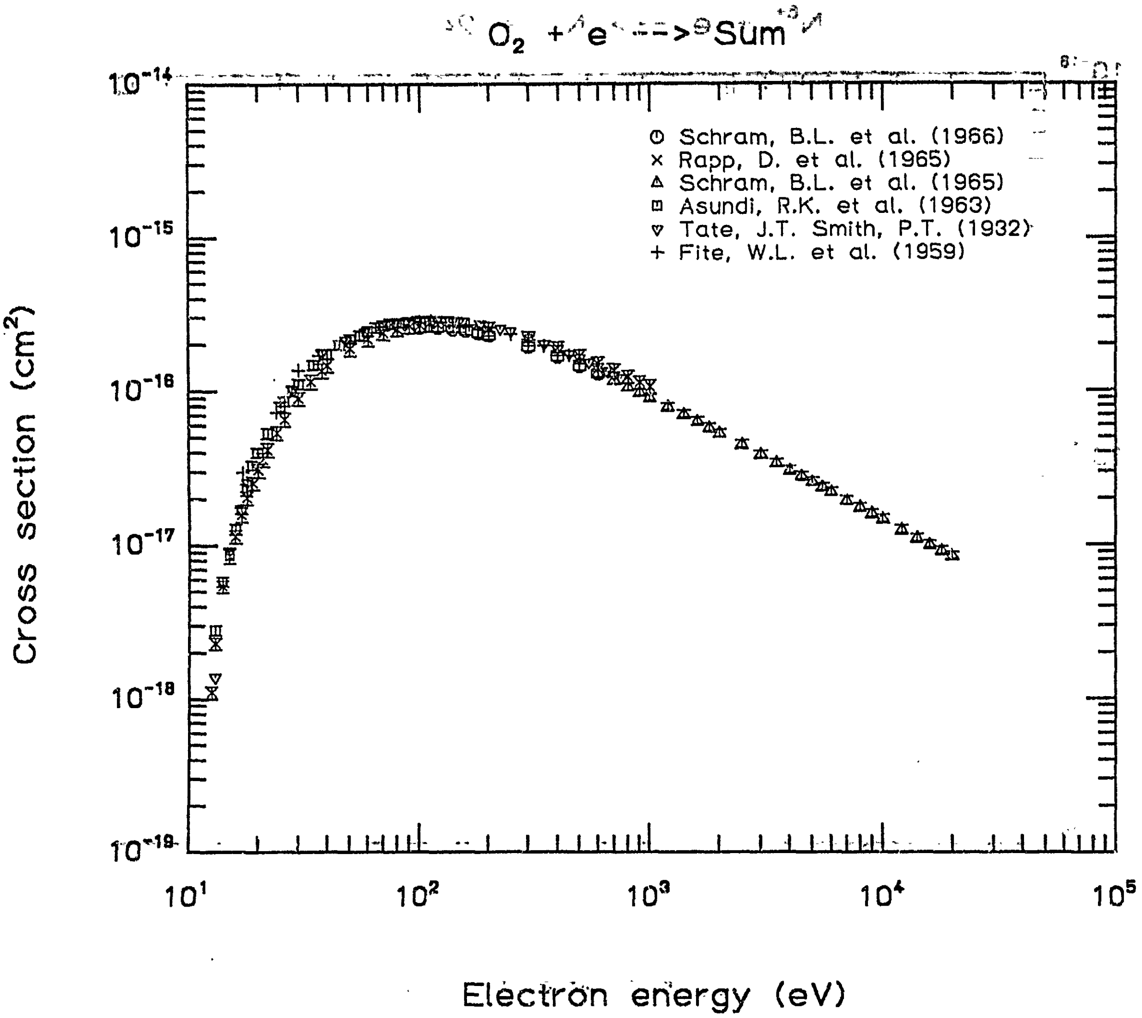
×10-19
N5+ + e --> N6+ + 2e
2.0
1.5
1.0
0.5
Cross section (cm2)
Salop, A. (1976)
Crandall, D.H. et al. (1979)
Younger, S.M. (1980)
Donets, E.D. et al. (1981)
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 40



N^6+ + e --> N^7+ + 2e
Salop, A. (1976)
Donets, E.D. et al. (1981)
Cross section (cm²)
10^-18
10^-19
10^-20
10^2
10^3
10^4
10^5
Electron energy (eV)
×10^-20
N^6+ + e --> N^7+ + 2e
8.0
6.0
4.0
2.0
0.0
Electron energy (eV)

Fig. 41


O_2 + e --> Sum
Schram, B.L. et al. (1966)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Asundi, R.K. et al. (1963)
Tate, J.T. Smith, P.T. (1932)
Fite, W.L. et al. (1959)
Cross section (cm²)
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

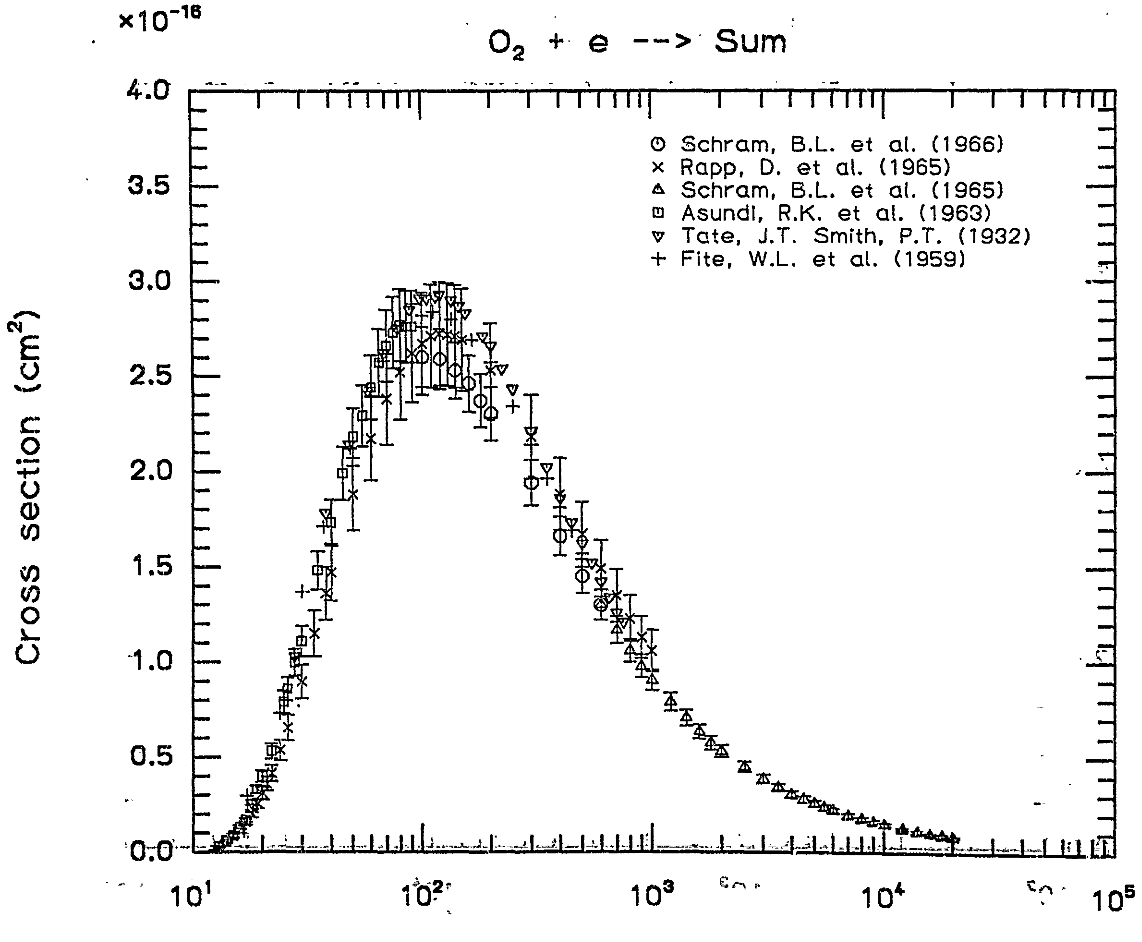
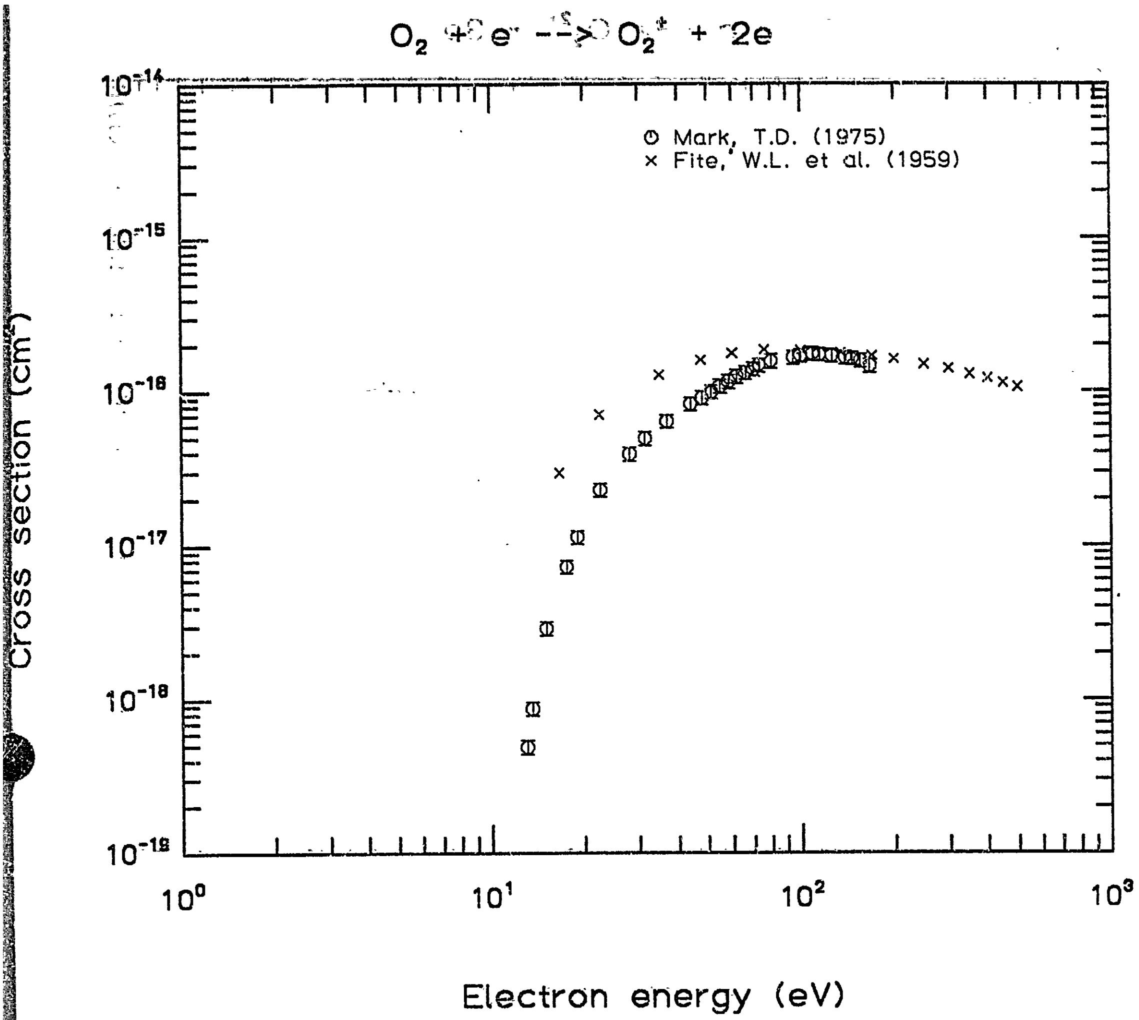

$\times 10^{-16}$
O_2 + e --> Sum
Schram, B.L. et al. (1966)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Asundi, R.K. et al. (1963)
Tate, J.T. Smith, P.T. (1932)
Fite, W.L. et al. (1959)
Cross section (cm²)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 42


$O_2 + e \rightarrow O_2^+ + 2e$
Mark, T.D. (1975)
Fite, W.L. et al. (1959)
Cross section (cm²)
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10⁻¹⁹
10⁰
10¹
10²
10³
Electron energy (eV)

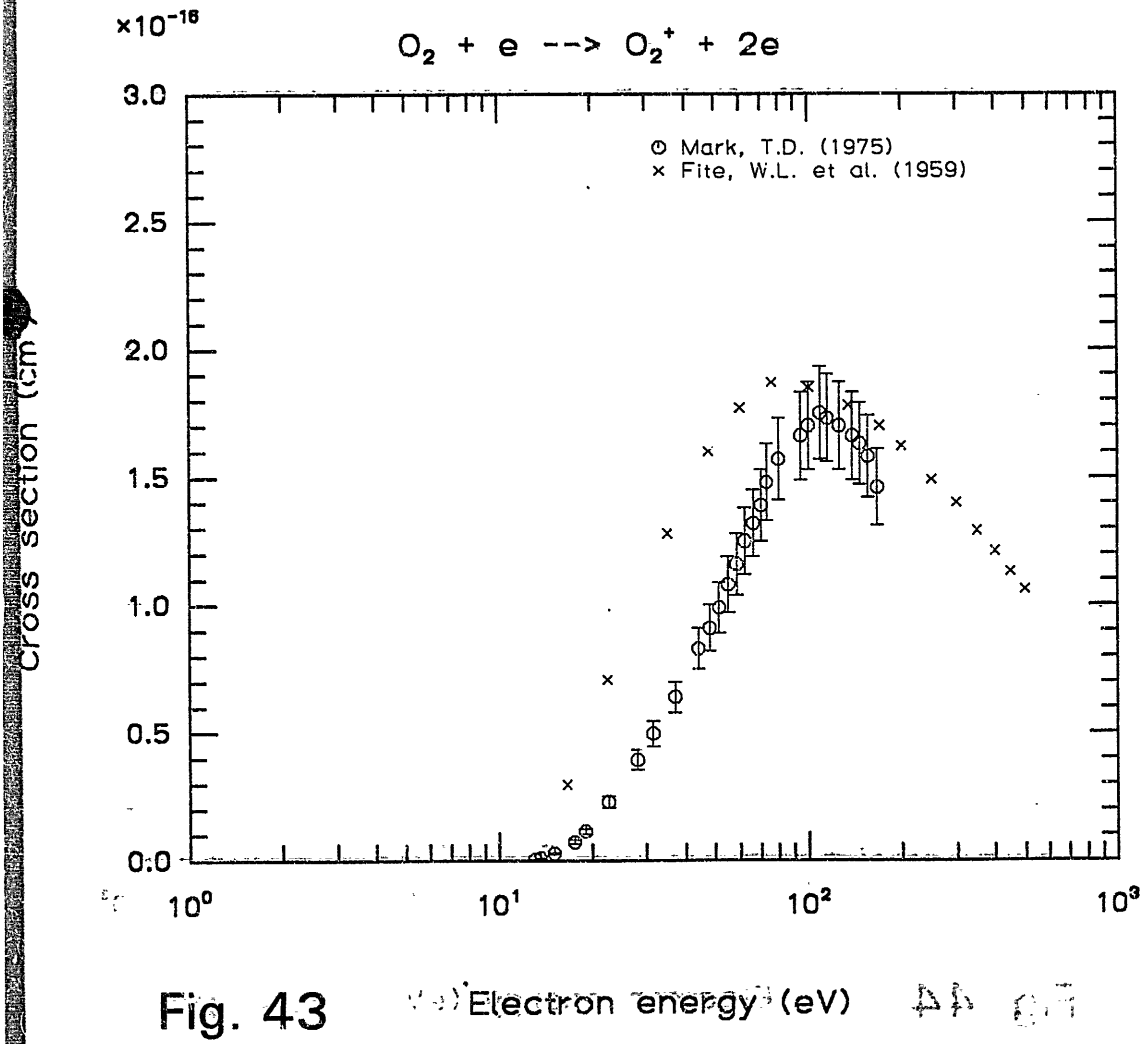
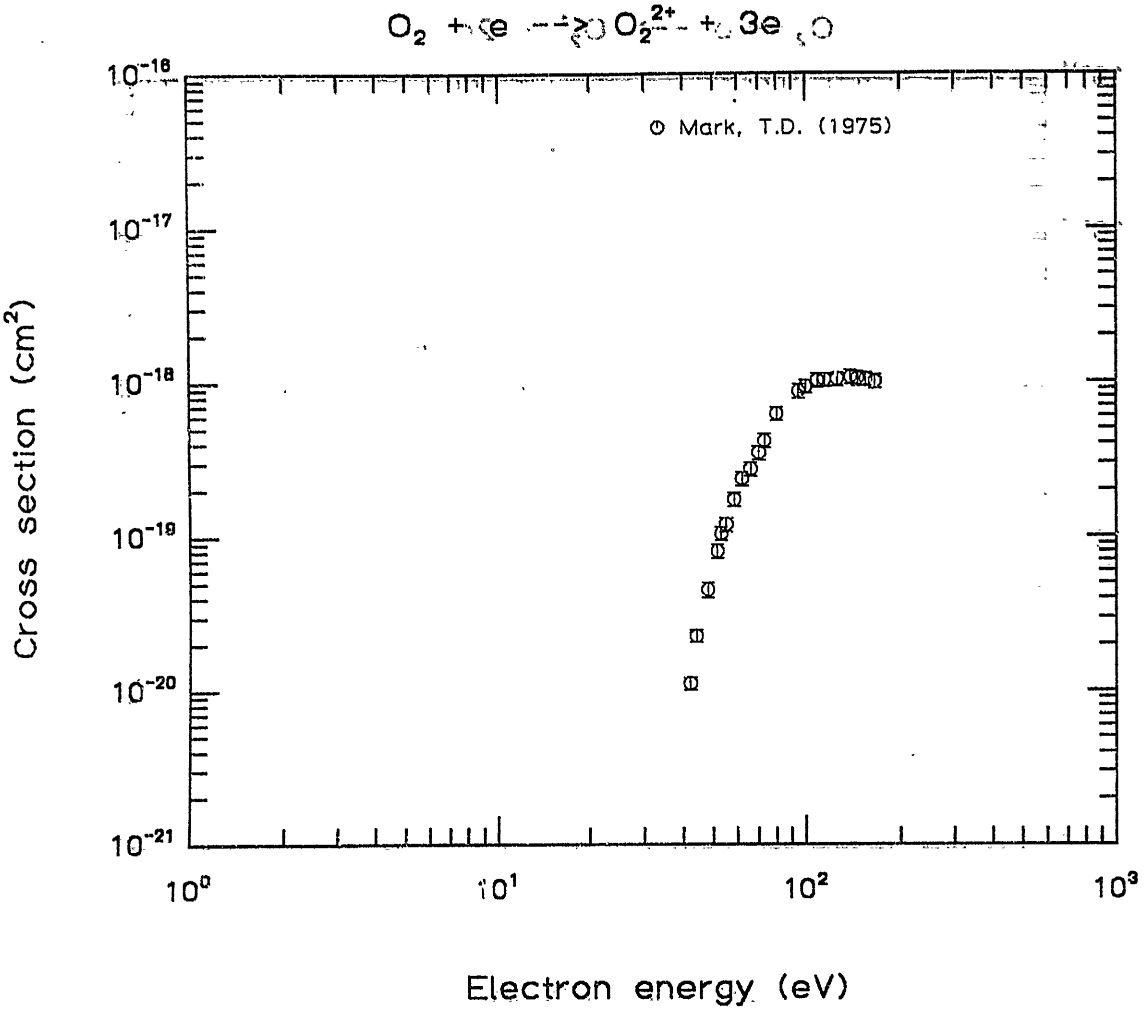

×10⁻¹⁶
$O_2 + e \rightarrow O_2^+ + 2e$
Mark, T.D. (1975)
Fite, W.L. et al. (1959)
Cross section (cm²)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10⁰
10¹
10²
10³
Electron energy (eV)

Fig. 43


$O_2 + e \rightarrow O_2^{2+} + 3e$
Mark, T.D. (1975)
Cross section (cm^2)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^0
10^1
10^2
10^3
Electron energy (eV)

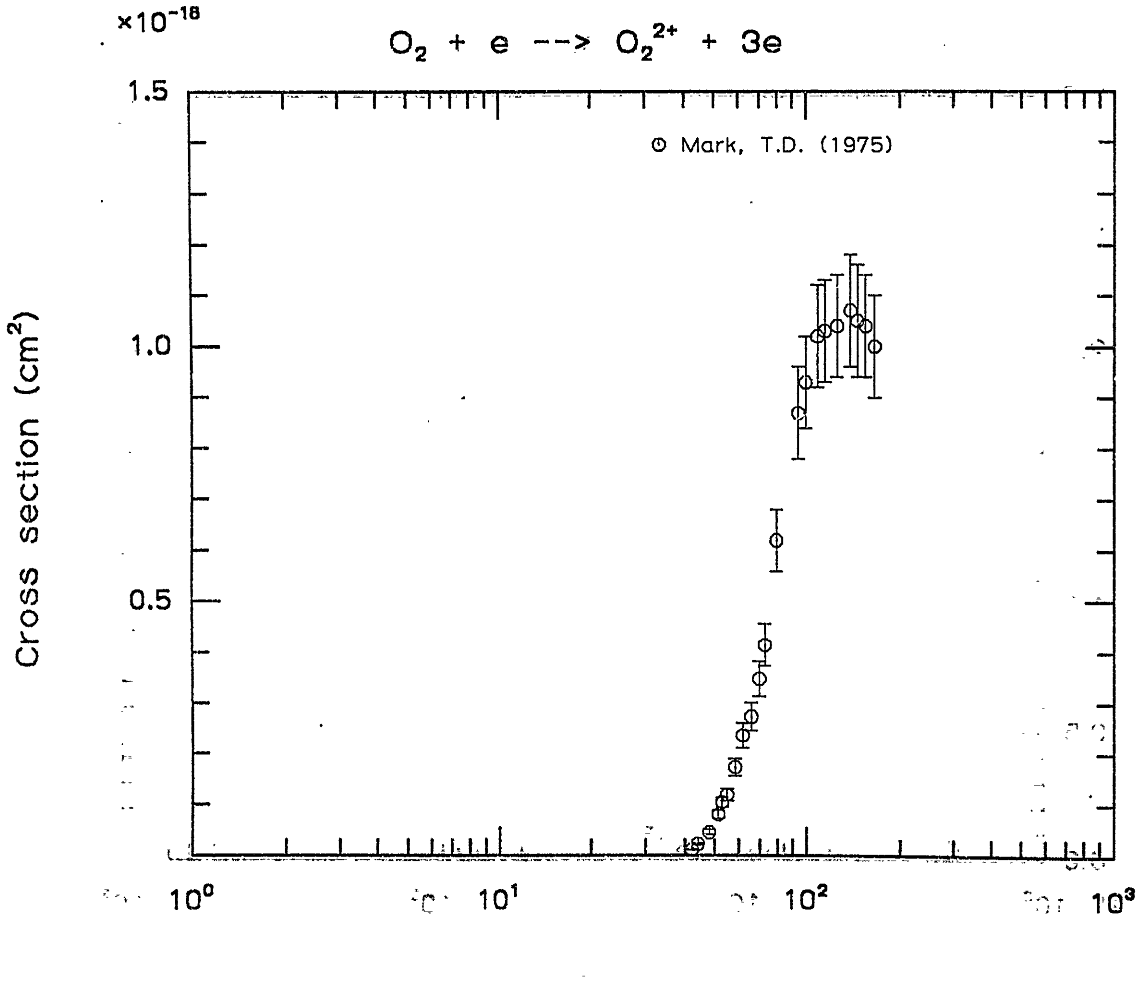

$\times 10^{-18}$
$O_2 + e \rightarrow O_2^{2+} + 3e$
Mark, T.D. (1975)
Cross section (cm^2)
1.5
1.0
0.5
10^0
10^1
10^2
10^3
Electron energy (eV)

Fig. 44

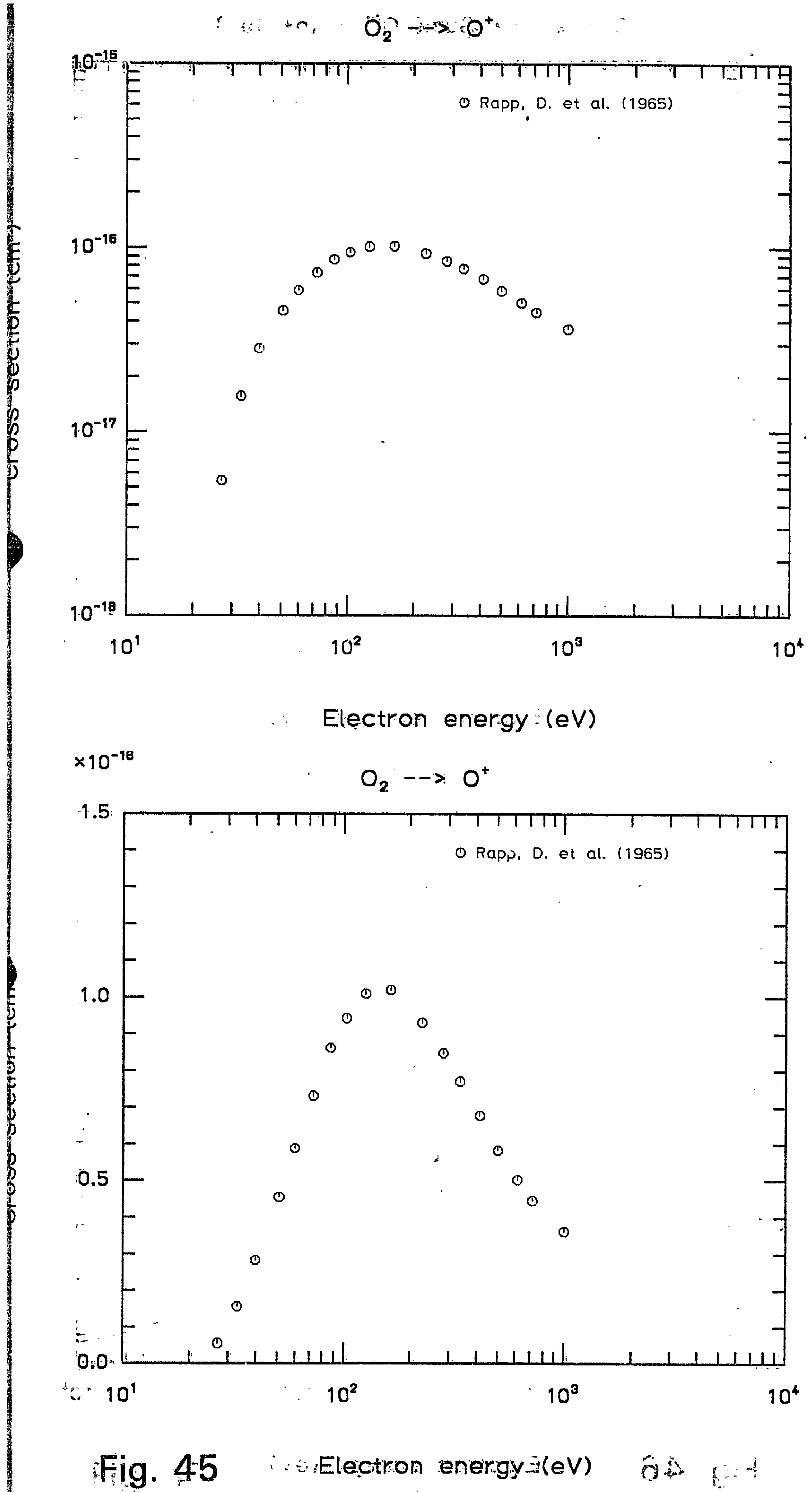

O_2 --> O^+
© Rapp, D. et al. (1965)
cross section (cm²)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^1
10^2
10^3
10^4
Electron energy (eV)
$\times 10^{-16}$
O_2 --> O^+
© Rapp, D. et al. (1965)
1.5
1.0
0.5
0.0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 45

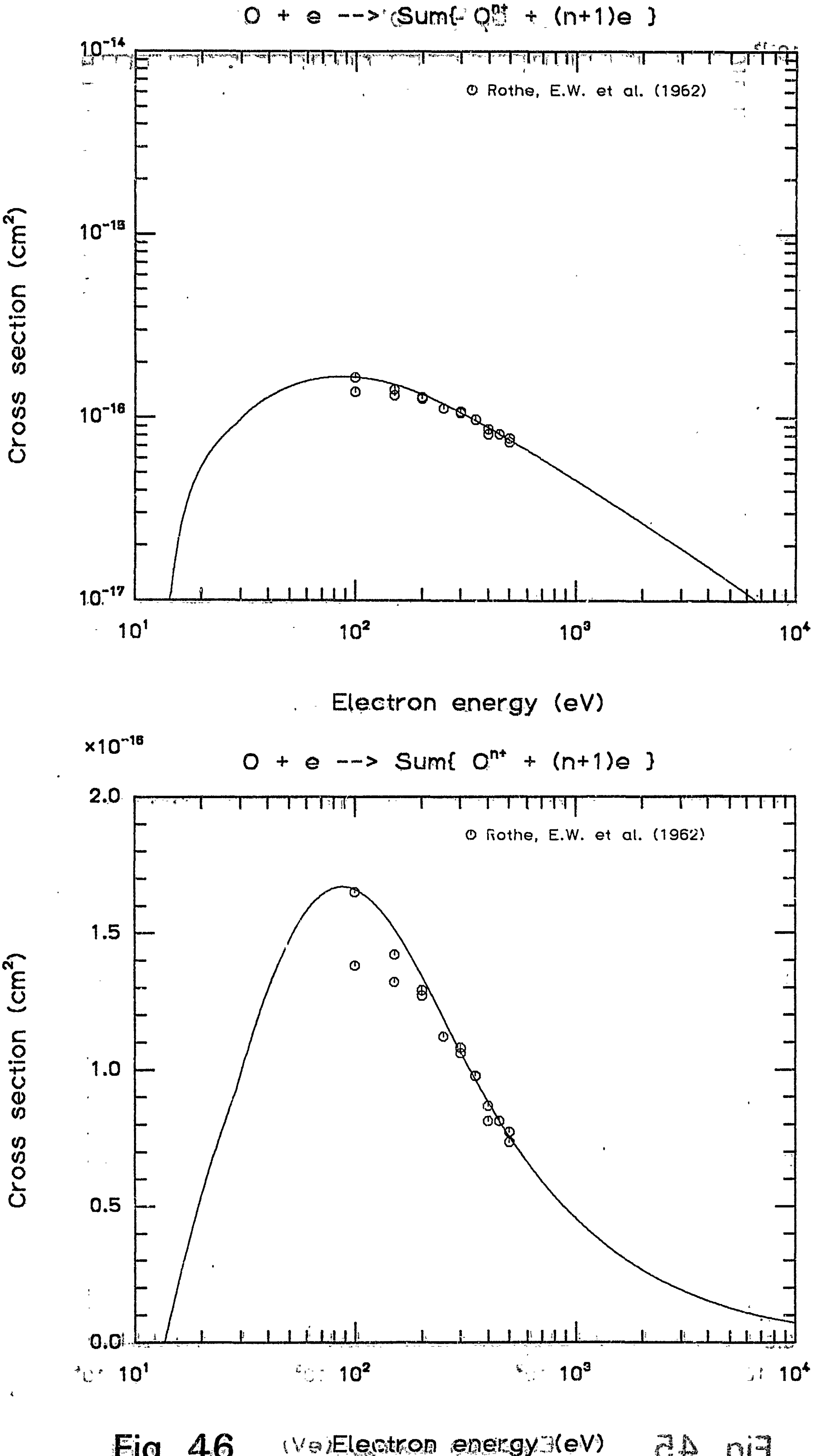
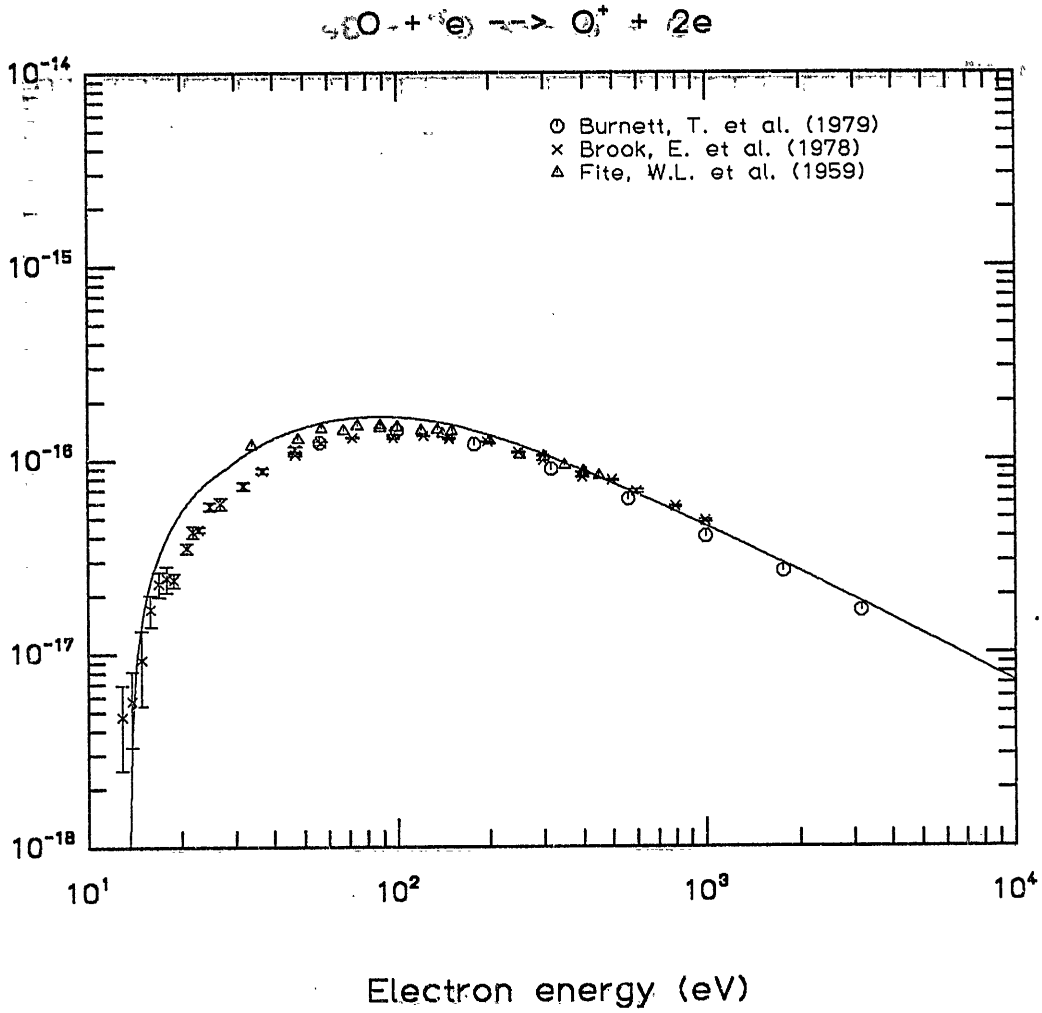

O + e --> Sum{ O^n+ + (n+1)e }
Rothe, E.W. et al. (1962)
Cross section (cm2)
10-14
10-15
10-16
10-17
101
102
103
104
Electron energy (eV)
x10-16
O + e --> Sum{ O^n+ + (n+1)e }
Rothe, E.W. et al. (1962)
Cross section (cm2)
2.0
1.5
1.0
0.5
0.0
101
102
103
104
Electron energy (eV)

Fig. 46



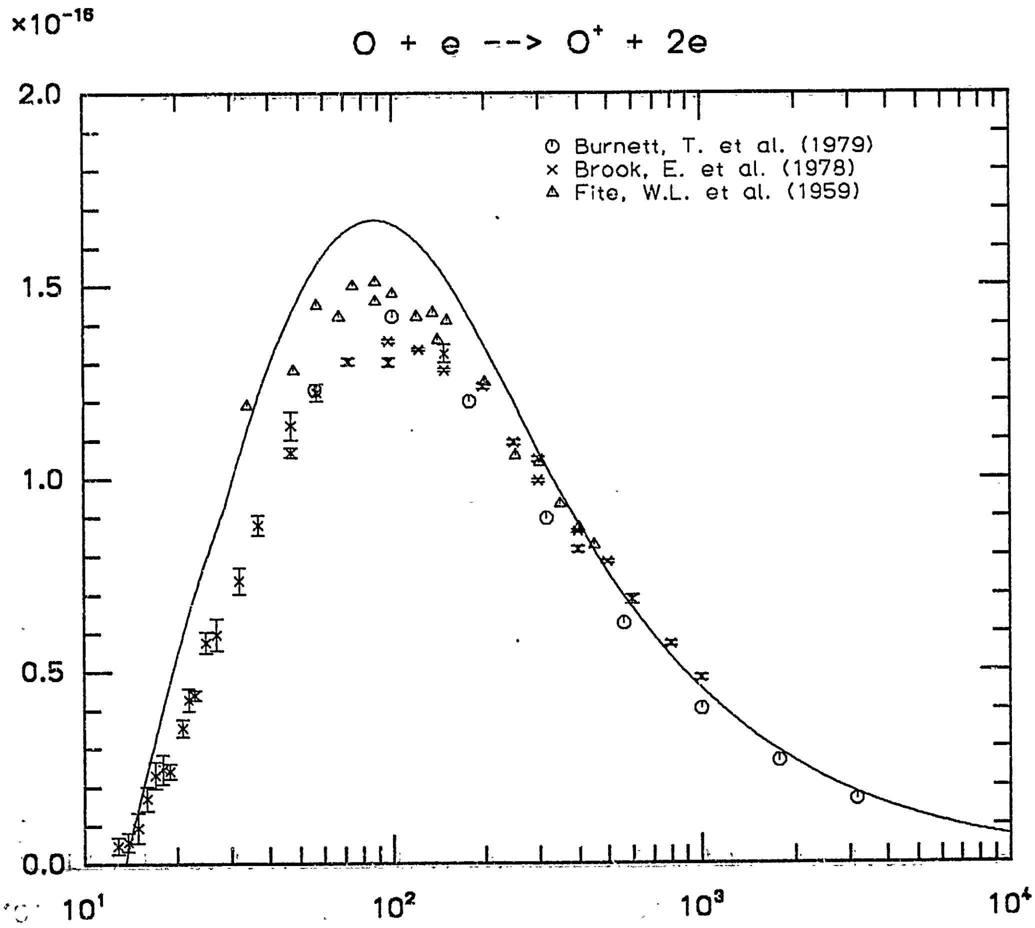
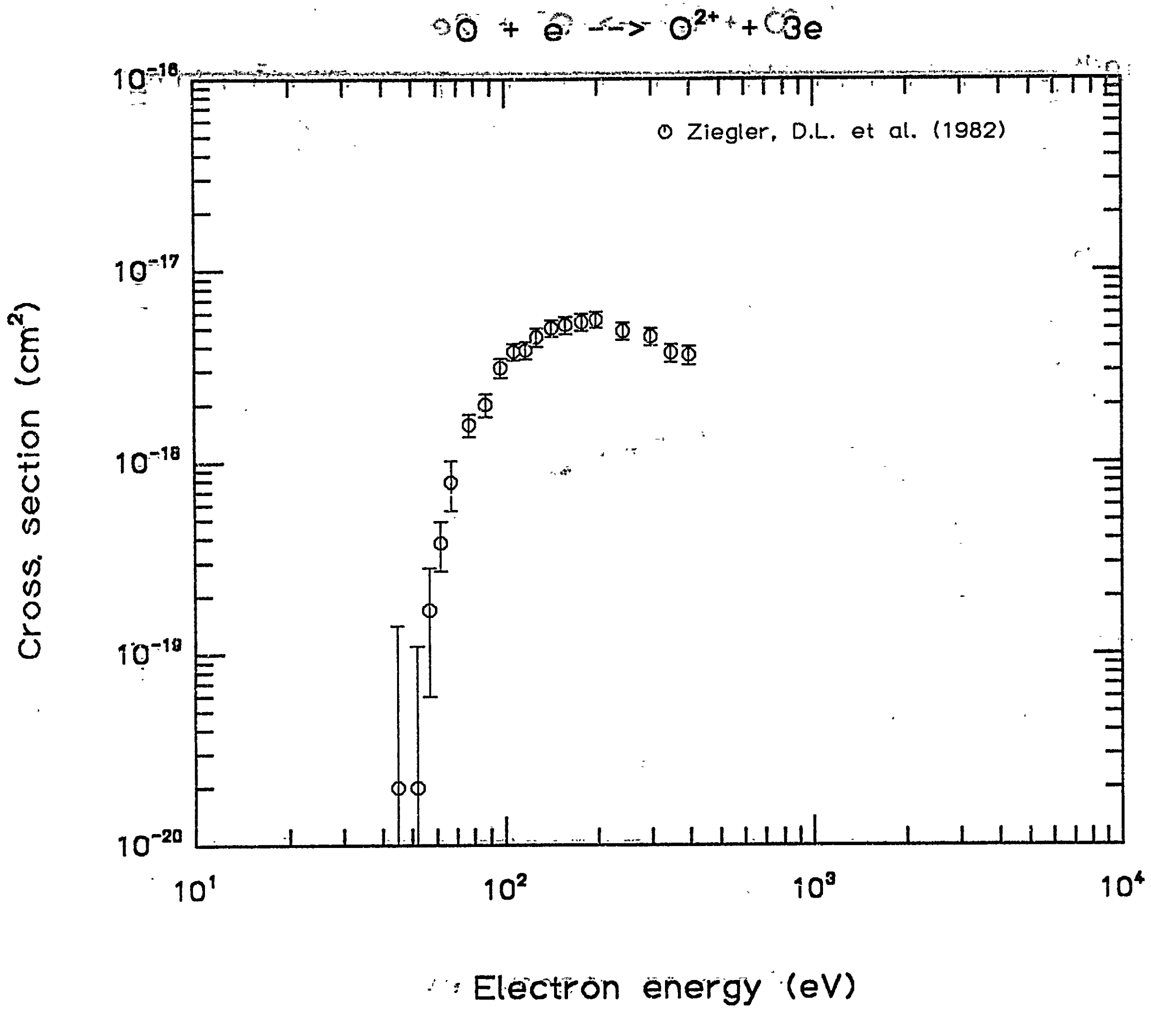


Fig. 47 Electron energy (eV)


O + e --> O2+ + 3e
Ziegler, D.L. et al. (1982)
Cross section (cm2)
Electron energy (eV)

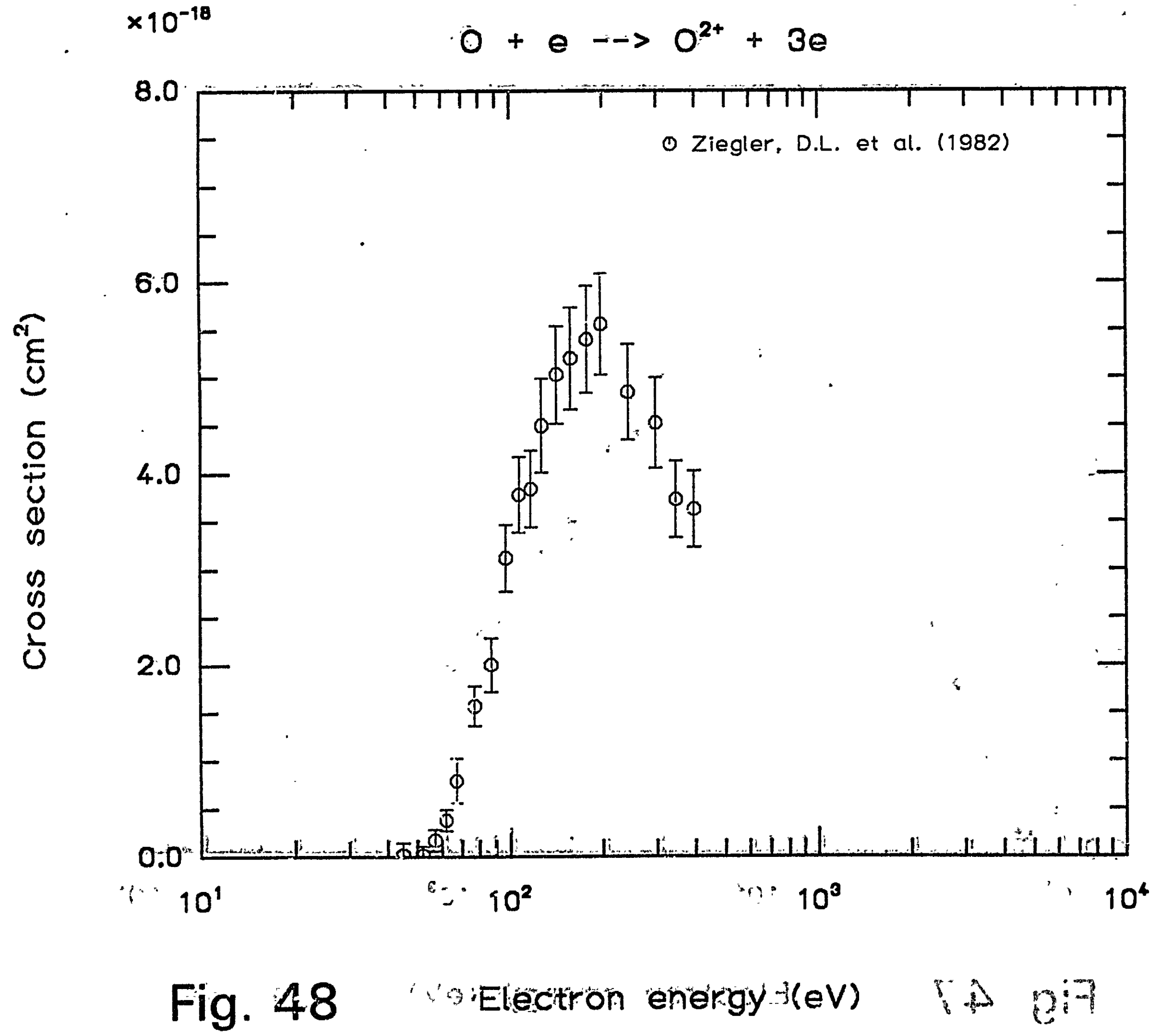

O + e --> O2+ + 3e
×10-18
Ziegler, D.L. et al. (1982)
Cross section (cm2)
Electron energy (eV)

Fig. 48

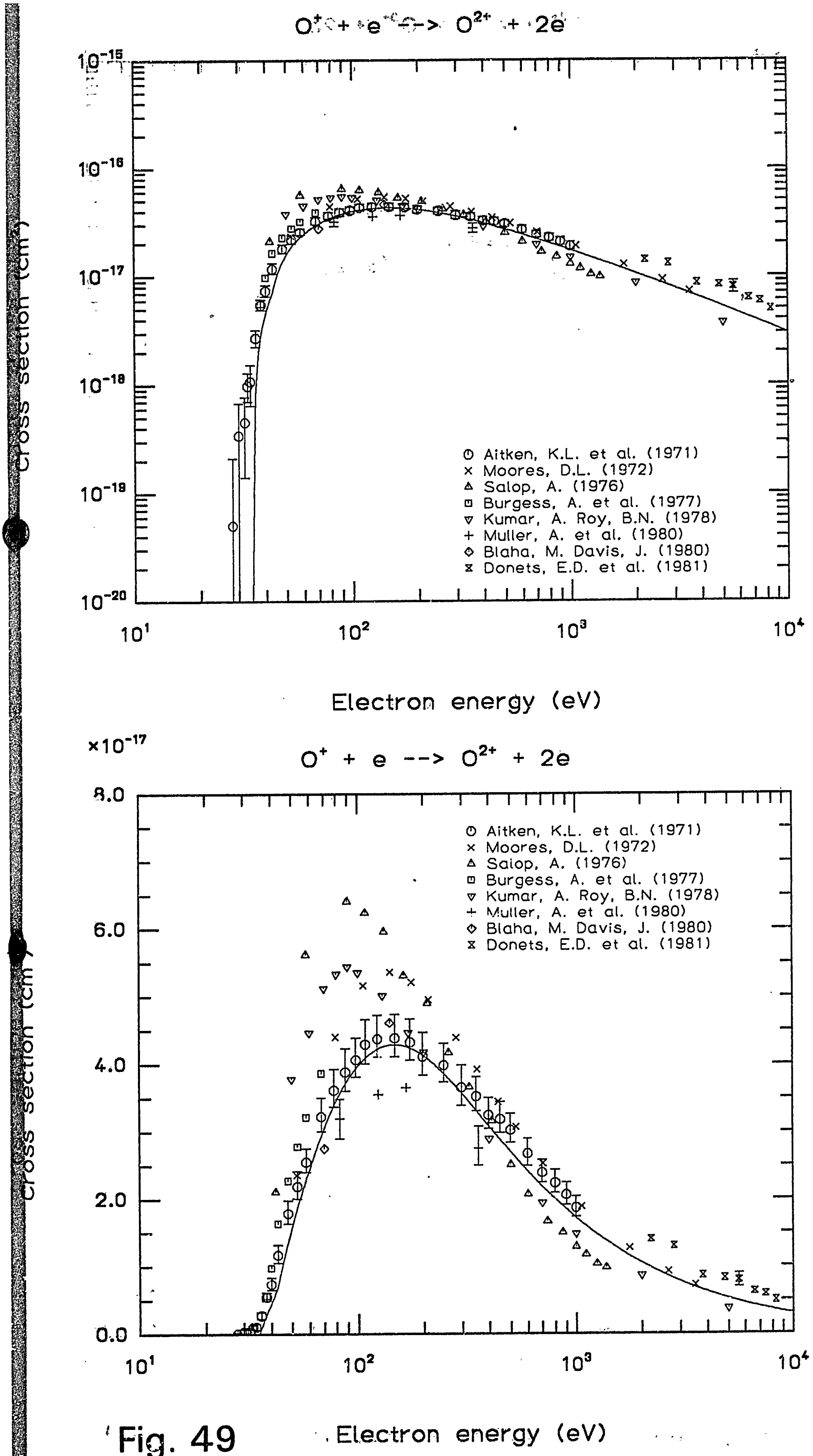

O+ + e --> O2+ + 2e
Cross section (cm2)
Aitken, K.L. et al. (1971)
Moores, D.L. (1972)
Salop, A. (1976)
Burgess, A. et al. (1977)
Kumar, A. Roy, B.N. (1978)
Muller, A. et al. (1980)
Blaha, M. Davis, J. (1980)
Donets, E.D. et al. (1981)
Electron energy (eV)
×10-17
O+ + e --> O2+ + 2e
Cross section (cm2)
Aitken, K.L. et al. (1971)
Moores, D.L. (1972)
Salop, A. (1976)
Burgess, A. et al. (1977)
Kumar, A. Roy, B.N. (1978)
Muller, A. et al. (1980)
Blaha, M. Davis, J. (1980)
Donets, E.D. et al. (1981)
Electron energy (eV)

Fig. 49

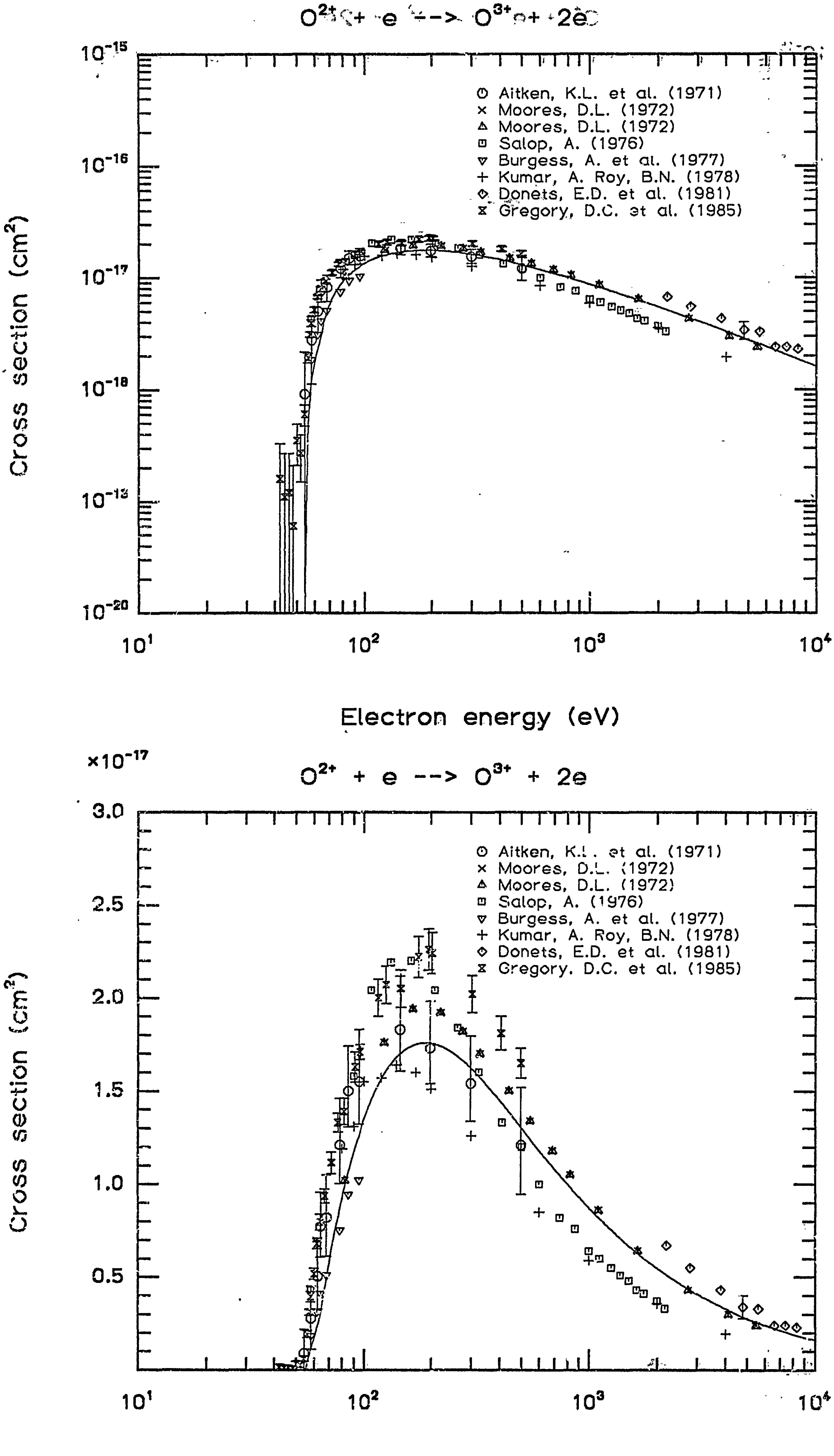
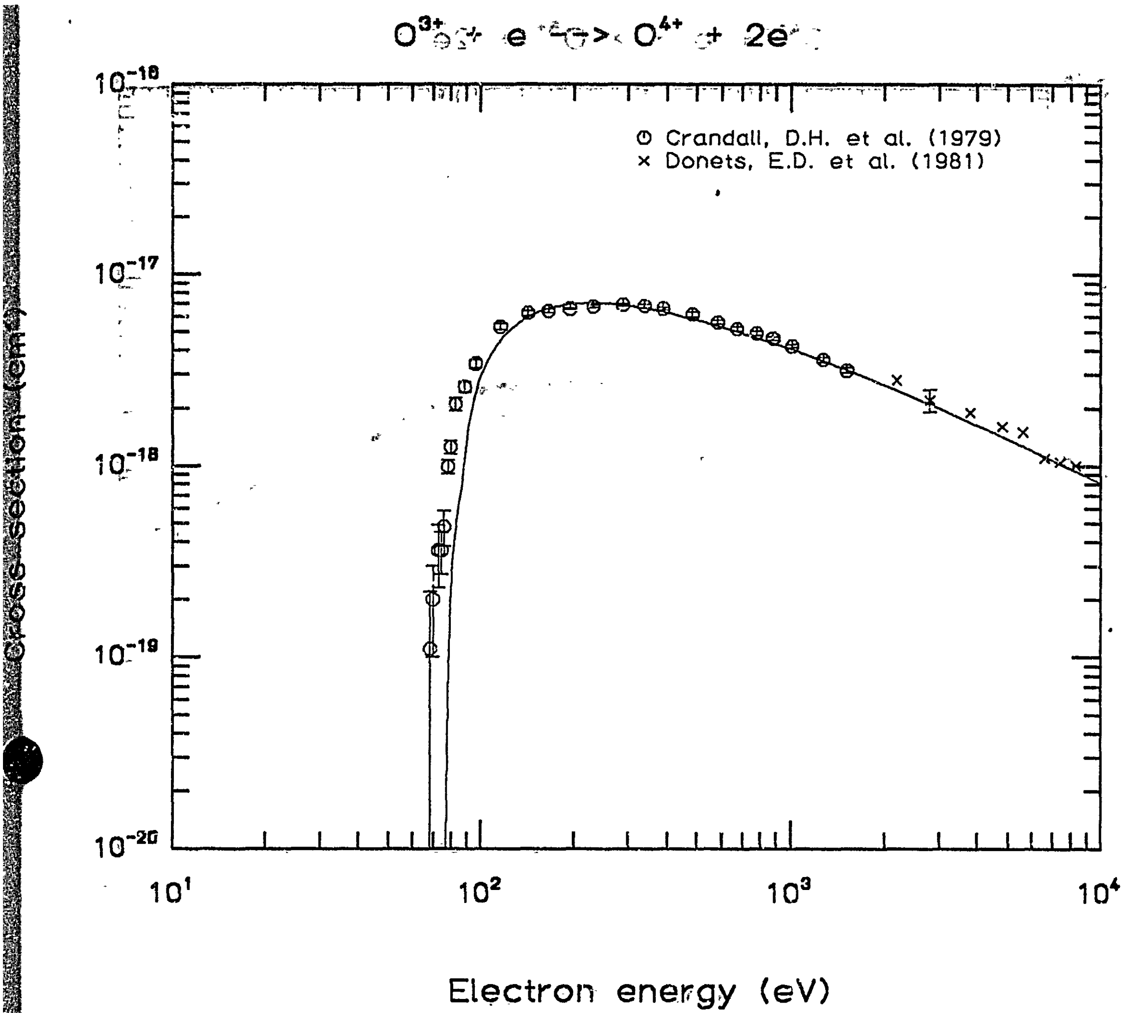
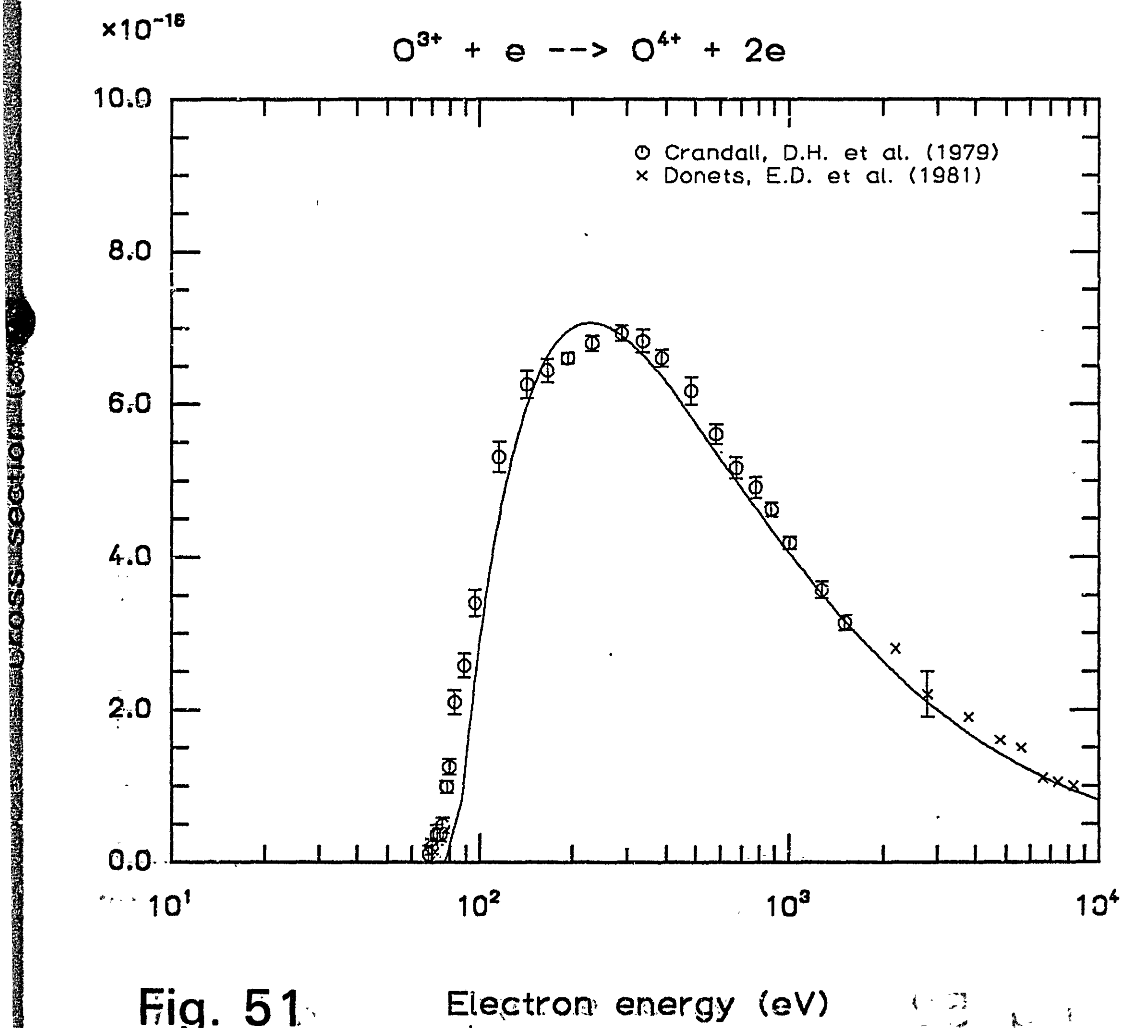

10^-15
10^-16
10^-17
10^-18
10^-19
10^-20
Cross section (cm^2)
Aitken, K.L. et al. (1971)
Moores, D.L. (1972)
Moores, D.L. (1972)
Salop, A. (1976)
Burgess, A. et al. (1977)
Kumar, A. Roy, B.N. (1978)
Donets, E.D. et al. (1981)
Gregory, D.C. et al. (1985)
10^1
10^2
10^3
10^4
Electron energy (eV)
×10^-17
O2+ + e --> O3+ + 2e
3.0
2.5
2.0
1.5
1.0
0.5
Cross section (cm^2)
Aitken, K.L. et al. (1971)
Moores, D.L. (1972)
Moores, D.L. (1972)
Salop, A. (1976)
Burgess, A. et al. (1977)
Kumar, A. Roy, B.N. (1978)
Donets, E.D. et al. (1981)
Gregory. D.C. et al. (1985)
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 50



O3+ + e --> O4+ + 2e
Crandall, D.H. et al. (1979)
Donets, E.D. et al. (1981)
10-16
10-17
10-18
10-19
10-20
Cross section (cm2)
10^1
10^2
10^3
10^4
Electron energy (eV)



×10-16
O3+ + e --> O4+ + 2e
Crandall, D.H. et al. (1979)
Donets, E.D. et al. (1981)
10.0
8.0
6.0
4.0
2.0
0.0
Cross section (cm2)
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 51

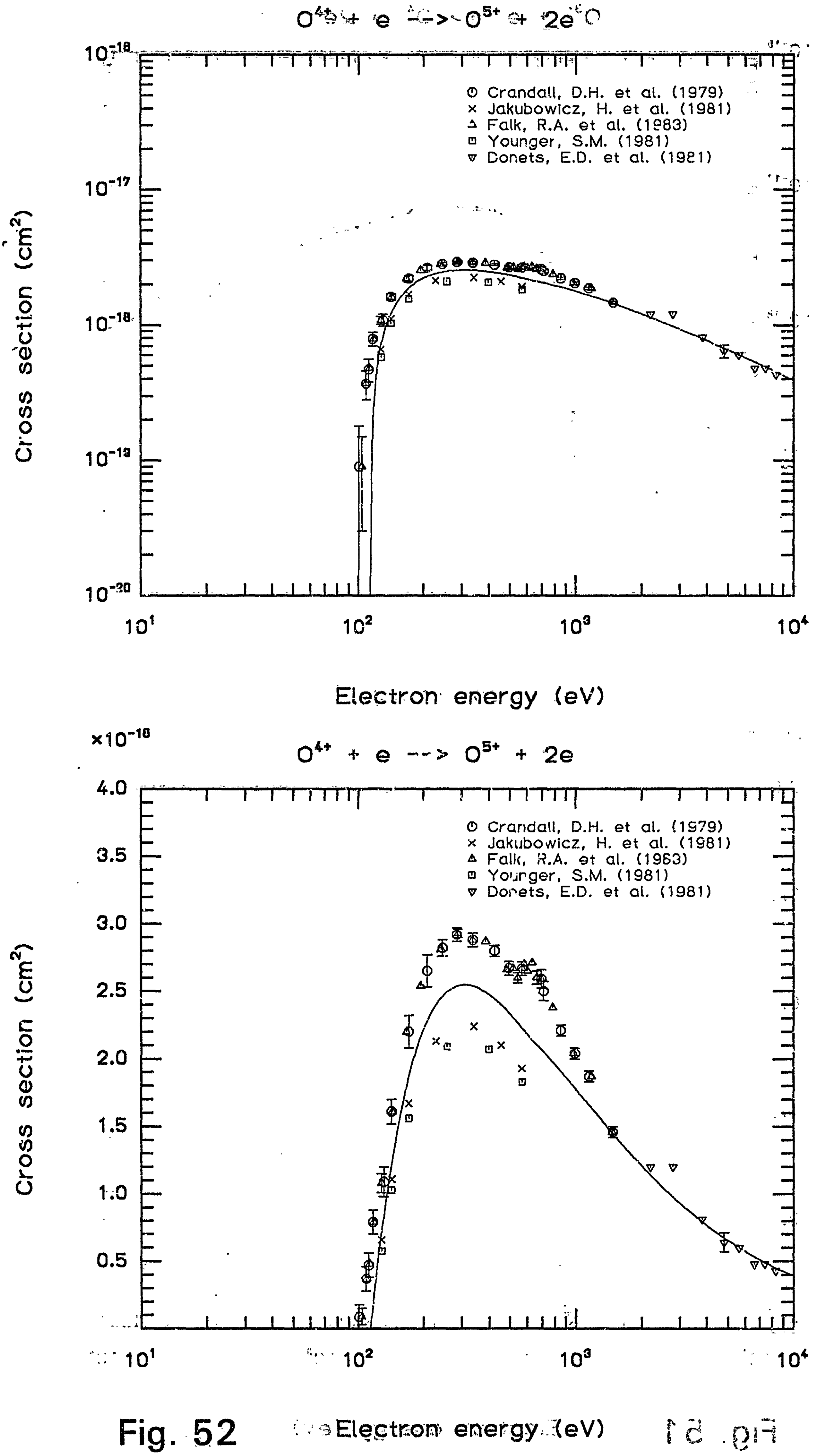
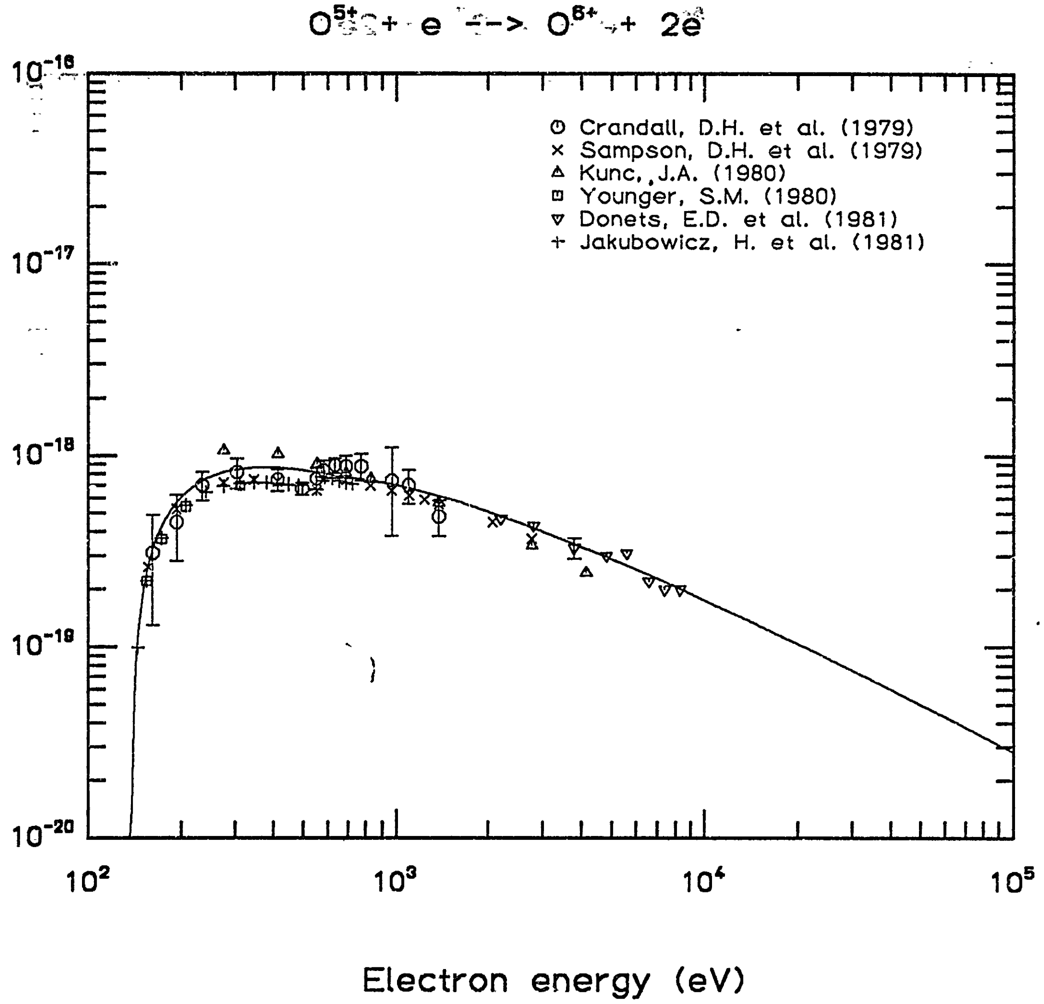

O4+ + e --> O5+ + 2e
Crandall, D.H. et al. (1979)
Jakubowicz, H. et al. (1981)
Falk, R.A. et al. (1983)
Younger, S.M. (1981)
Donets, E.D. et al. (1981)
Cross section (cm2)
Electron energy (eV)
×10-18
O4+ + e --> O5+ + 2e
Crandall, D.H. et al. (1979)
Jakubowicz, H. et al. (1981)
Falk, R.A. et al. (1983)
Younger, S.M. (1981)
Donets, E.D. et al. (1981)
Cross section (cm2)
Electron energy (eV)

Fig. 52


O^{5+} + e --> O^{6+} + 2e
Crandall, D.H. et al. (1979)
Sampson, D.H. et al. (1979)
Kunc, J.A. (1980)
Younger, S.M. (1980)
Donets, E.D. et al. (1981)
Jakubowicz, H. et al. (1981)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^{2}
10^{3}
10^{4}
10^{5}
Electron energy (eV)

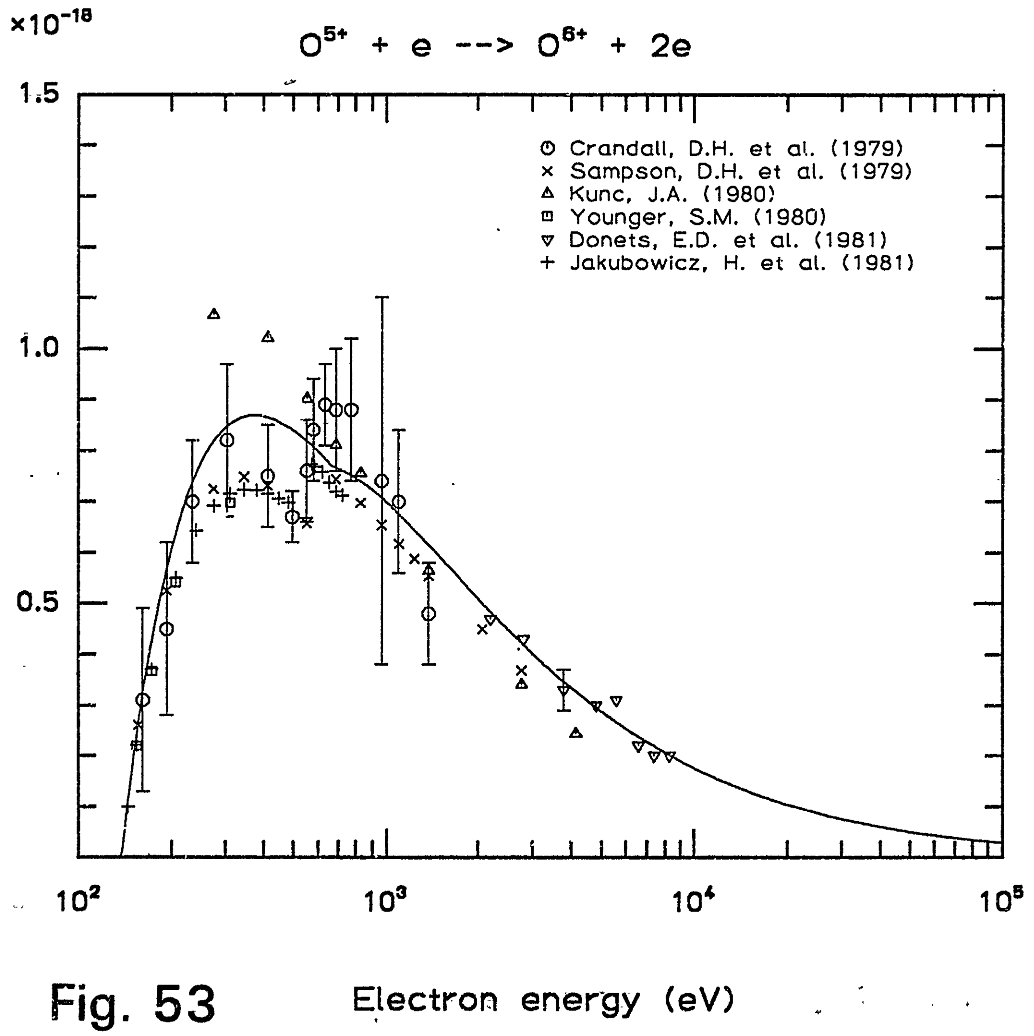
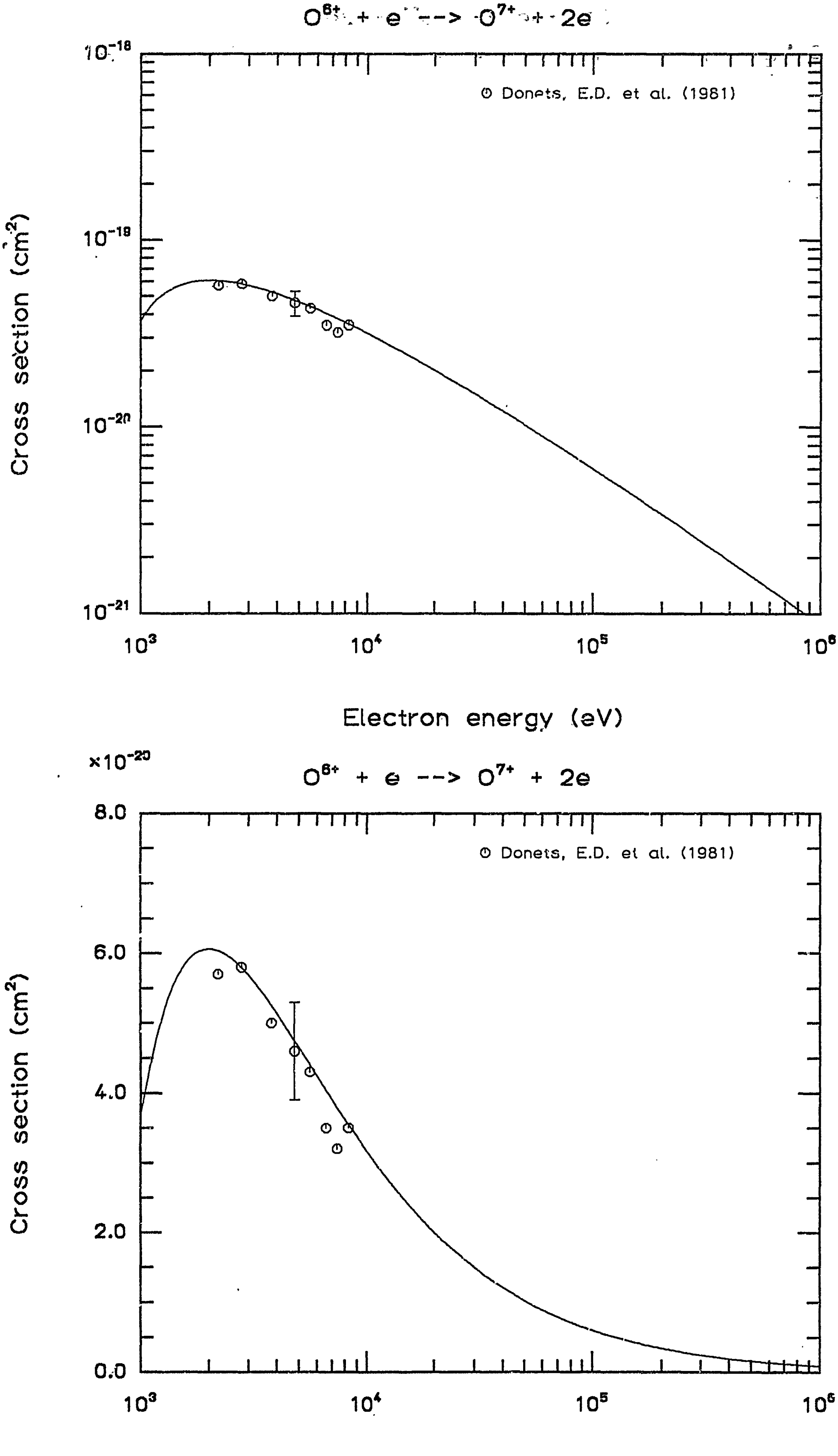
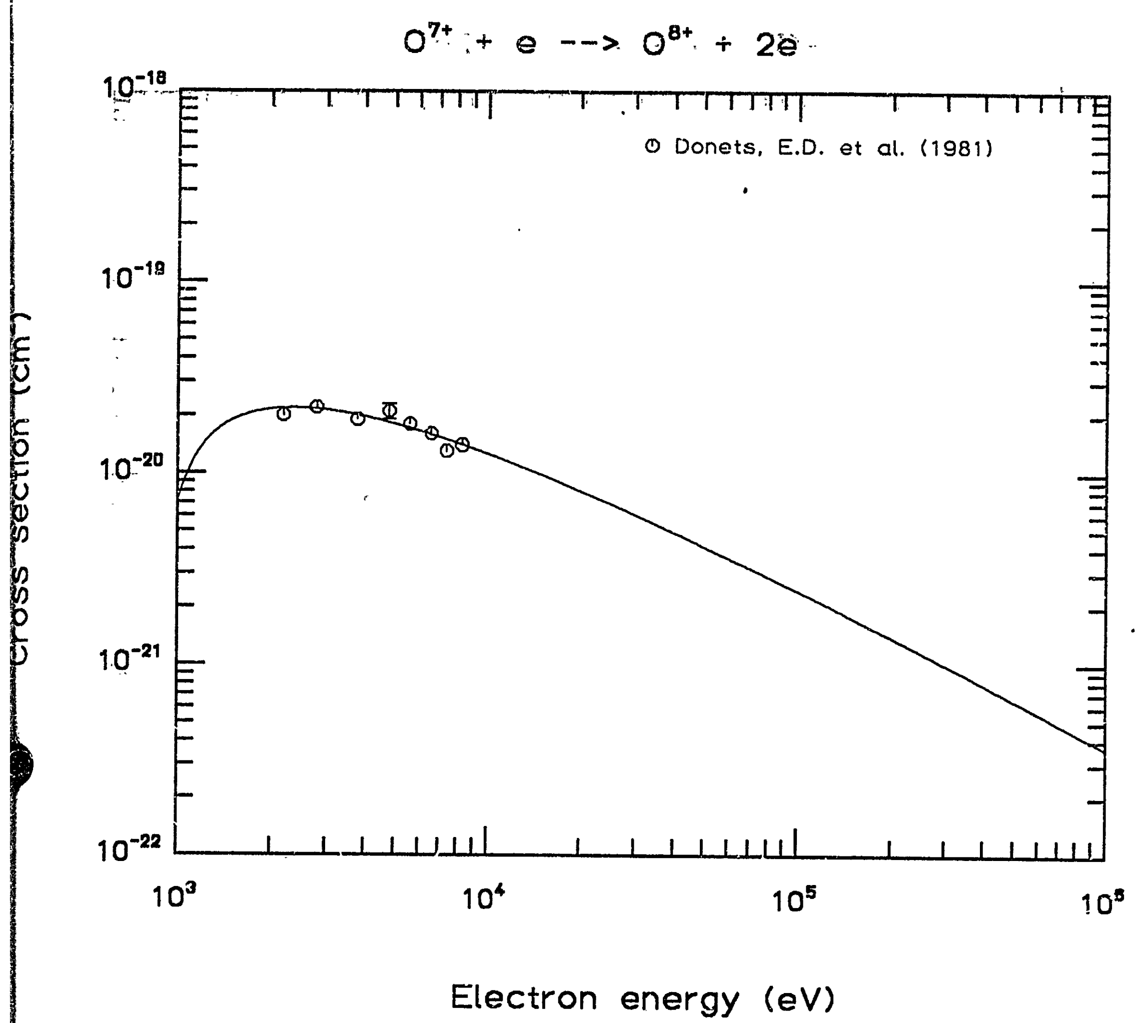

$\times 10^{-18}$
O^{5+} + e --> O^{6+} + 2e
Crandall, D.H. et al. (1979)
Sampson, D.H. et al. (1979)
Kunc, J.A. (1980)
Younger, S.M. (1980)
Donets, E.D. et al. (1981)
Jakubowicz, H. et al. (1981)
1.5
1.0
0.5
10^{2}
10^{3}
10^{4}
10^{5}
Electron energy (eV)

Fig. 53



O⁶⁺ + e --> O⁷⁺ + 2e
Donets, E.D. et al. (1981)
Cross section (cm²)
Electron energy (eV)
10⁻¹⁸
10⁻¹⁹
10⁻²⁰
10⁻²¹
10³
10⁴
10⁵
10⁶
O⁶⁺ + e --> O⁷⁺ + 2e
×10⁻²⁰
8.0
6.0
4.0
2.0
0.0
Donets, E.D. et al. (1981)
Cross section (cm²)
10³
10⁴
10⁵
10⁶
Electron energy (eV)

Fig. 54



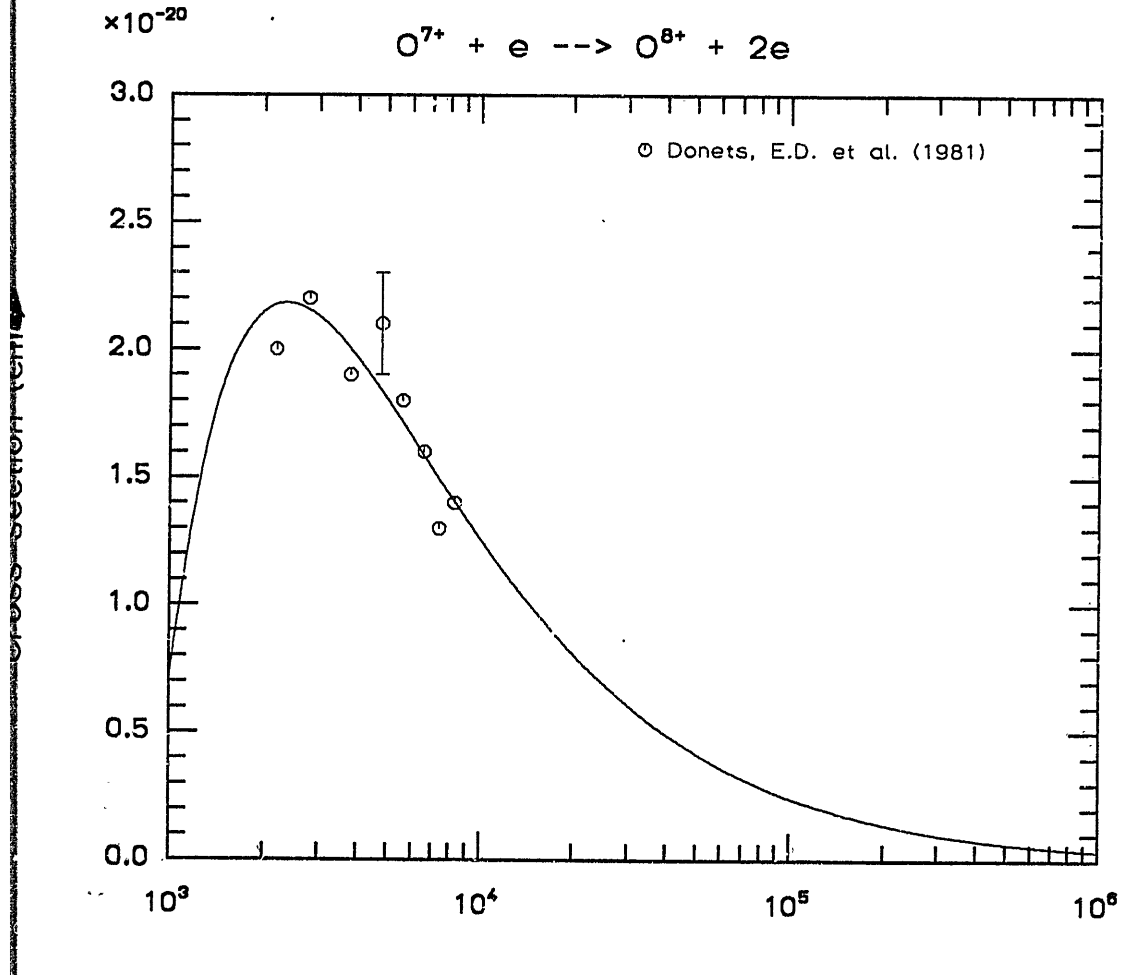
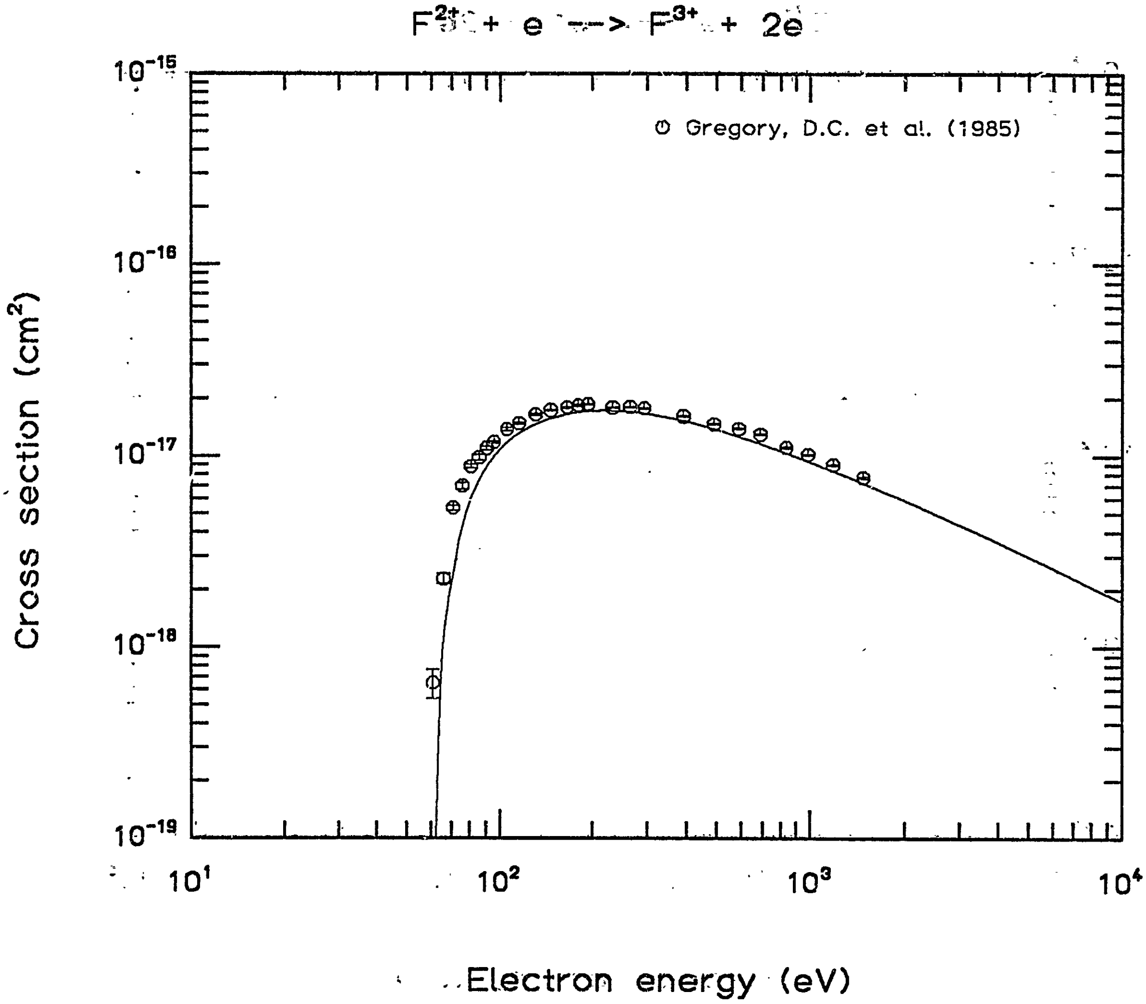
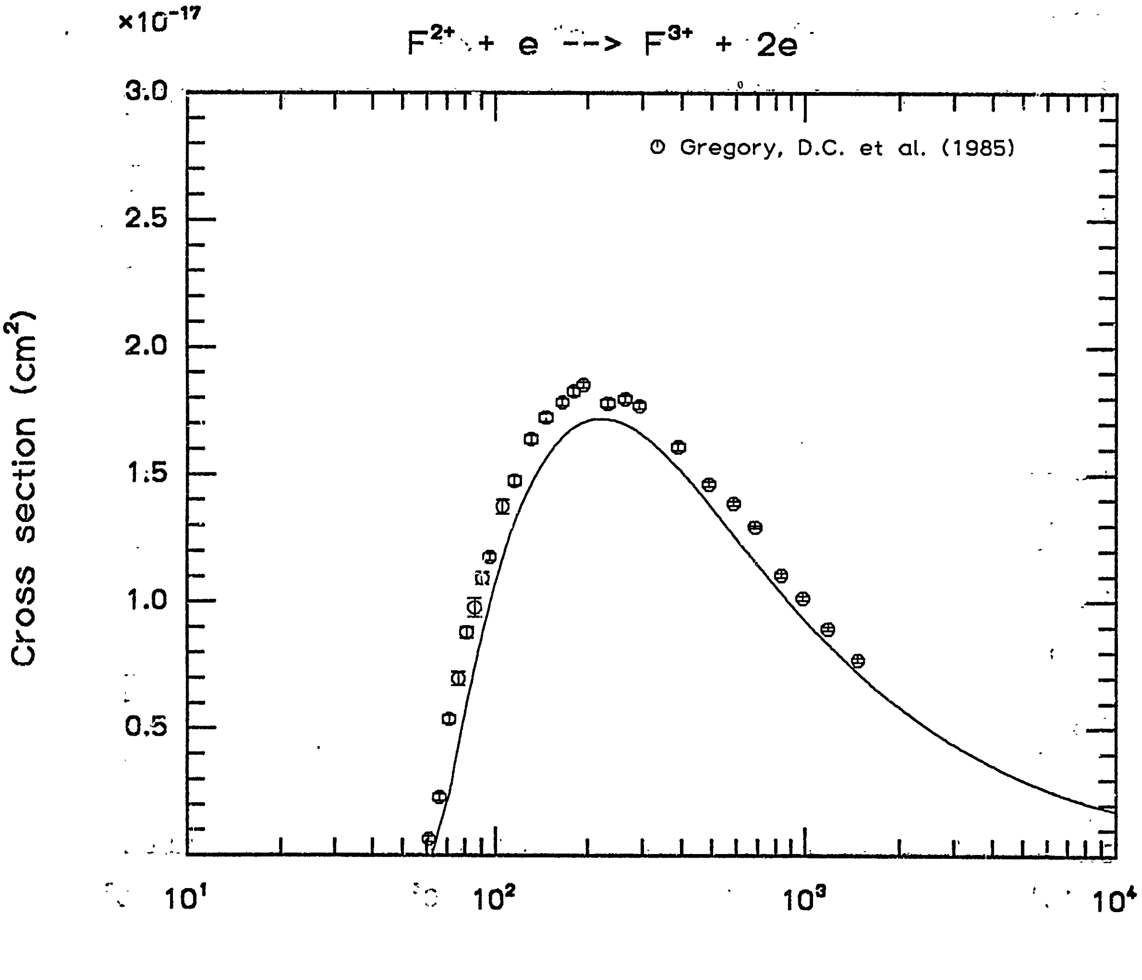


Fig. 55 Electron energy (eV)

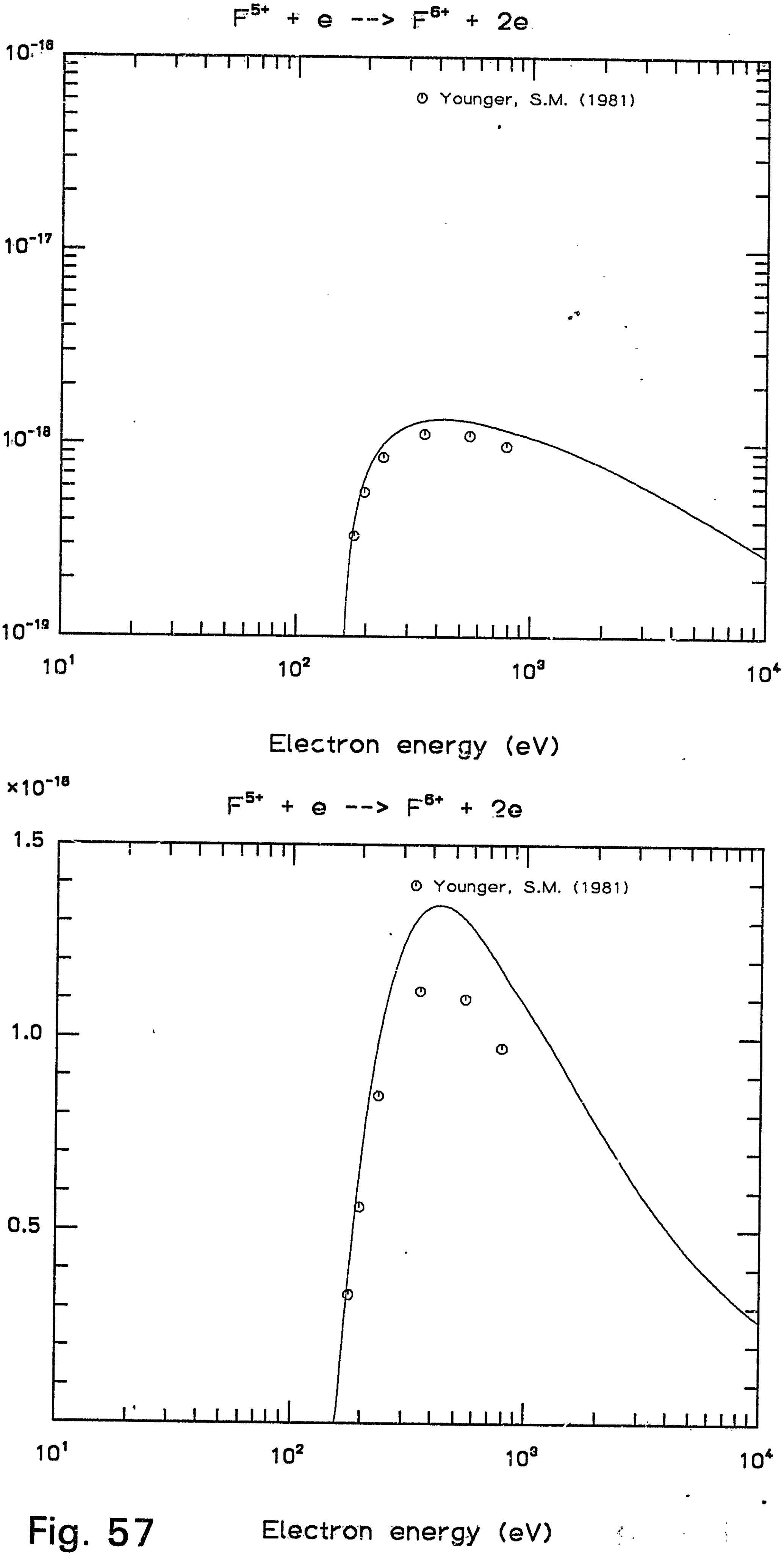


F^{2+} + e ---> F^{3+} + 2e
Gregory, D.C. et al. (1985)
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^1
10^2
10^3
10^4
Electron energy (eV)



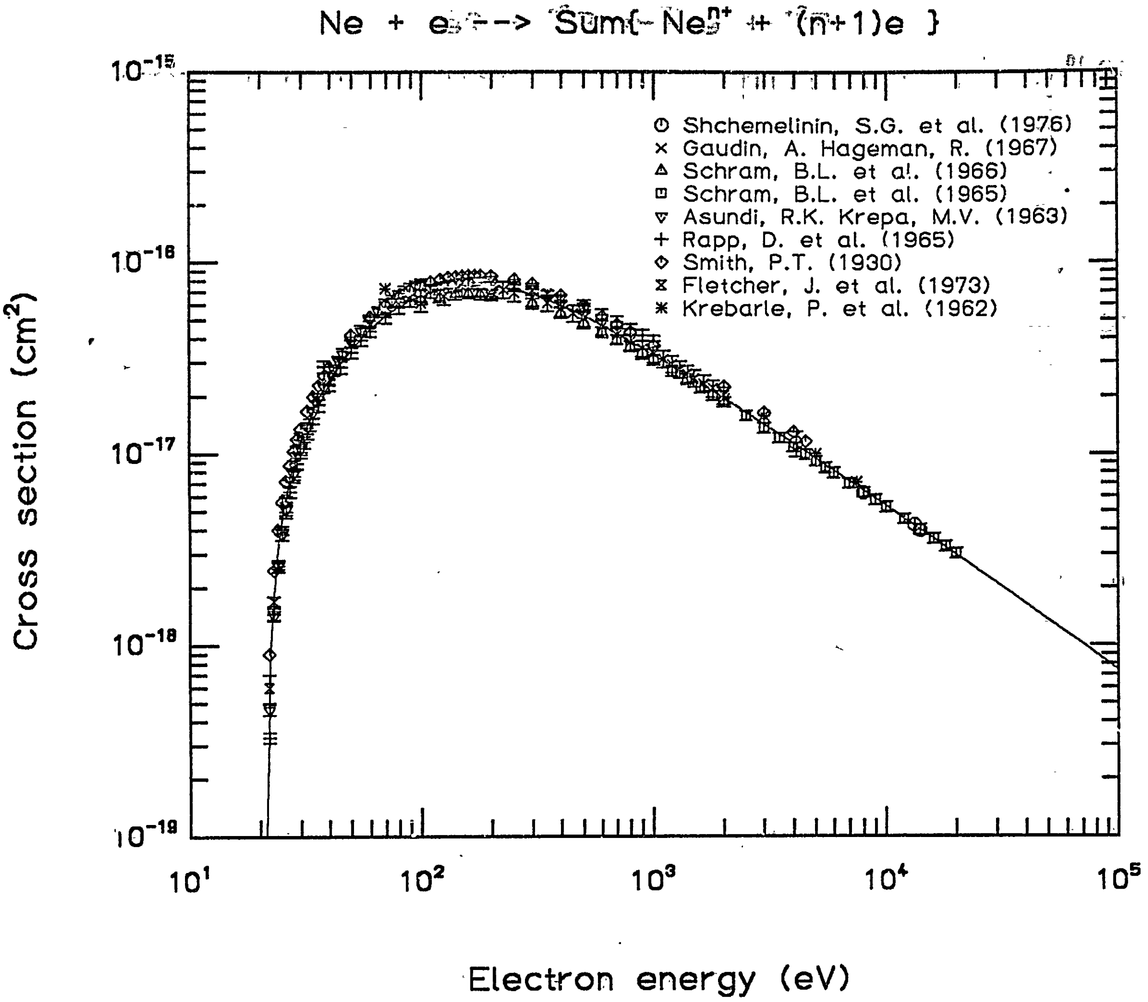
×10^{-17}
F^{2+} + e ---> F^{3+} + 2e
Gregory, D.C. et al. (1985)
Cross section (cm^2)
3.0
2.5
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 56



F5+ + e --> F6+ + 2e
Younger, S.M. (1981)
10-16
10-17
10-18
10-19
101
102
103
104
Electron energy (eV)
×10-18
F5+ + e --> F6+ + 2e
Younger, S.M. (1981)
1.5
1.0
0.5
101
102
103
104
Electron energy (eV)

Fig. 57


Ne + e --> Sum{ Ne^{n+} + (n+1)e }
Shchemelinin, S.G. et al. (1976)
Gaudin, A. Hageman, R. (1967)
Schram, B.L. et al. (1966)
Schram, B.L. et al. (1965)
Asundi, R.K. Krepa, M.V. (1963)
Rapp, D. et al. (1965)
Smith, P.T. (1930)
Fletcher, J. et al. (1973)
Krebarle, P. et al. (1962)
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

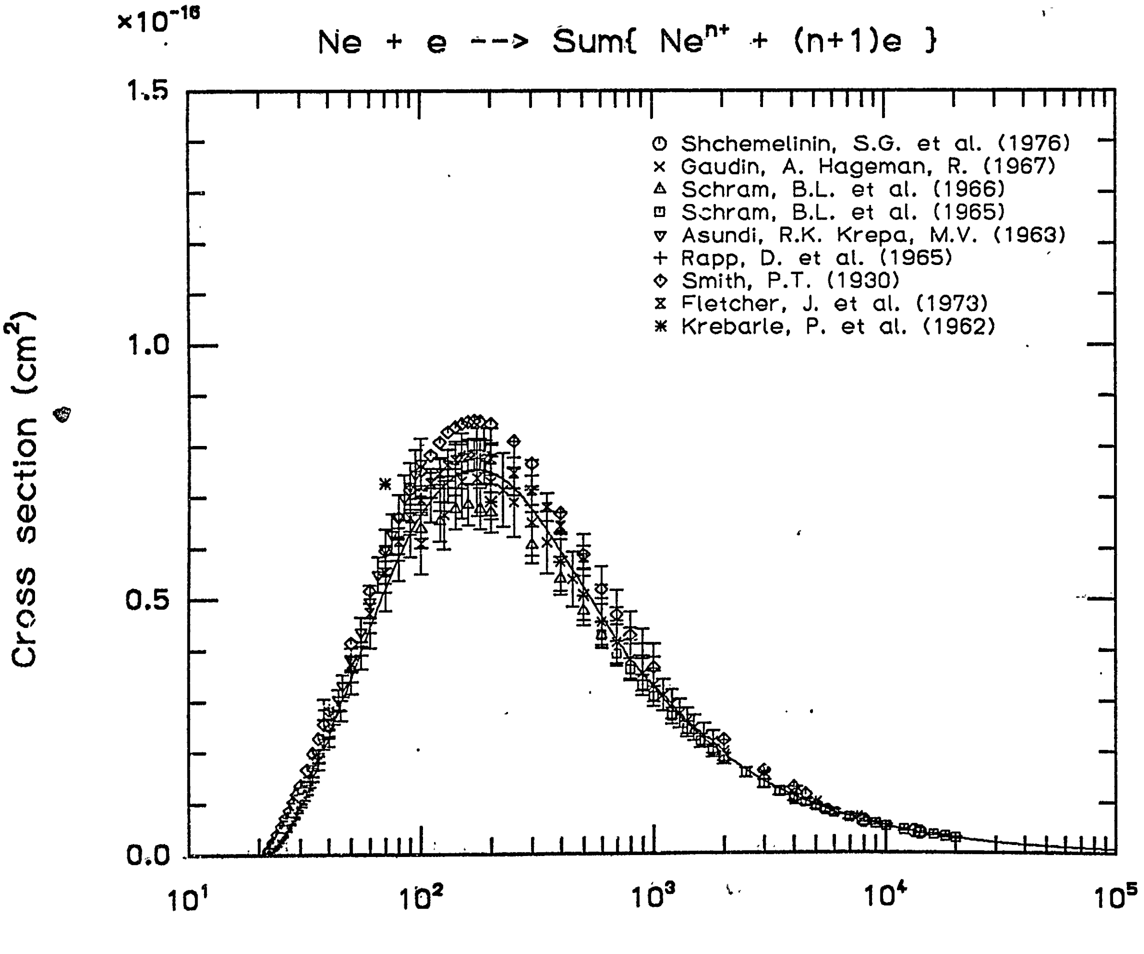
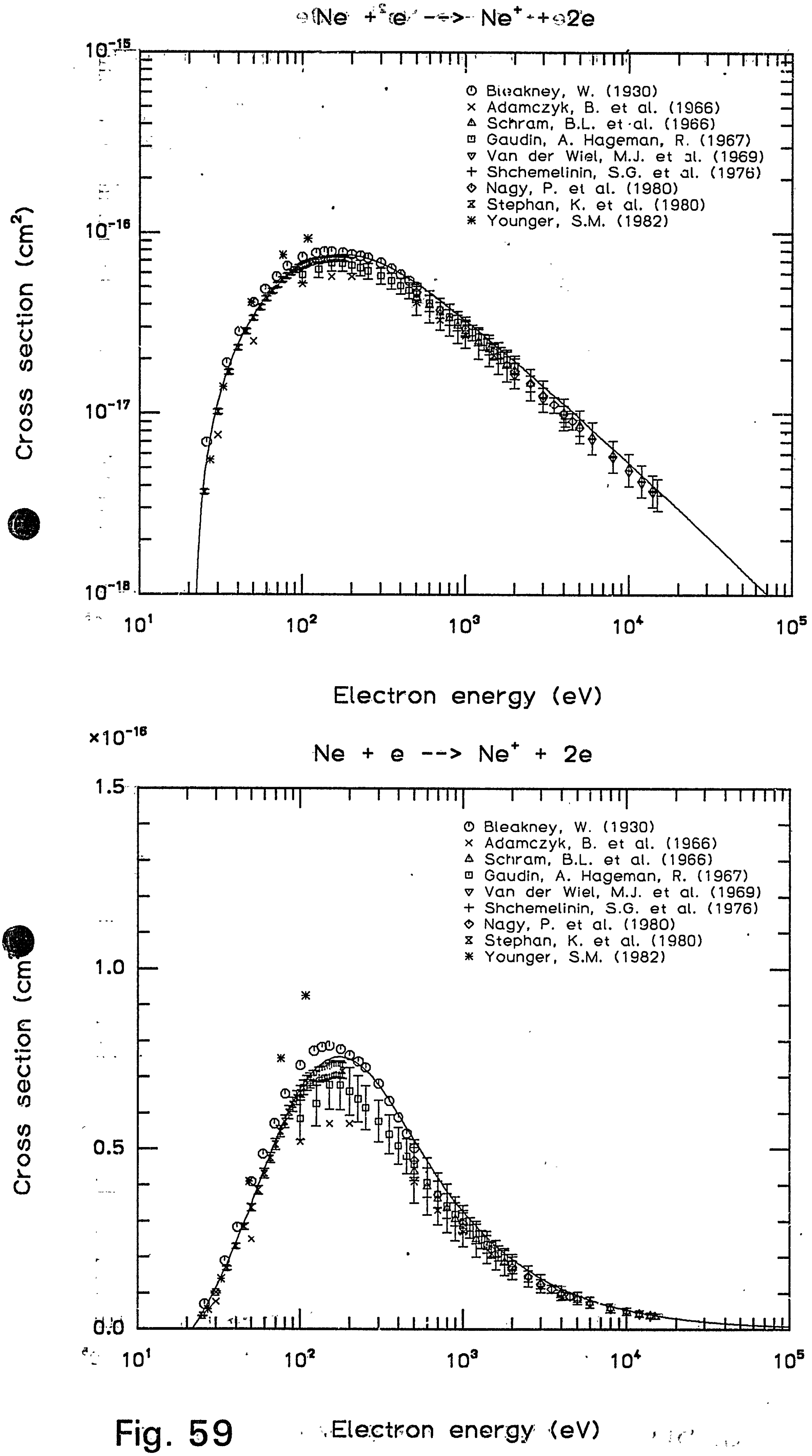
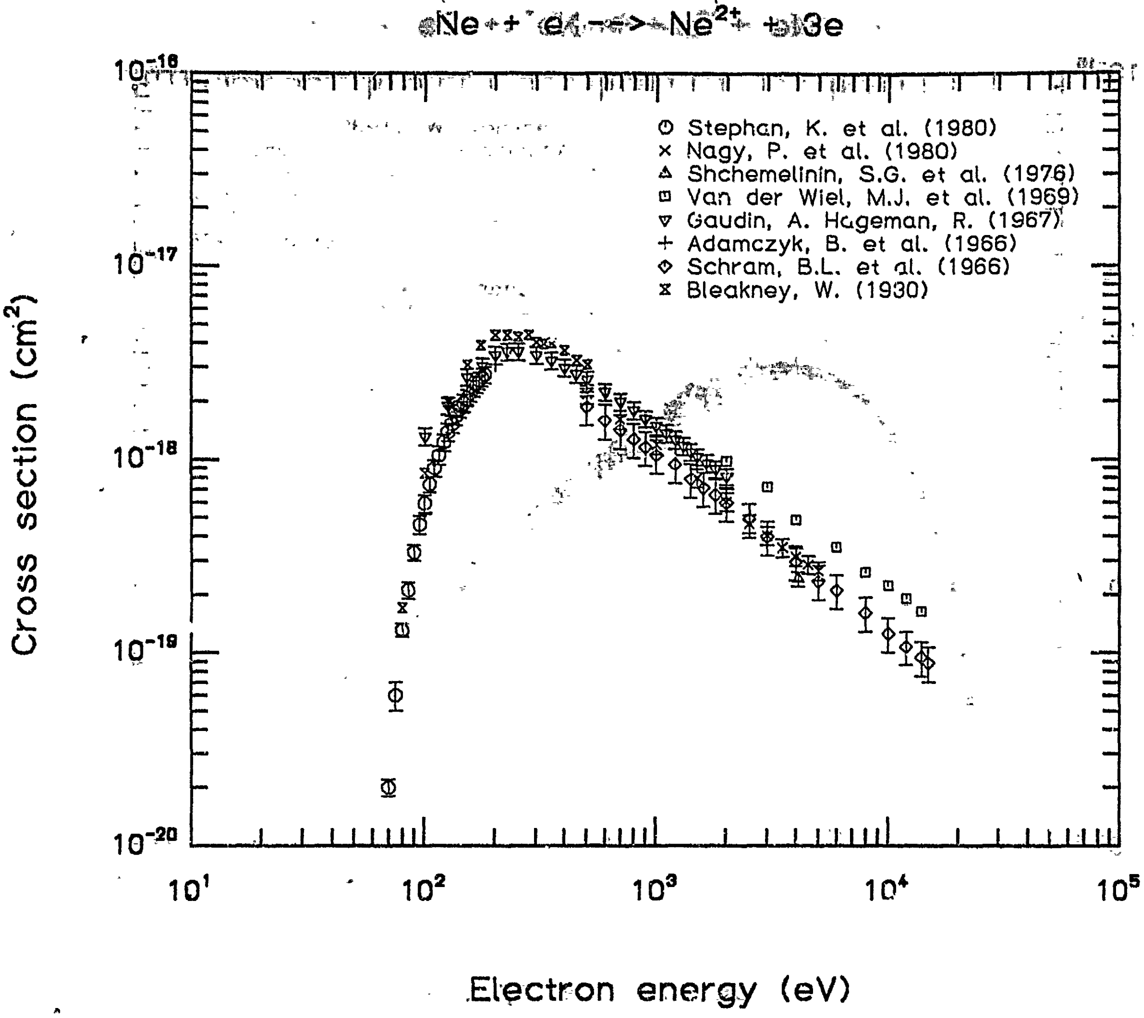

×10^{-16}
Ne + e --> Sum{ Ne^{n+} + (n+1)e }
Shchemelinin, S.G. et al. (1976)
Gaudin, A. Hageman, R. (1967)
Schram, B.L. et al. (1966)
Schram, B.L. et al. (1965)
Asundi, R.K. Krepa, M.V. (1963)
Rapp, D. et al. (1965)
Smith, P.T. (1930)
Fletcher, J. et al. (1973)
Krebarle, P. et al. (1962)
Cross section (cm^2)
1.5
1.0
0.5
0.0
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 58



Ne + e --> Ne$^+$ + 2e
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)
Bleakney, W. (1930)
Adamczyk, B. et al. (1966)
Schram, B.L. et al. (1966)
Gaudin, A. Hageman, R. (1967)
Van der Wiel, M.J. et al. (1969)
Shchemelinin, S.G. et al. (1976)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
Younger, S.M. (1982)
$\times 10^{-16}$
Ne + e --> Ne$^+$ + 2e
Cross section (cm^2)
1.5
1.0
0.5
0.0
10^1
10^2
10^3
10^4
10^5
Bleakney, W. (1930)
Adamczyk, B. et al. (1966)
Schram, B.L. et al. (1966)
Gaudin, A. Hageman, R. (1967)
Van der Wiel, M.J. et al. (1969)
Shchemelinin, S.G. et al. (1976)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
Younger, S.M. (1982)
Electron energy (eV)

Fig. 59


Ne + e --> Ne^{2+} + 3e
Cross section (cm^2)
Electron energy (eV)
Stephan, K. et al. (1980)
Nagy, P. et al. (1980)
Shchemelinin, S.G. et al. (1976)
Van der Wiel, M.J. et al. (1969)
Gaudin, A. Hageman, R. (1967)
Adamczyk, B. et al. (1966)
Schram, B.L. et al. (1966)
Bleakney, W. (1930)

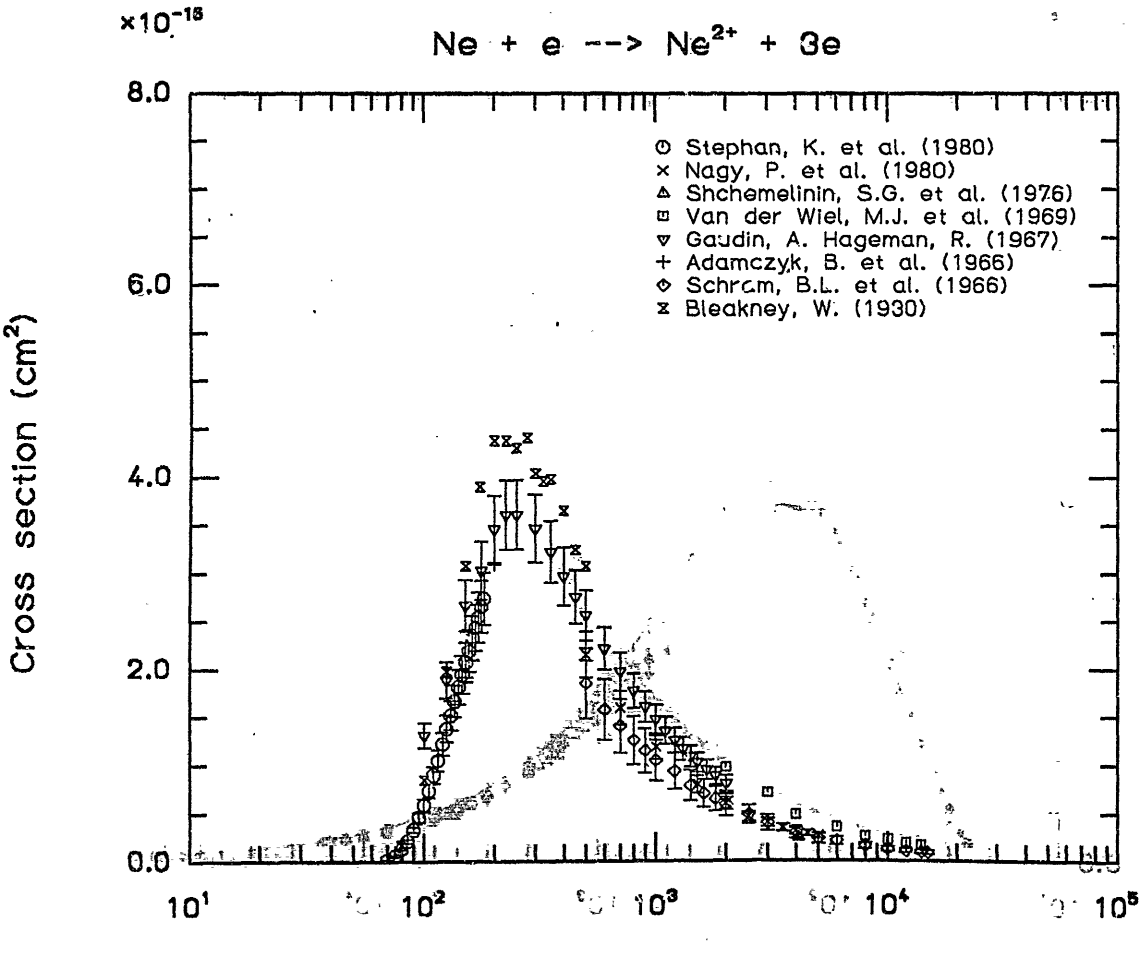
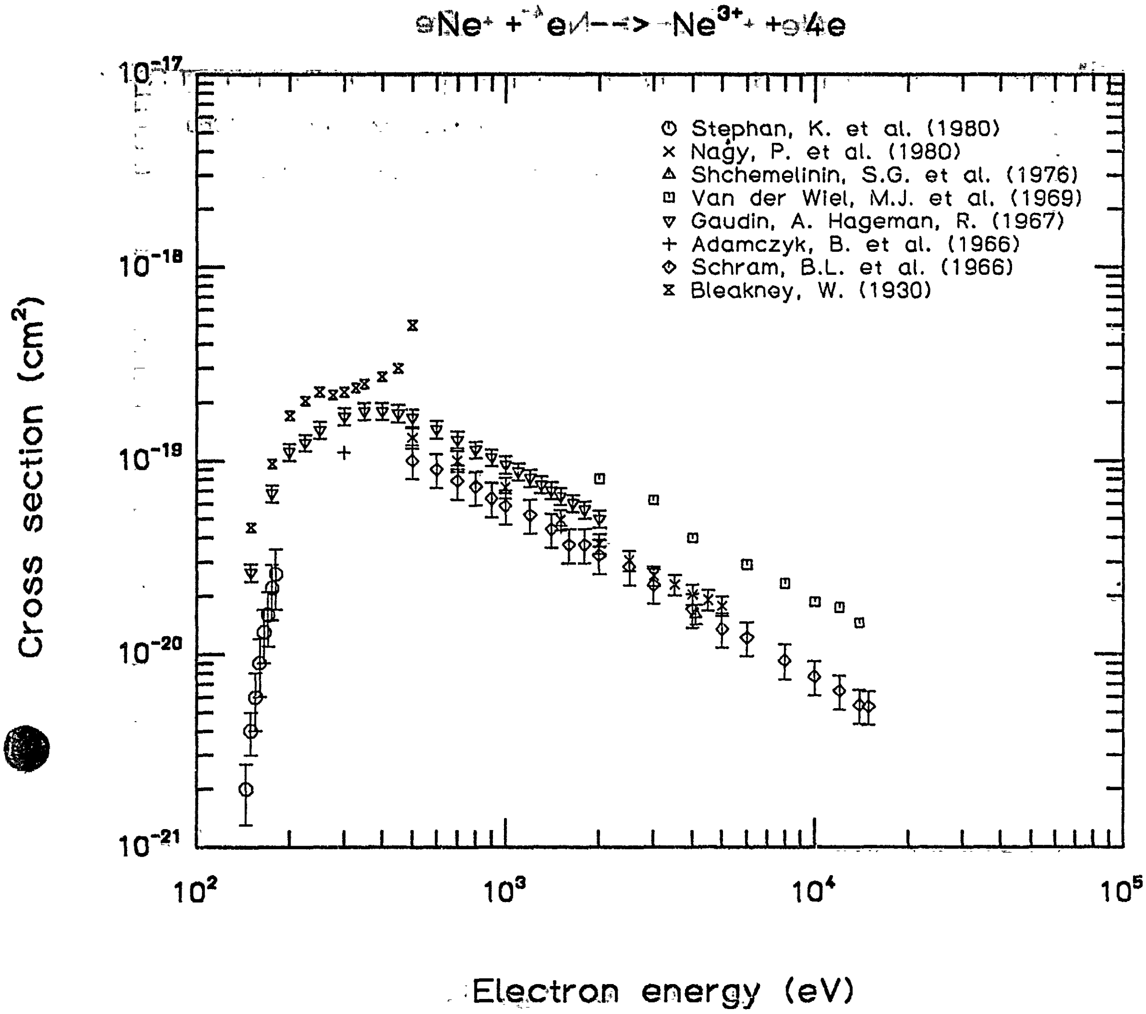

×10^{-18}
Ne + e --> Ne^{2+} + 3e
Cross section (cm^2)
Electron energy (eV)
Stephan, K. et al. (1980)
Nagy, P. et al. (1980)
Shchemelinin, S.G. et al. (1976)
Van der Wiel, M.J. et al. (1969)
Gaudin, A. Hageman, R. (1967)
Adamczyk, B. et al. (1966)
Schram, B.L. et al. (1966)
Bleakney, W. (1930)

Fig. 60



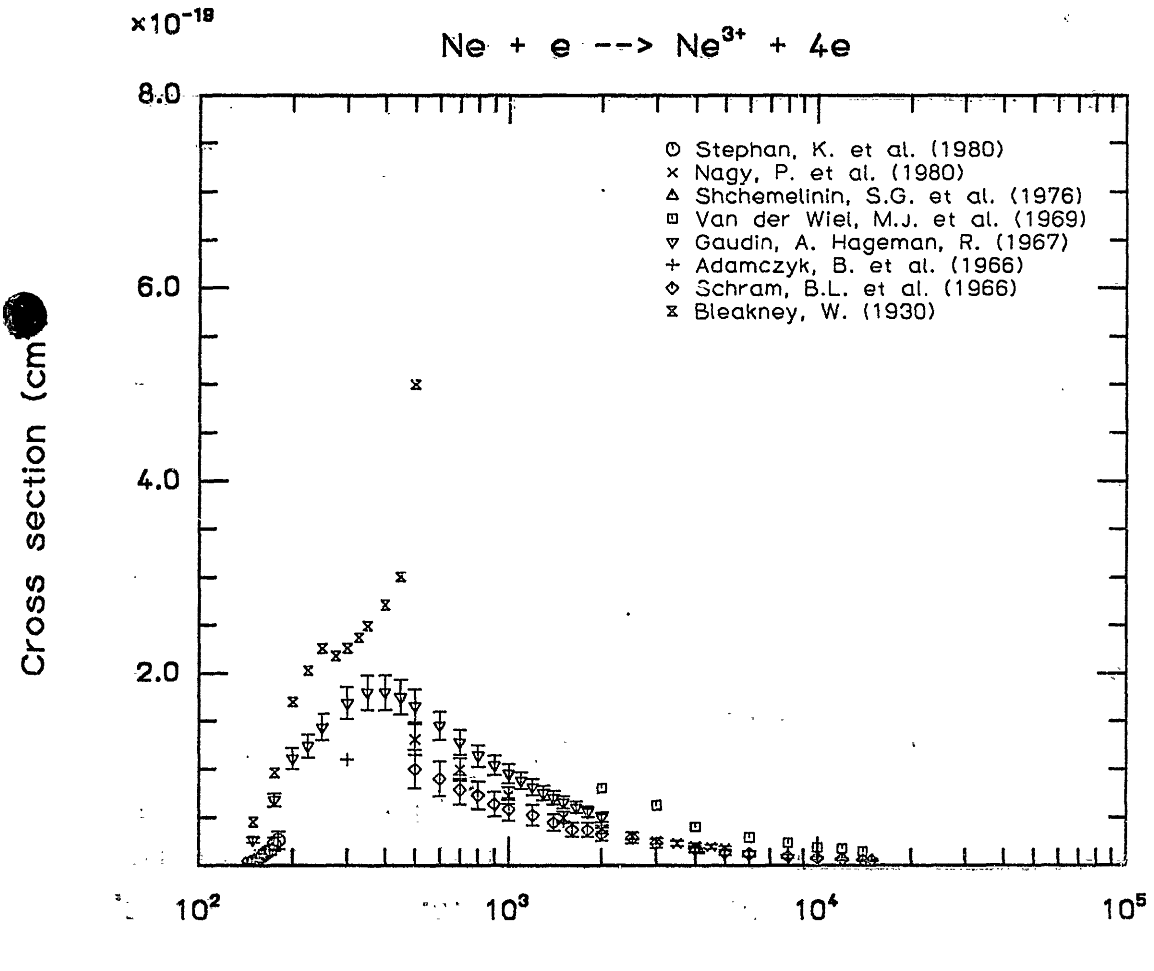
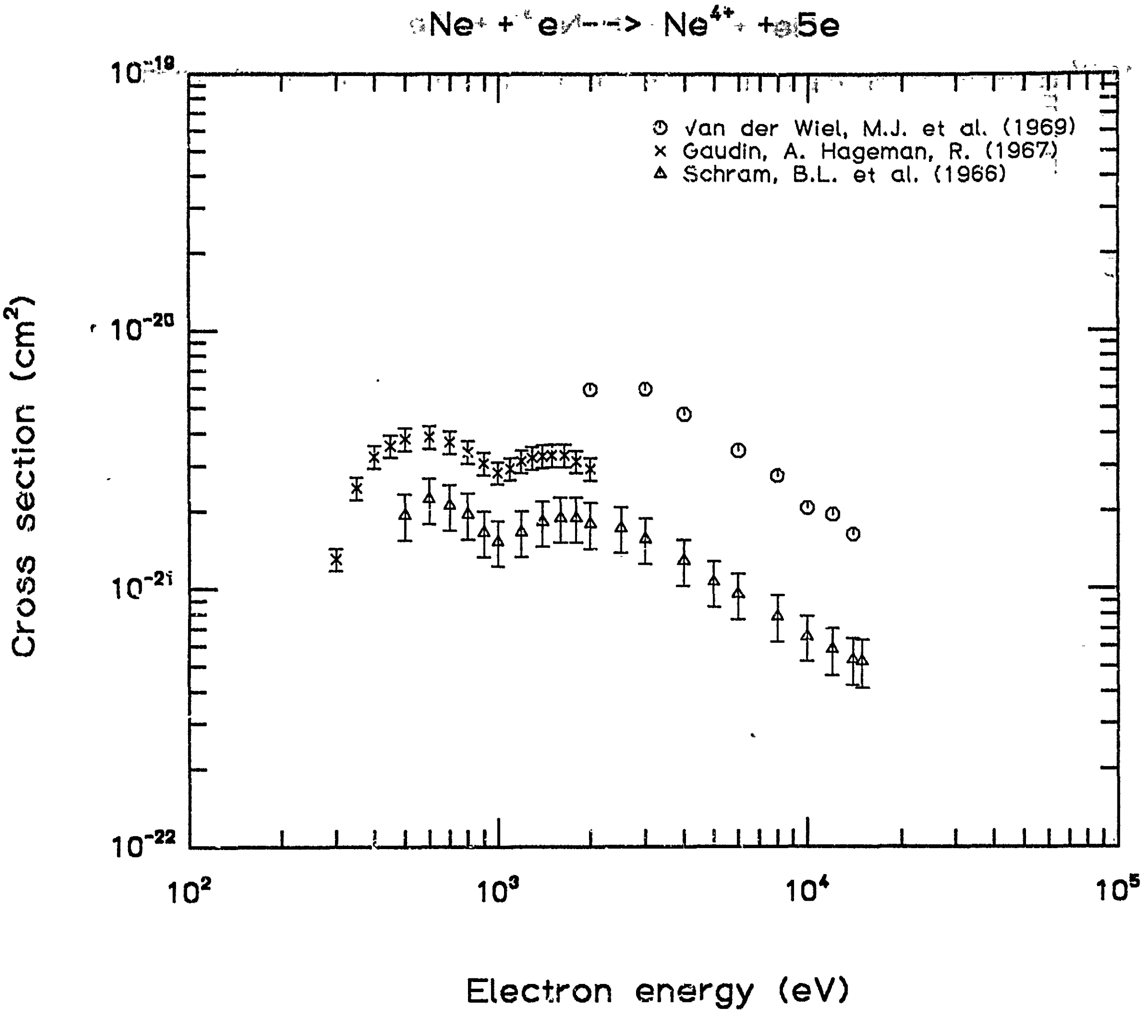


Fig. 61 Electron energy (eV)


Ne + e --> Ne^{4+} + 5e
Van der Wiel, M.J. et al. (1969)
Gaudin, A. Hageman, R. (1967)
Schram, B.L. et al. (1966)
Cross section (cm^2)
10^{-19}
10^{-20}
10^{-21}
10^{-22}
10^2
10^3
10^4
10^5
Electron energy (eV)

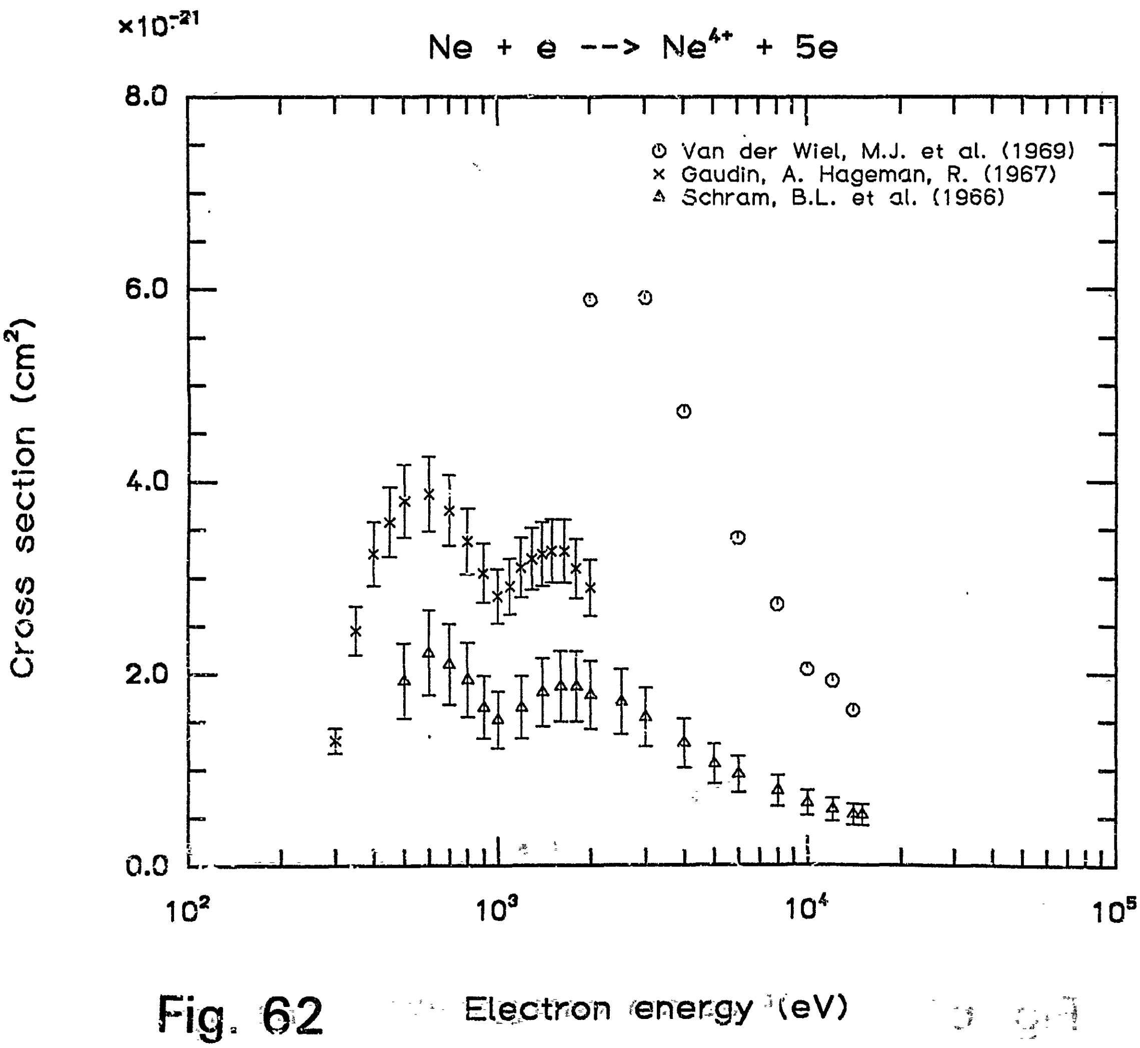
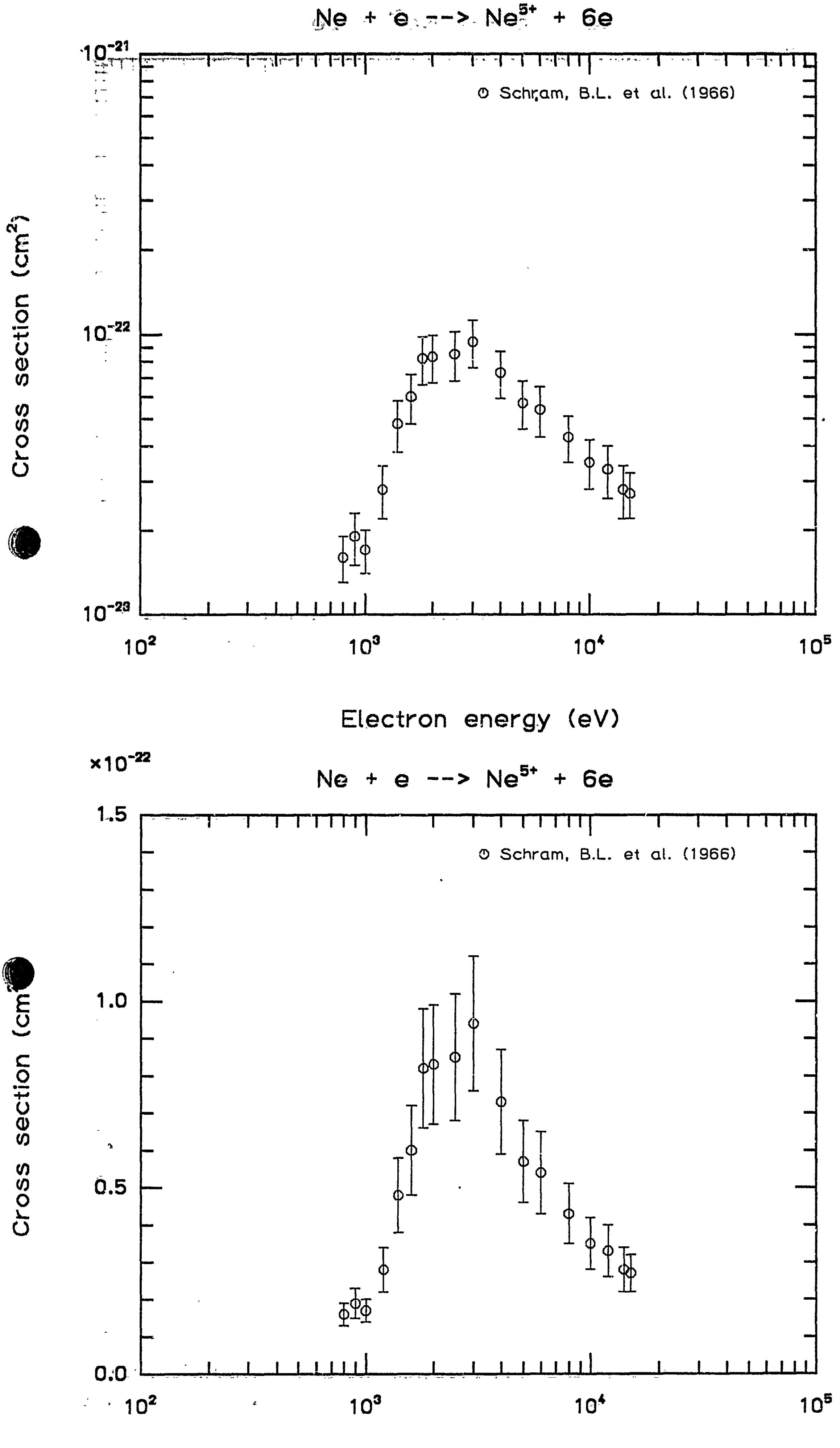
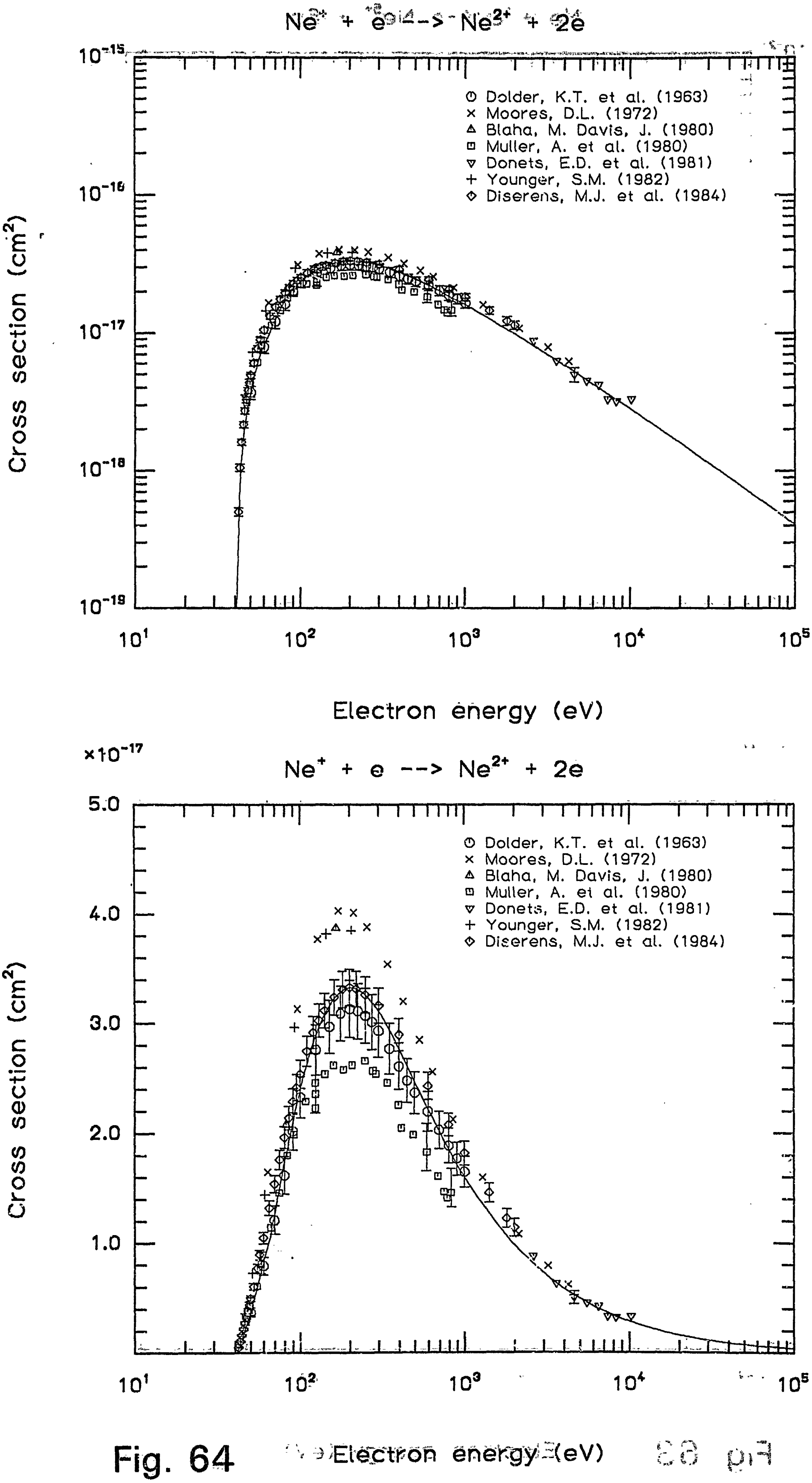

$\times 10^{-21}$
Ne + e --> Ne^{4+} + 5e
Van der Wiel, M.J. et al. (1969)
Gaudin, A. Hageman, R. (1967)
Schram, B.L. et al. (1966)
Cross section (cm^2)
8.0
6.0
4.0
2.0
0.0
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 62



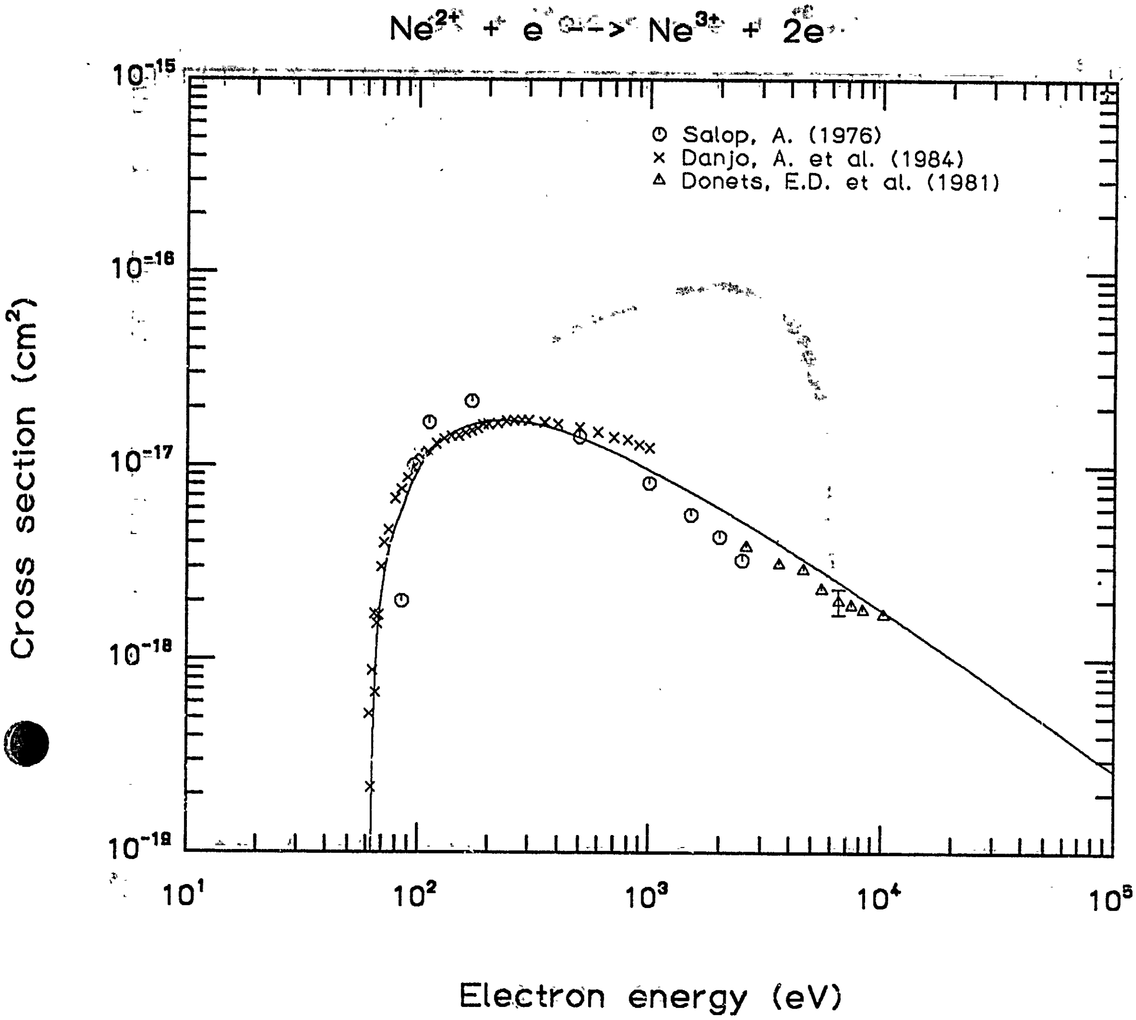
Ne + e --> Ne5+ + 6e
Schram, B.L. et al. (1966)
Cross section (cm2)
10-21
10-22
10-23
102
103
104
105
Electron energy (eV)
×10-22
Ne + e --> Ne5+ + 6e
Schram, B.L. et al. (1966)
Cross section (cm2)
1.5
1.0
0.5
0.0
102
103
104
105
Electron energy (eV)

Fig. 63

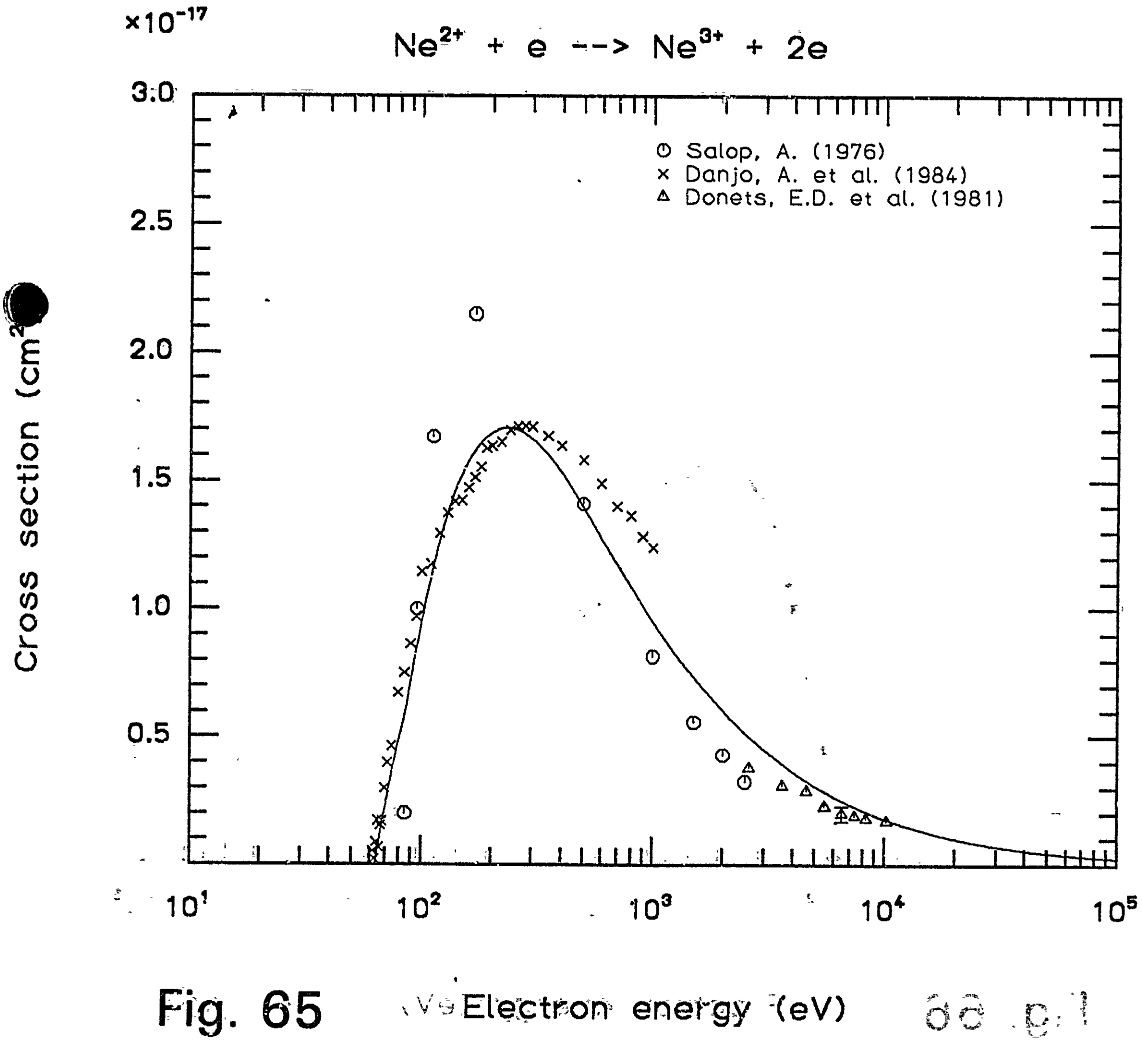


Ne+ + e --> Ne2+ + 2e
Cross section (cm2)
10−15
10−16
10−17
10−18
10−19
101
102
103
104
105
Electron energy (eV)
Dolder, K.T. et al. (1963)
Moores, D.L. (1972)
Blaha, M. Davis, J. (1980)
Muller, A. et al. (1980)
Donets, E.D. et al. (1981)
Younger, S.M. (1982)
Diserens, M.J. et al. (1984)
×10−17
Ne+ + e --> Ne2+ + 2e
Cross section (cm2)
5.0
4.0
3.0
2.0
1.0
101
102
103
104
105
Dolder, K.T. et al. (1963)
Moores, D.L. (1972)
Blaha, M. Davis, J. (1980)
Muller, A. et al. (1980)
Donets, E.D. et al. (1981)
Younger, S.M. (1982)
Diserens, M.J. et al. (1984)
Electron energy (eV)

Fig. 64

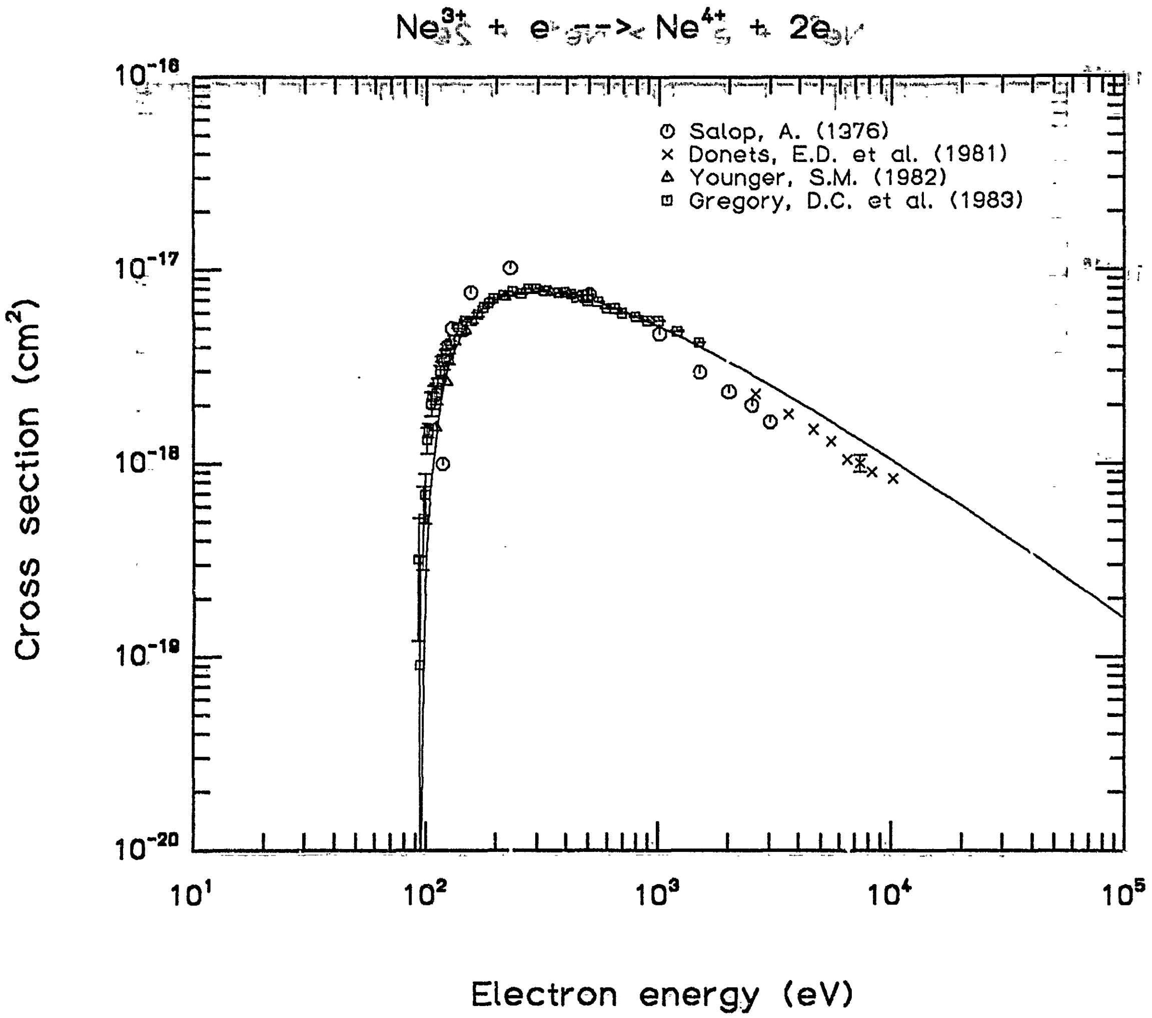


Ne2+ + e --> Ne3+ + 2e
Salop, A. (1976)
Danjo, A. et al. (1984)
Donets, E.D. et al. (1981)
Cross section (cm2)
10-15
10-16
10-17
10-18
10-19
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)



x10-17
Ne2+ + e --> Ne3+ + 2e
Salop, A. (1976)
Danjo, A. et al. (1984)
Donets, E.D. et al. (1981)
Cross section (cm2)
3.0
2.5
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 65


Ne3+ + e --> Ne4+ + 2e
Salop, A. (1976)
Donets, E.D. et al. (1981)
Younger, S.M. (1982)
Gregory, D.C. et al. (1983)
Cross section (cm2)
10-16
10-17
10-18
10-19
10-20
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

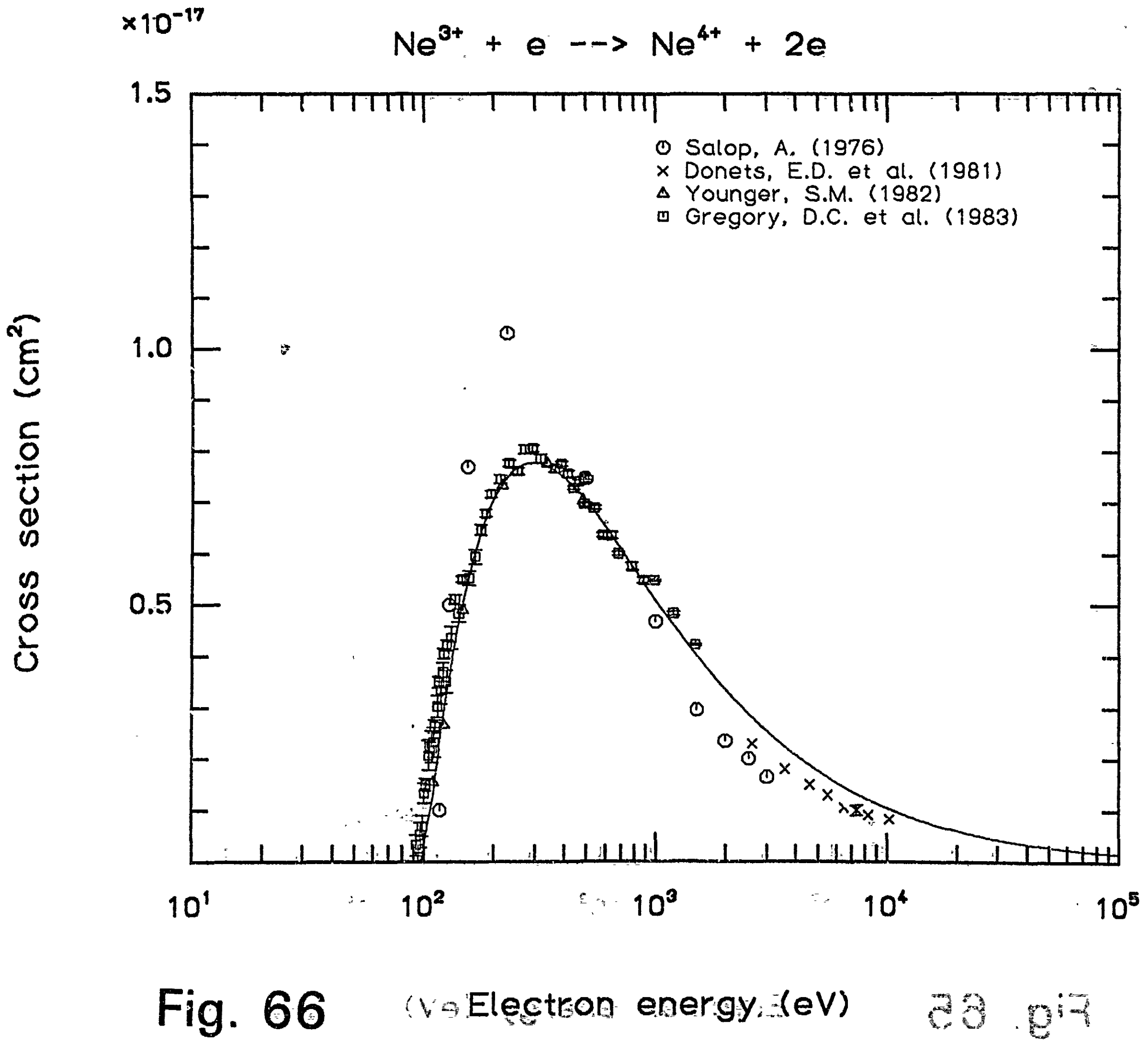
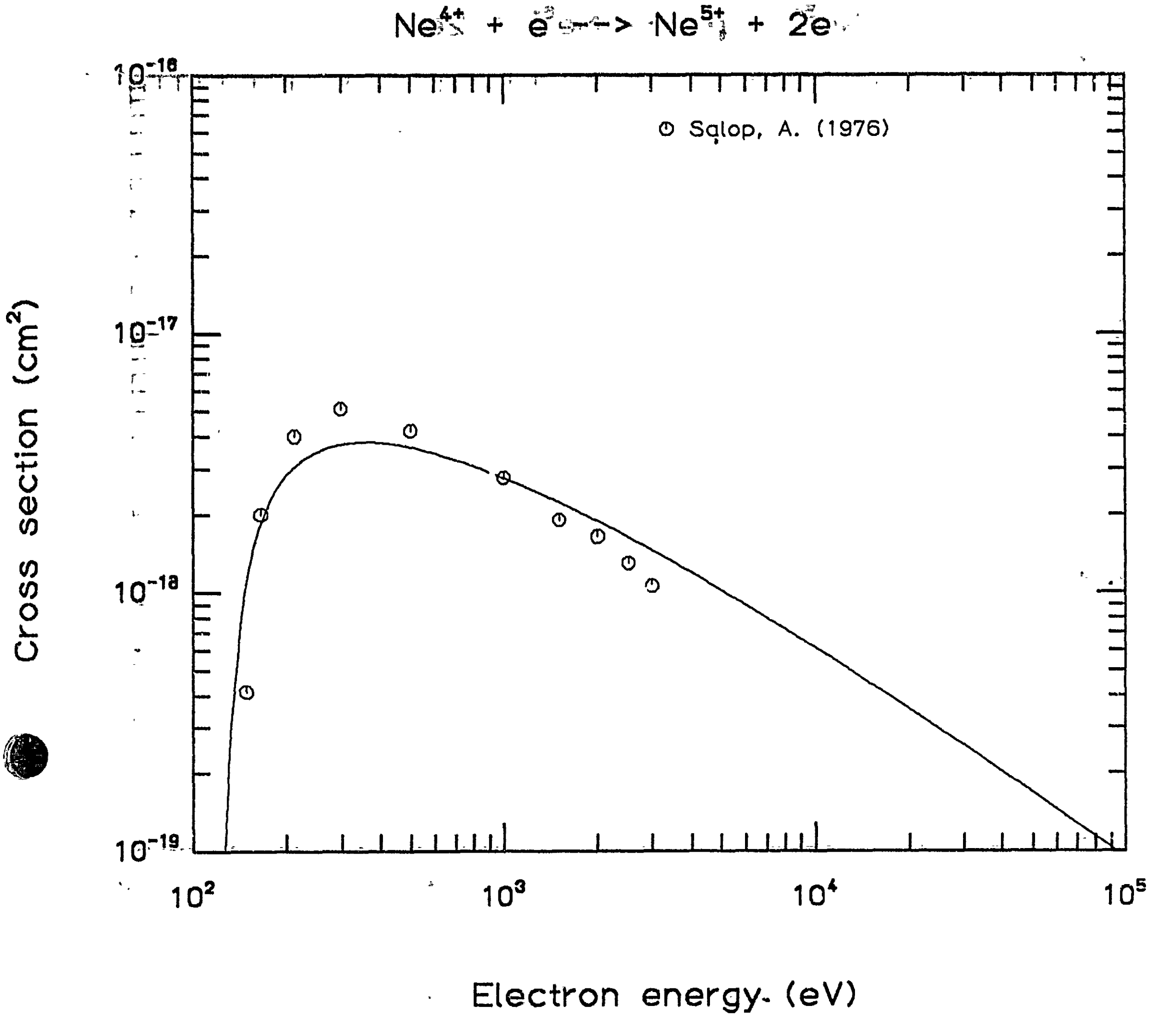

×10-17
Ne3+ + e --> Ne4+ + 2e
Salop, A. (1976)
Donets, E.D. et al. (1981)
Younger, S.M. (1982)
Gregory, D.C. et al. (1983)
Cross section (cm2)
1.5
1.0
0.5
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 66



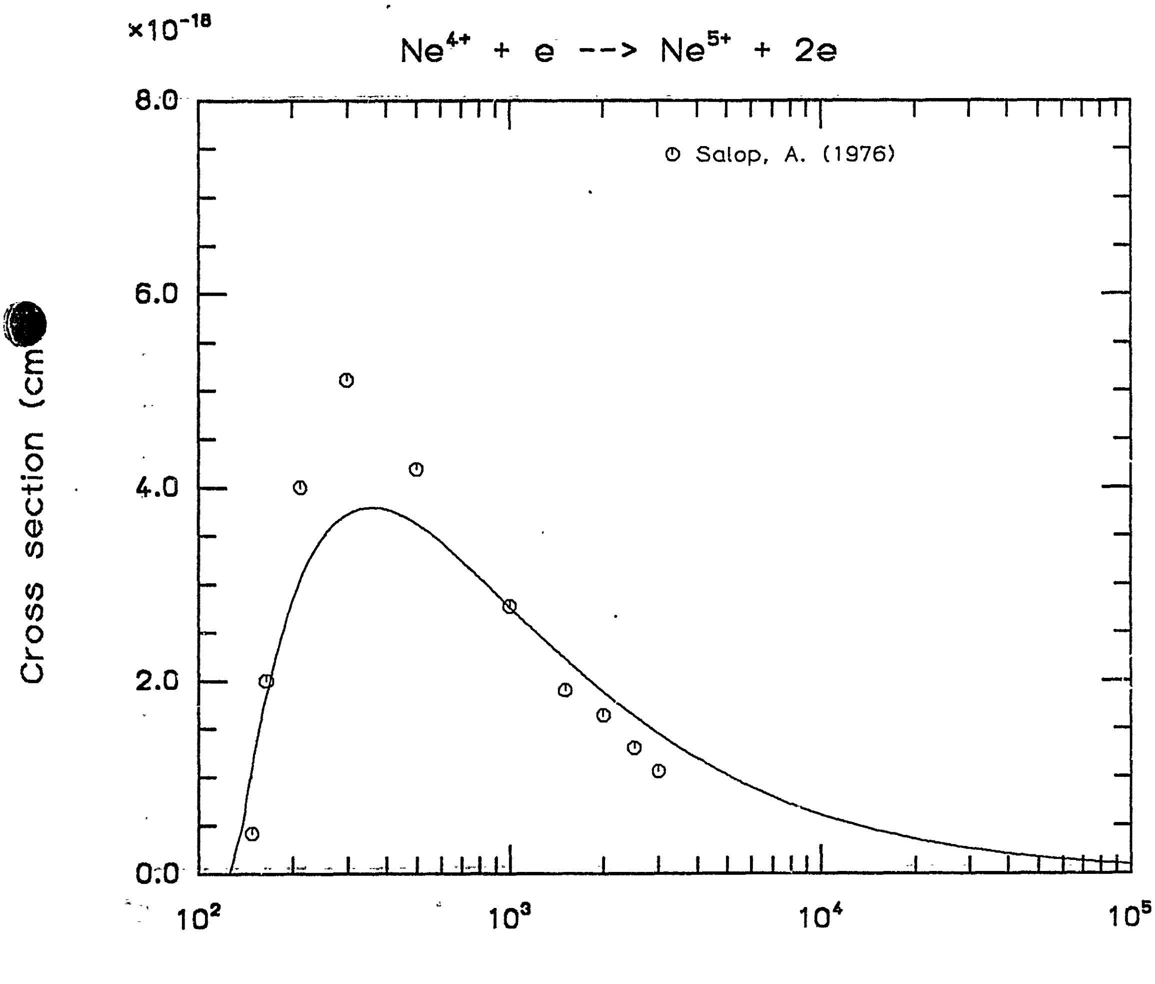
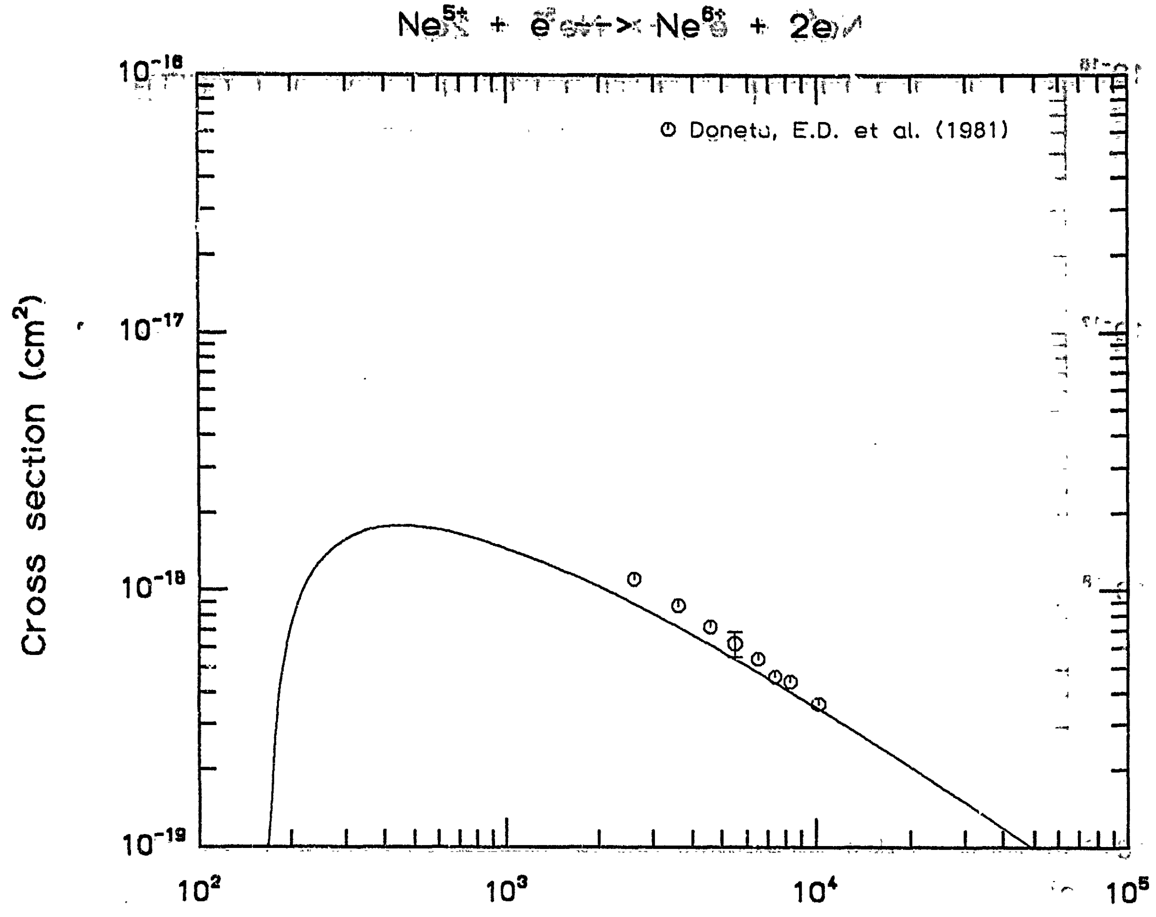
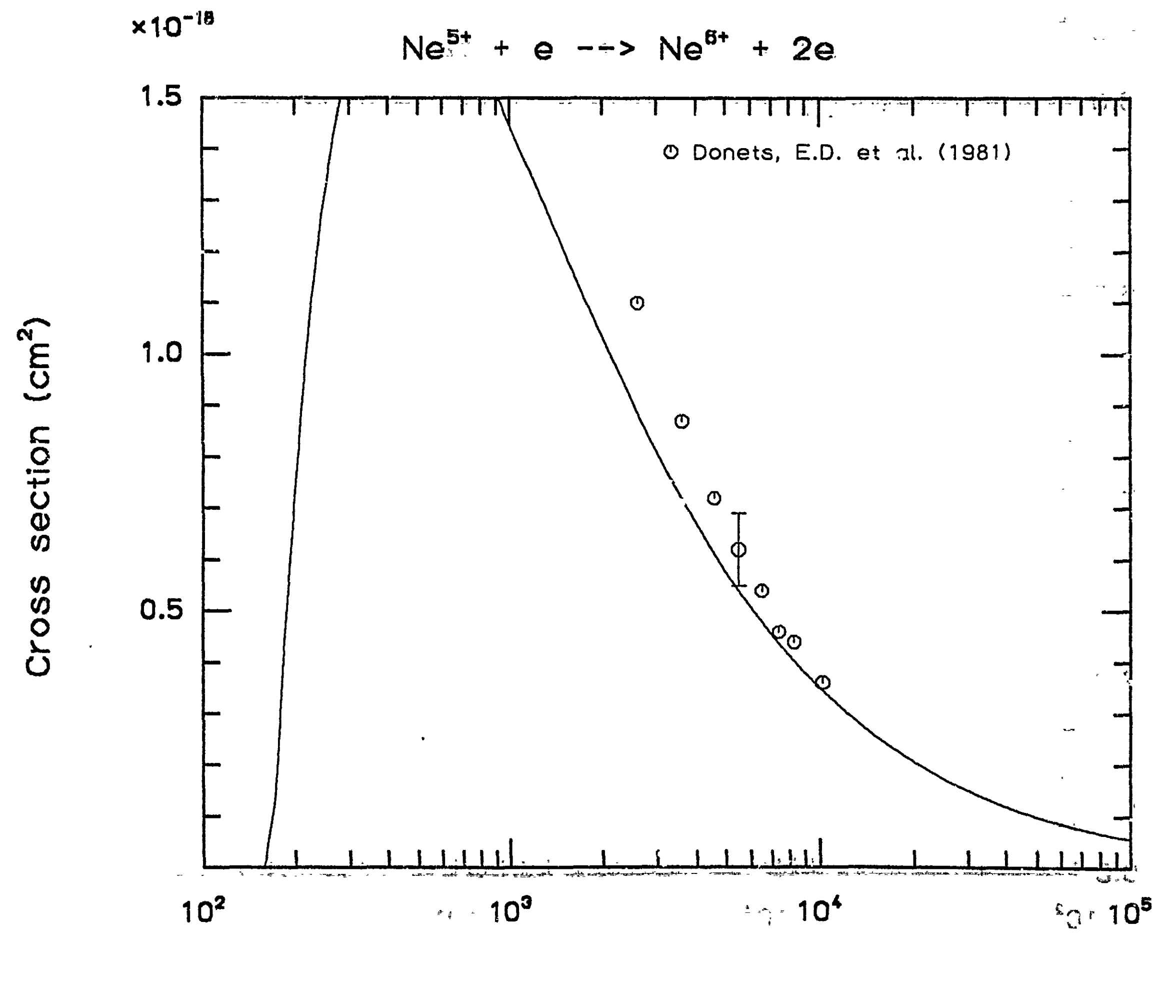


Fig. 67 Electron energy (eV)

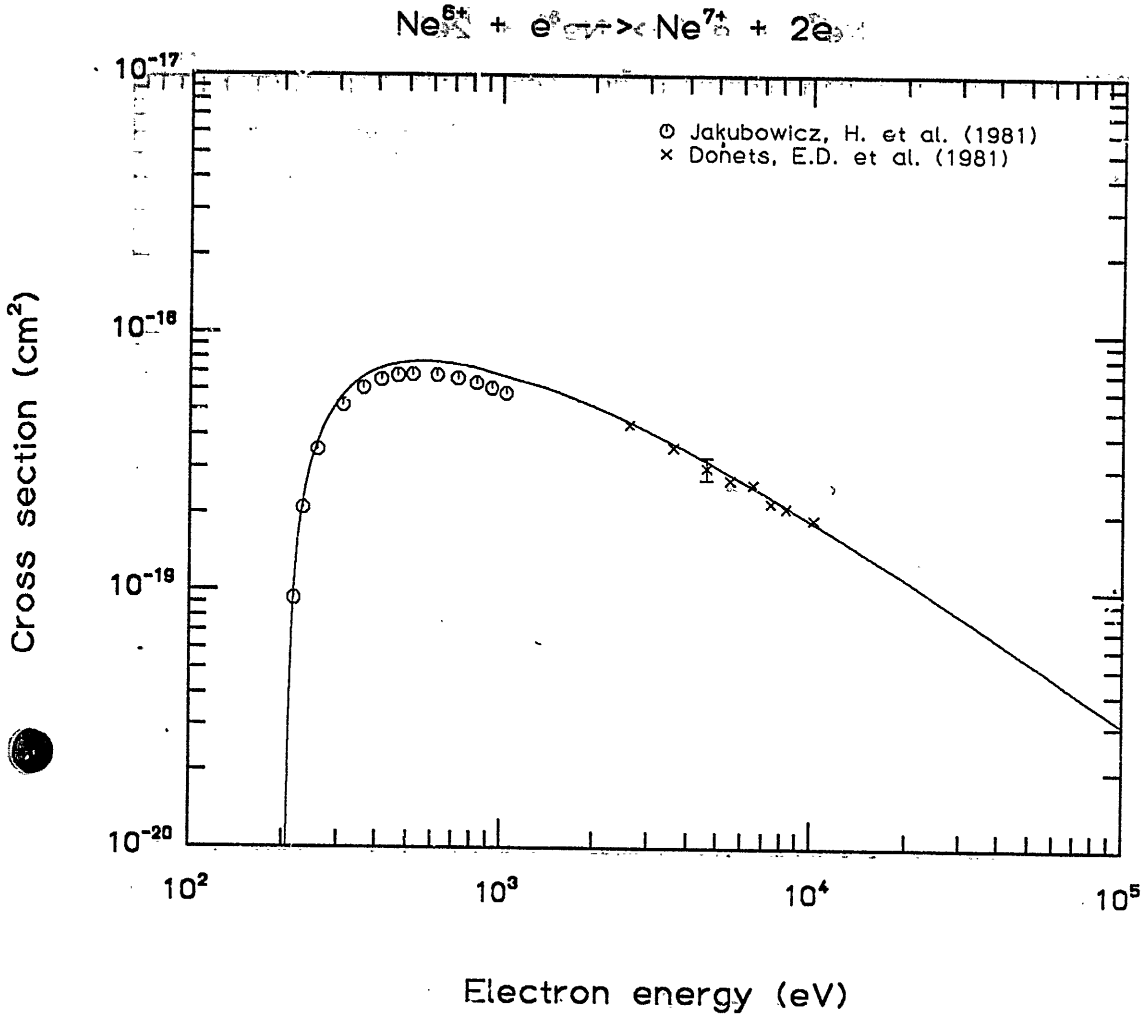


Ne5+ + e --> Ne6+ + 2e
Donets, E.D. et al. (1981)
Cross section (cm2)
10-16
10-17
10-18
10-19
102
103
104
105
Electron energy (eV)



×10-18
Ne5+ + e --> Ne6+ + 2e
Donets, E.D. et al. (1981)
Cross section (cm2)
1.5
1.0
0.5
102
103
104
105
Electron energy (eV)

Fig. 68


Ne6+ + e --> Ne7+ + 2e
Jakubowicz, H. et al. (1981)
Donets, E.D. et al. (1981)
Cross section (cm2)
10-17
10-18
10-19
10-20
10^2
10^3
10^4
10^5
Electron energy (eV)

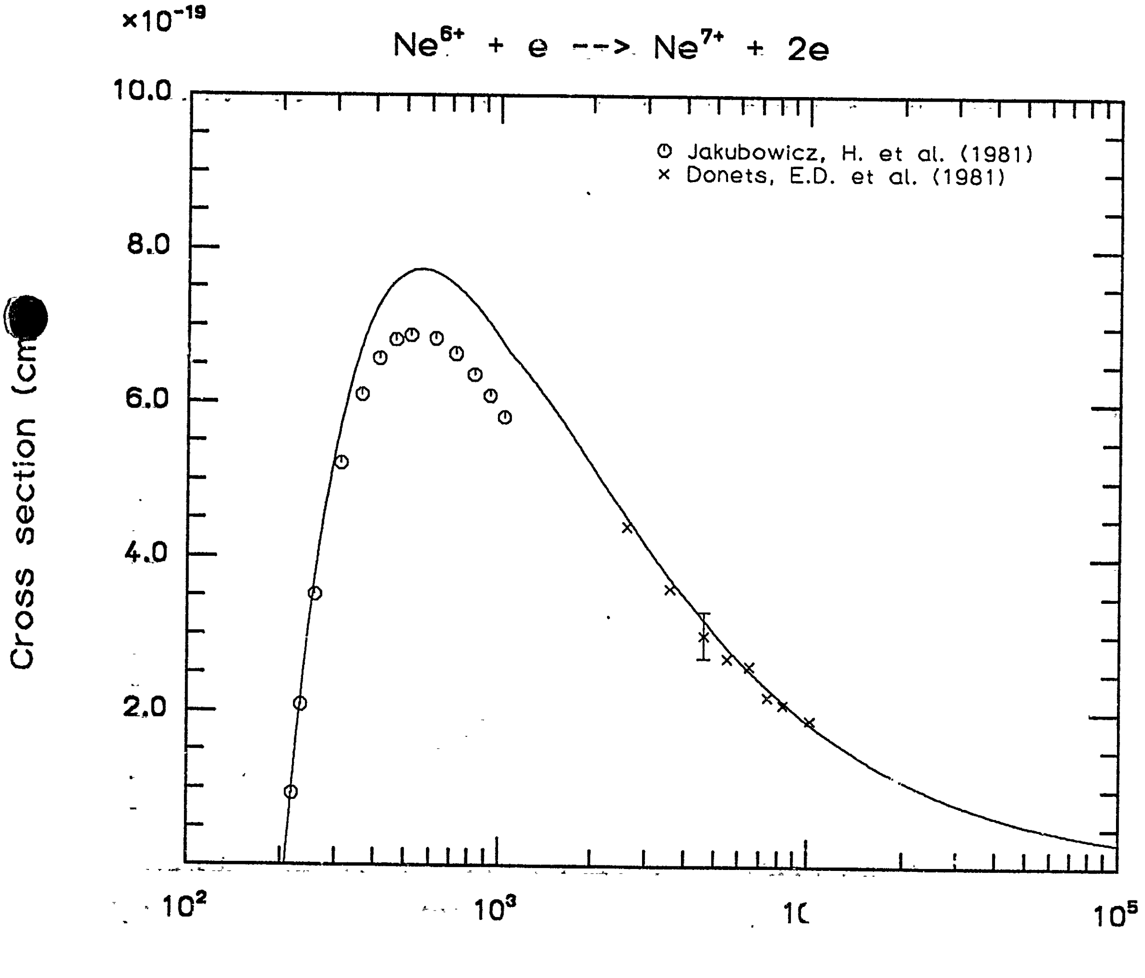
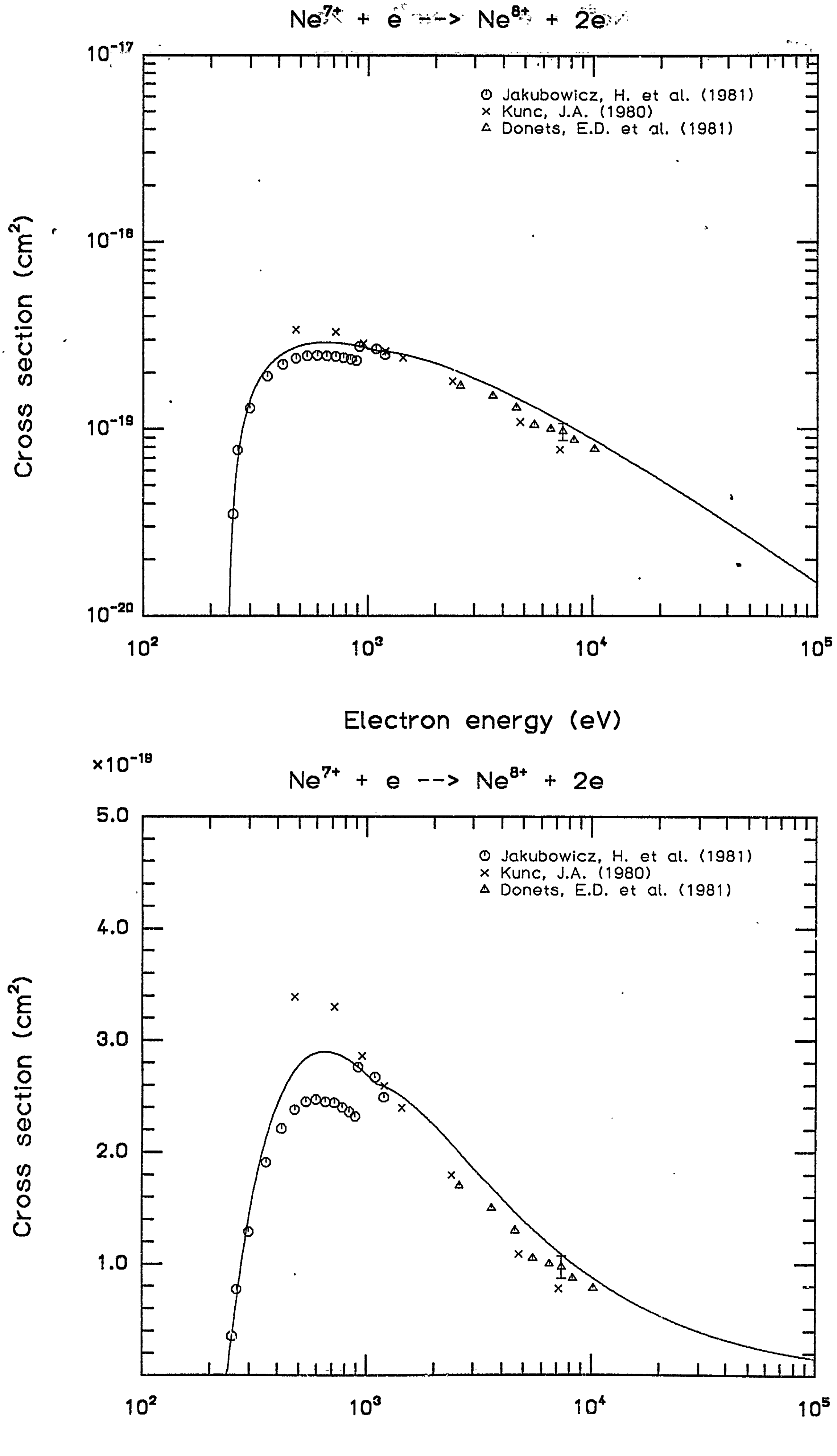
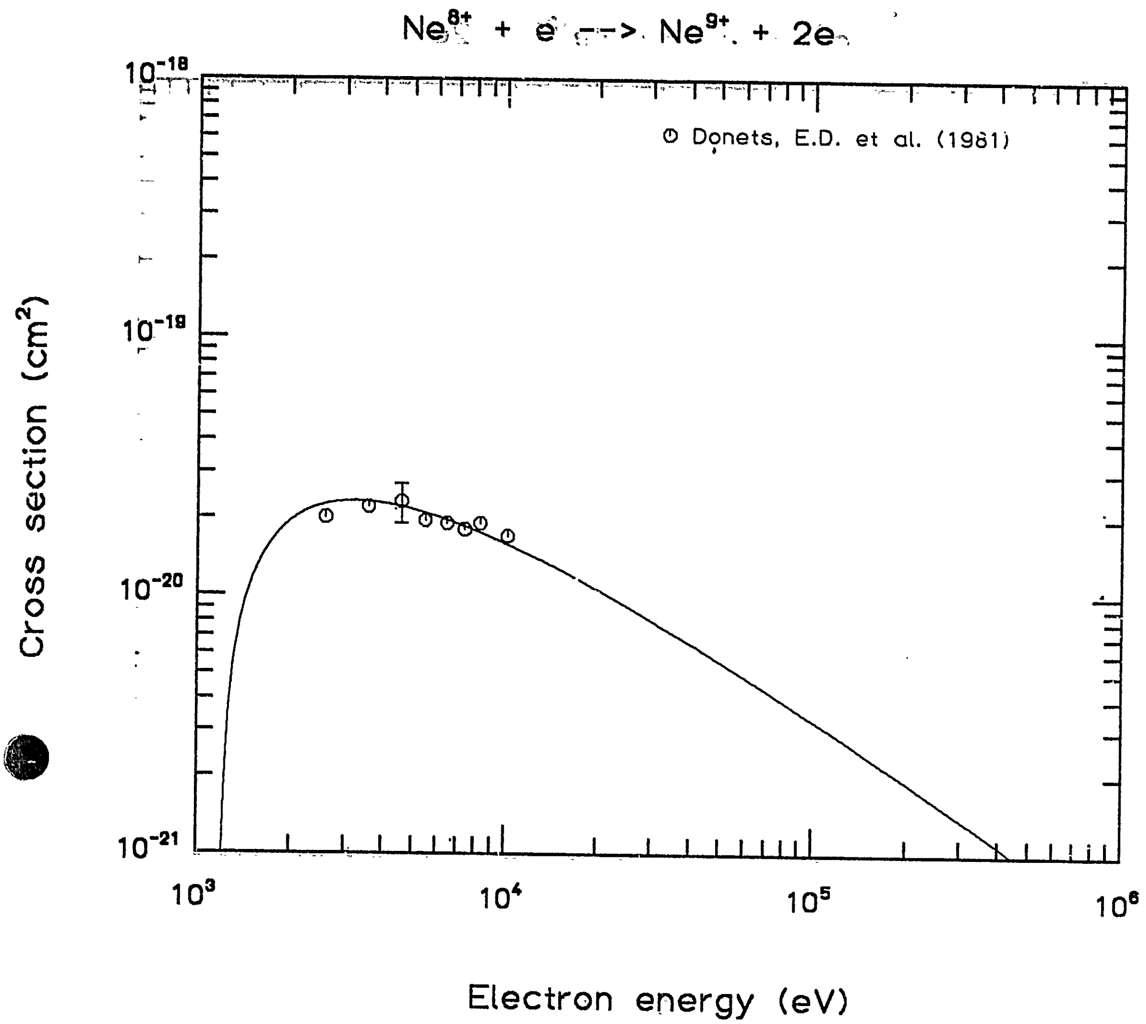

×10-19
Ne6+ + e --> Ne7+ + 2e
Jakubowicz, H. et al. (1981)
Donets, E.D. et al. (1981)
Cross section (cm
10.0
8.0
6.0
4.0
2.0
10^2
10^3
10^5
Electron energy (eV)

Fig. 69



Ne7+ + e --> Ne8+ + 2e
Jakubowicz, H. et al. (1981)
Kunc, J.A. (1980)
Donets, E.D. et al. (1981)
Cross section (cm2)
Electron energy (eV)
×10-19

Fig. 70



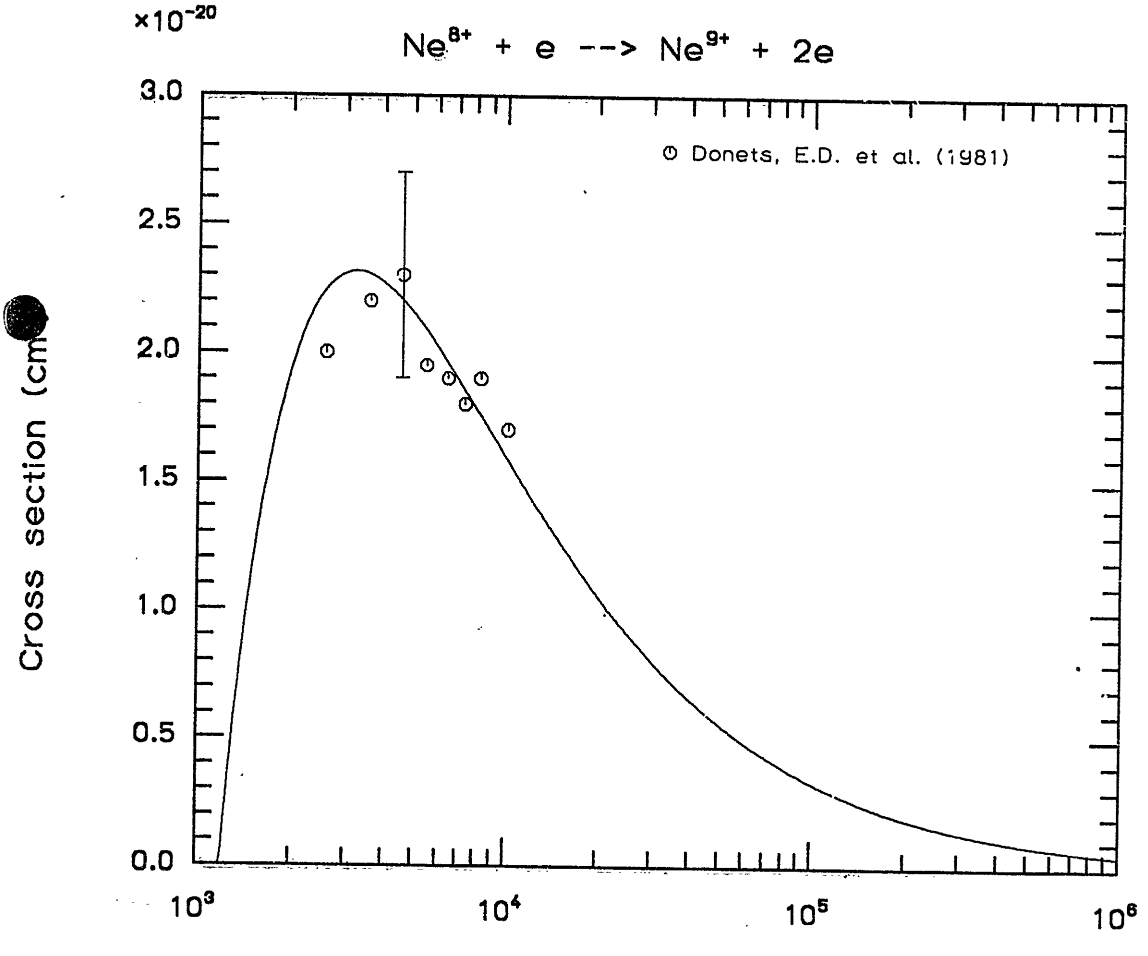
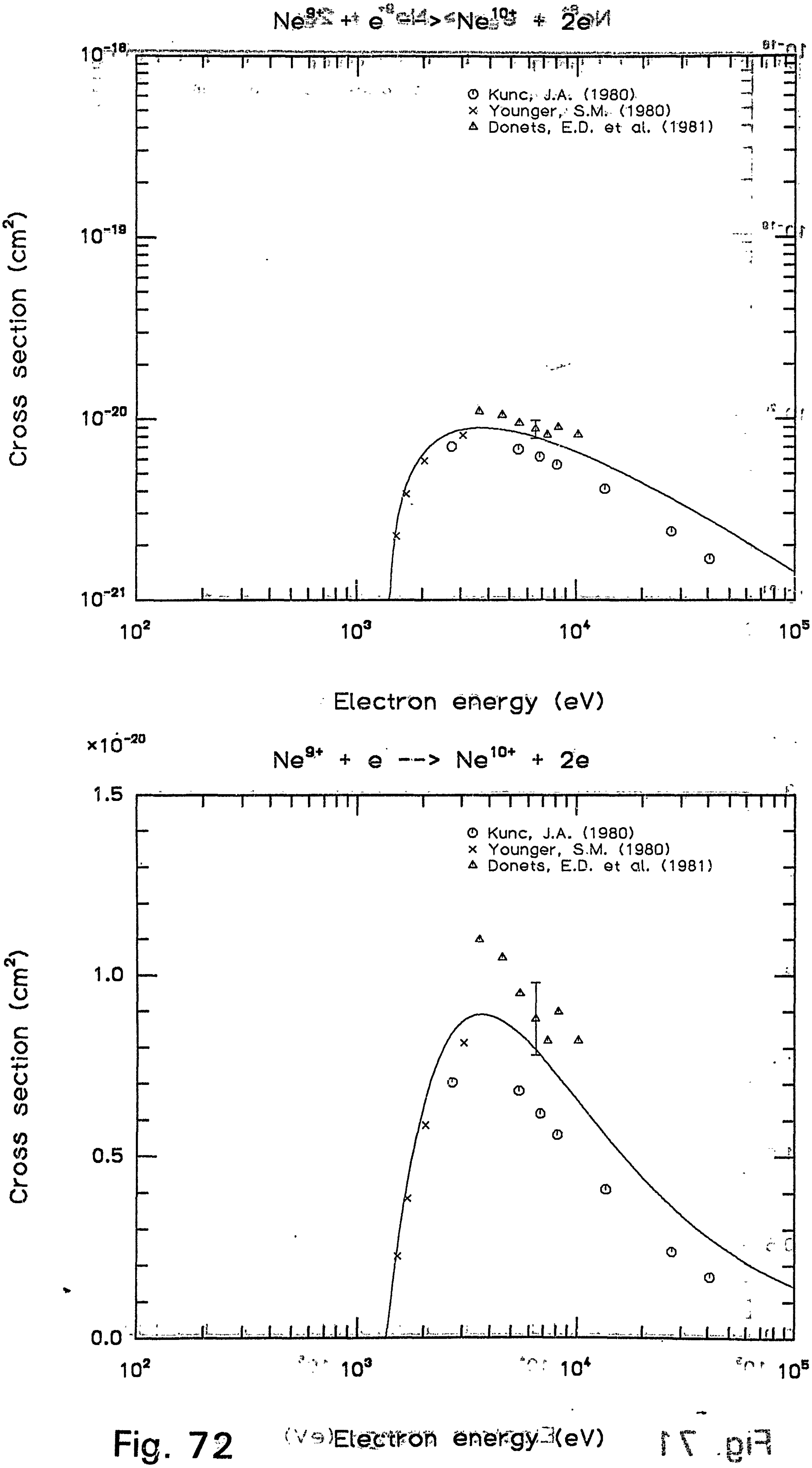
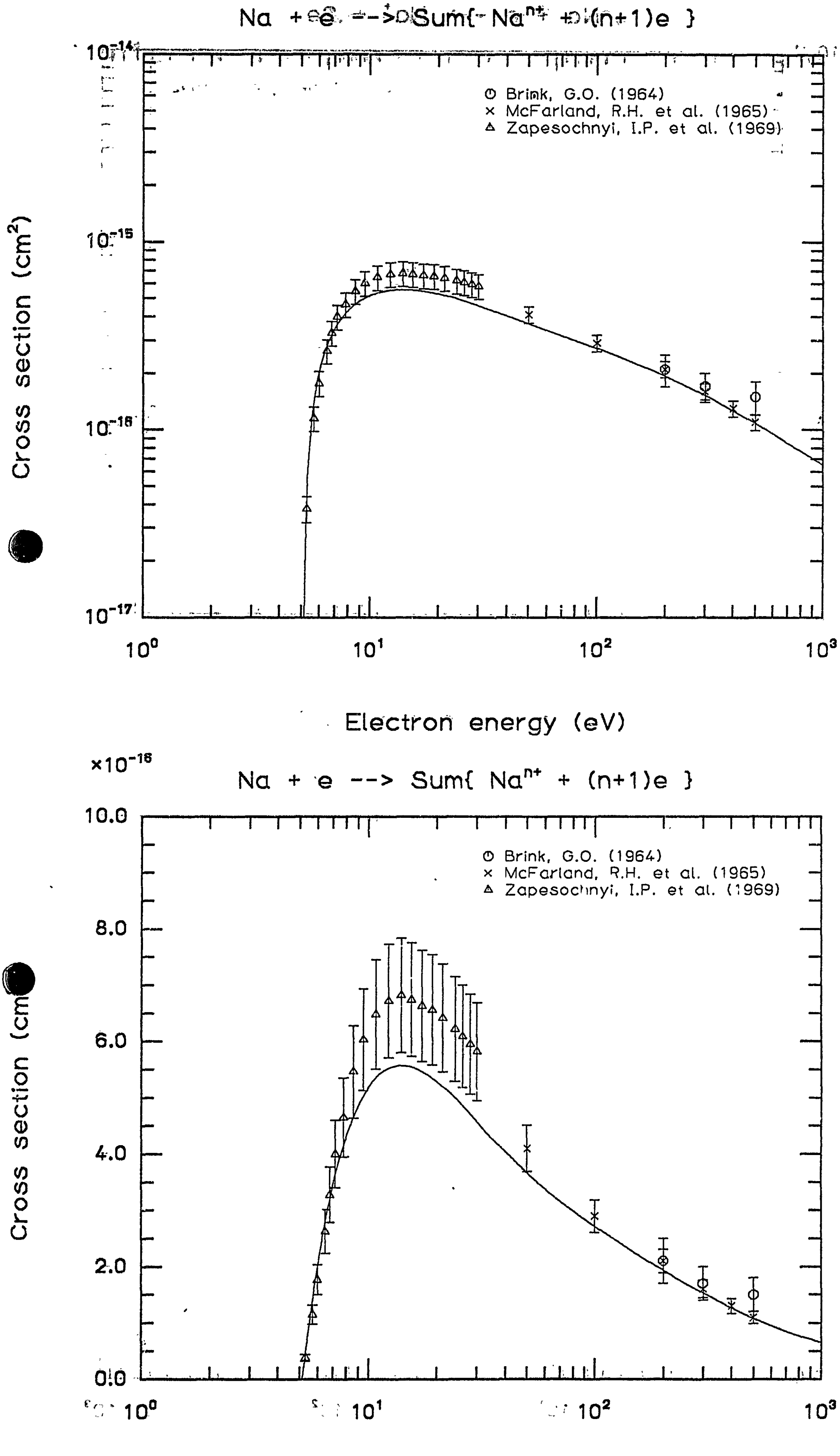


Fig. 71 Electron energy (eV)



Ne9+ + e --> Ne10+ + 2e
Kunc, J.A. (1980)
Younger, S.M. (1980)
Donets, E.D. et al. (1981)
Cross section (cm2)
10-18
10-19
10-20
10-21
10²
10³
10⁴
10⁵
Electron energy (eV)
×10-20
Ne9+ + e --> Ne10+ + 2e
Kunc, J.A. (1980)
Younger, S.M. (1980)
Donets, E.D. et al. (1981)
Cross section (cm2)
1.5
1.0
0.5
0.0
10²
10³
10⁴
10⁵
Electron energy (eV)

Fig. 72



Na + e --> Sum{ Na^{n+} + (n+1)e }
Brink, G.O. (1964)
McFarland, R.H. et al. (1965)
Zapesochnyi, I.P. et al. (1969)
Cross section (cm^2)
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^0
10^1
10^2
10^3
Electron energy (eV)
$\times 10^{-16}$
Na + e --> Sum{ Na^{n+} + (n+1)e }
Brink, G.O. (1964)
McFarland, R.H. et al. (1965)
Zapesochnyi, I.P. et al. (1969)
Cross section (cm
10.0
8.0
6.0
4.0
2.0
0.0
10^0
10^1
10^2
10^3
Electron energy (eV)

Fig. 73

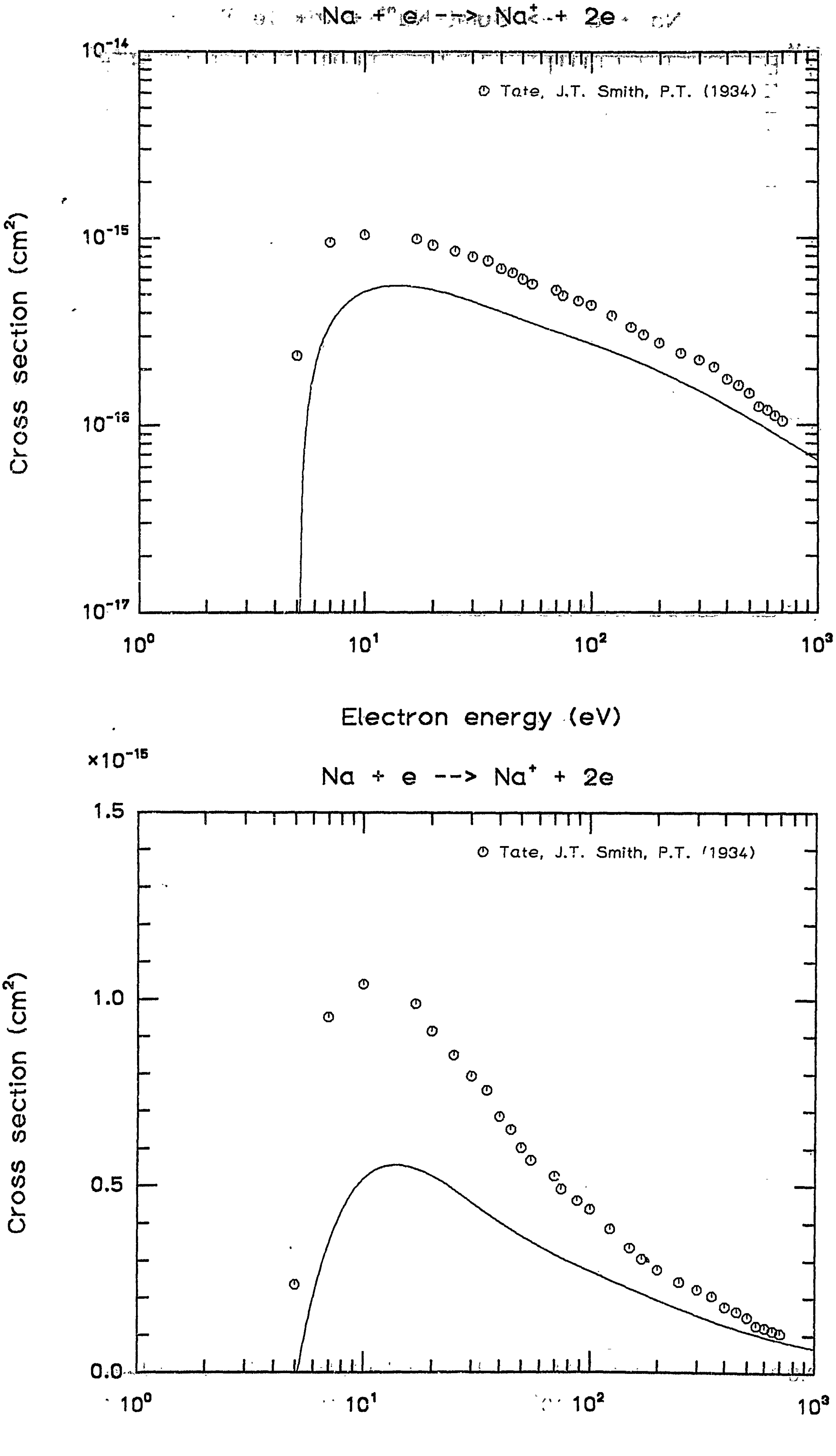
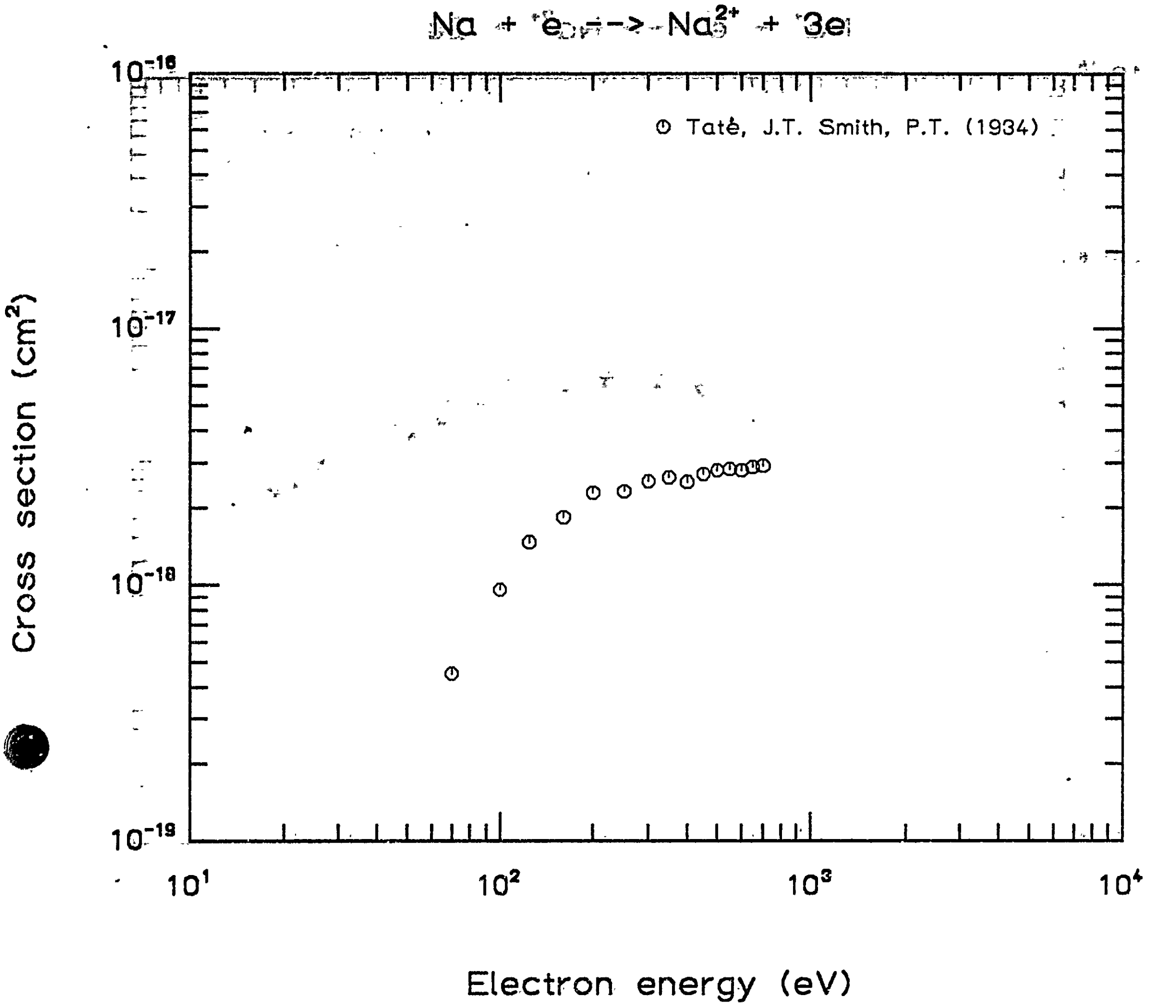
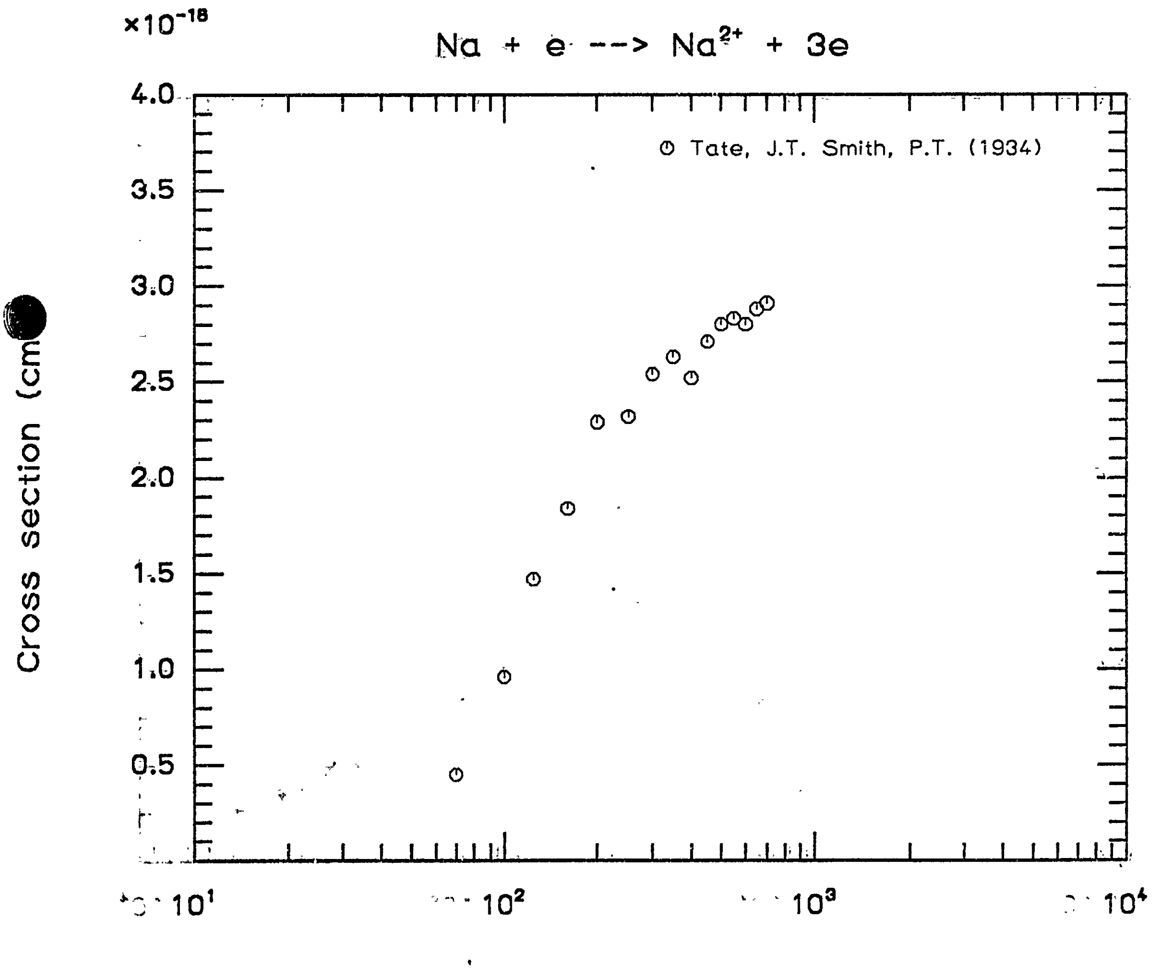

Na + e --> Na+ + 2e
Tate, J.T. Smith, P.T. (1934)
Cross section (cm2)
10-14
10-15
10-16
10-17
10^0
10^1
10^2
10^3
Electron energy (eV)
x10-15
Na + e --> Na+ + 2e
Tate, J.T. Smith, P.T. (1934)
Cross section (cm2)
1.5
1.0
0.5
0.0
10^0
10^1
10^2
10^3
Electron energy (eV)

Fig. 74

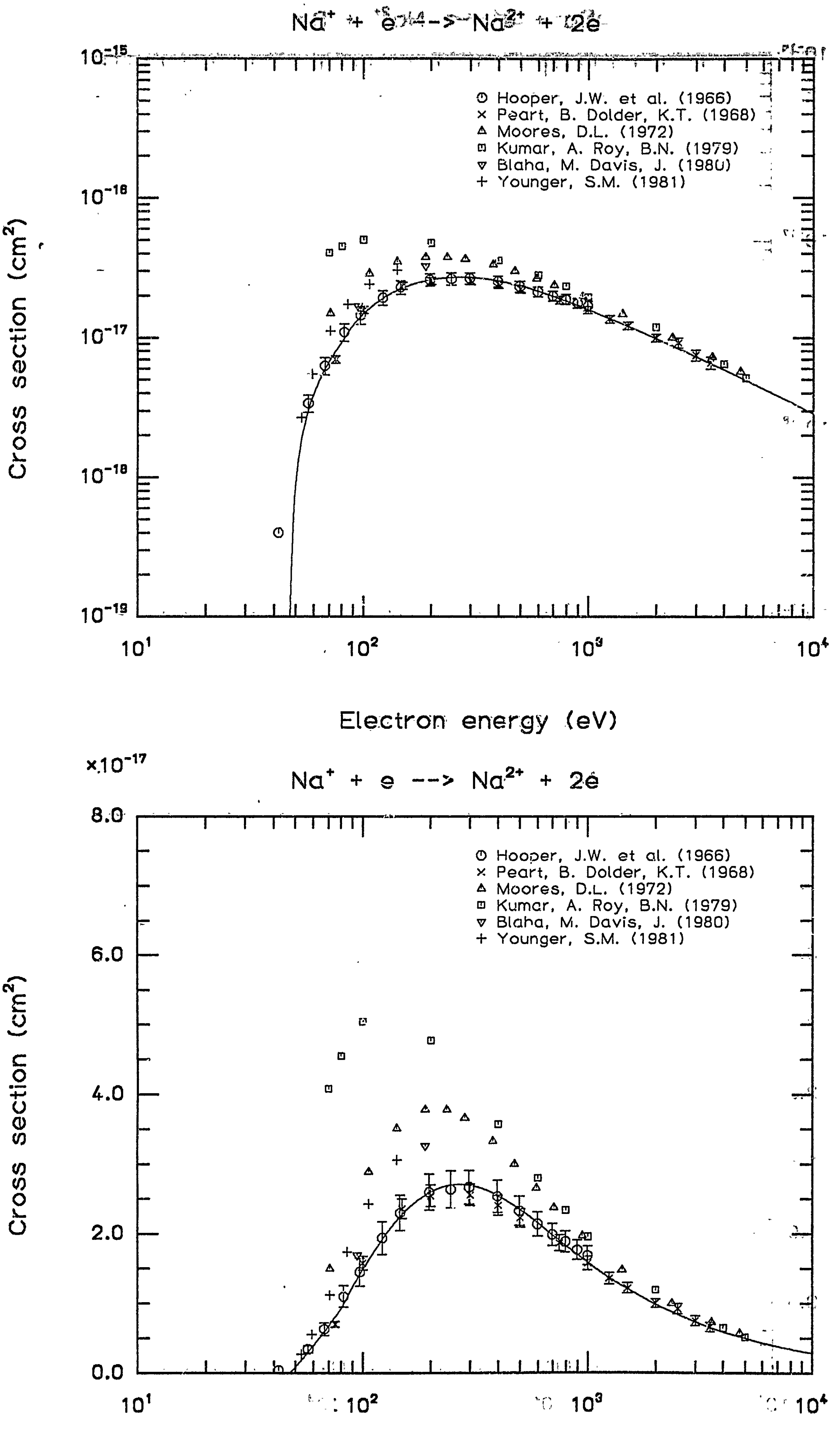


Na + e --> Na^{2+} + 3e
Tate, J.T. Smith, P.T. (1934)
Cross section (cm^2)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^1
10^2
10^3
10^4
Electron energy (eV)



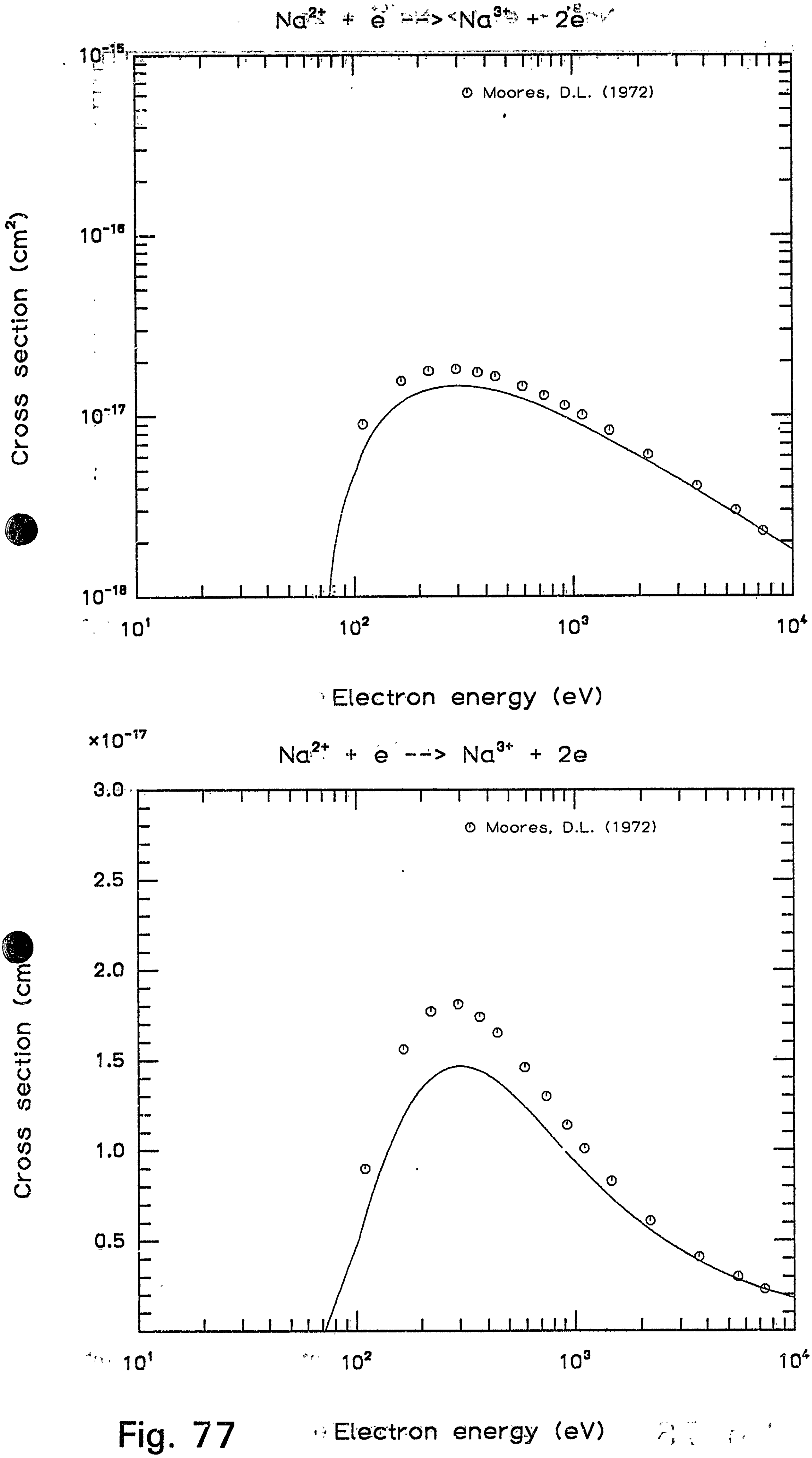
$\times 10^{-18}$
Na + e --> Na^{2+} + 3e
Tate, J.T. Smith, P.T. (1934)
Cross section (cm
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 75



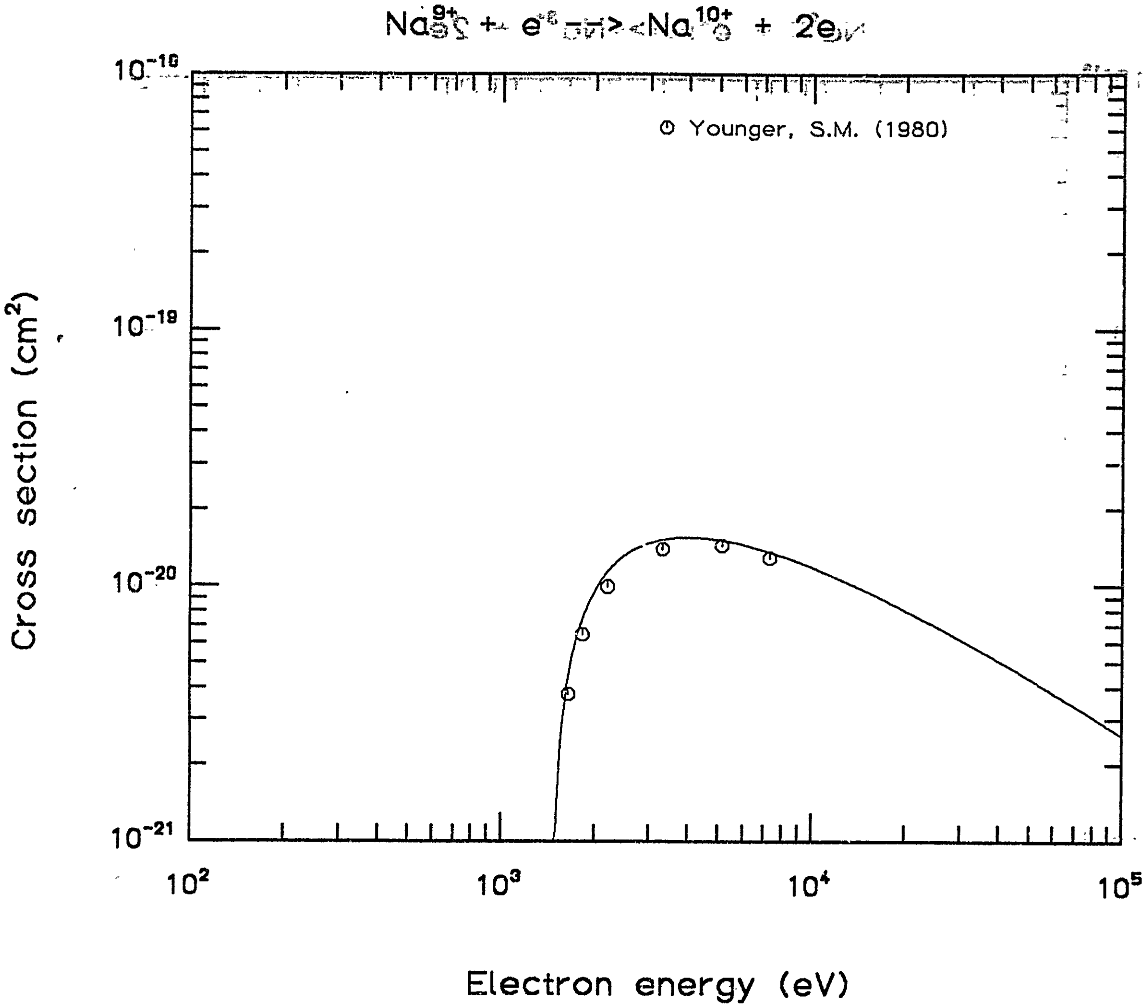
Na+ + e --> Na2+ + 2e
Hooper, J.W. et al. (1966)
Peart, B. Dolder, K.T. (1968)
Moores, D.L. (1972)
Kumar, A. Roy, B.N. (1979)
Blaha, M. Davis, J. (1980)
Younger, S.M. (1981)
Cross section (cm2)
Electron energy (eV)
×10-17
Na+ + e --> Na2+ + 2e
Hooper, J.W. et al. (1966)
Peart, B. Dolder, K.T. (1968)
Moores, D.L. (1972)
Kumar, A. Roy, B.N. (1979)
Blaha, M. Davis, J. (1980)
Younger, S.M. (1981)
Cross section (cm2)
Electron energy (eV)

Fig. 76

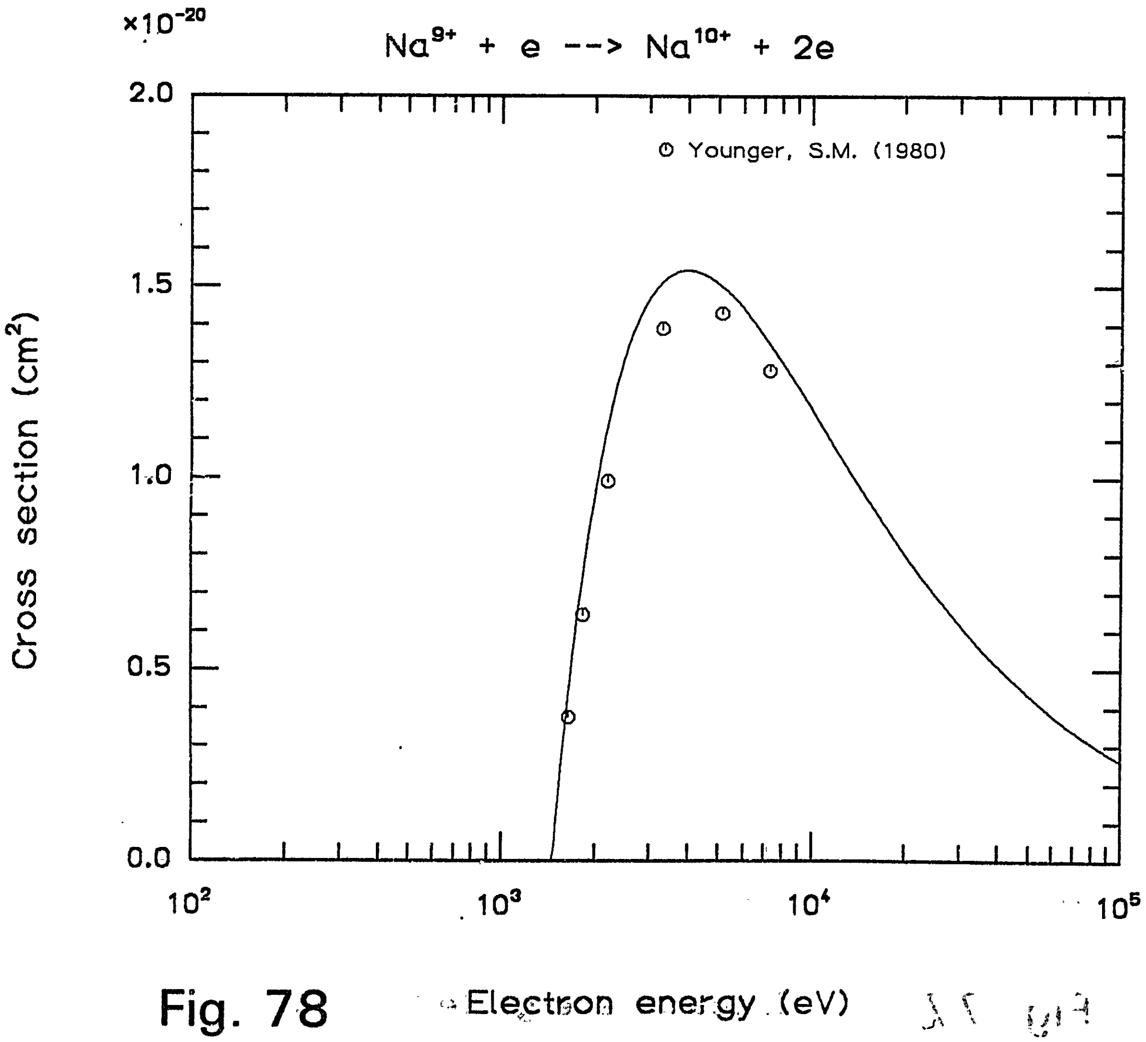


Na^{2+} + e --> Na^{3+} + 2e
Moores, D.L. (1972)
Cross section (cm²)
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10¹
10²
10³
10⁴
Electron energy (eV)
×10⁻¹⁷
Na^{2+} + e --> Na^{3+} + 2e
Moores, D.L. (1972)
3.0
2.5
2.0
1.5
1.0
0.5
Cross section (cm
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 77

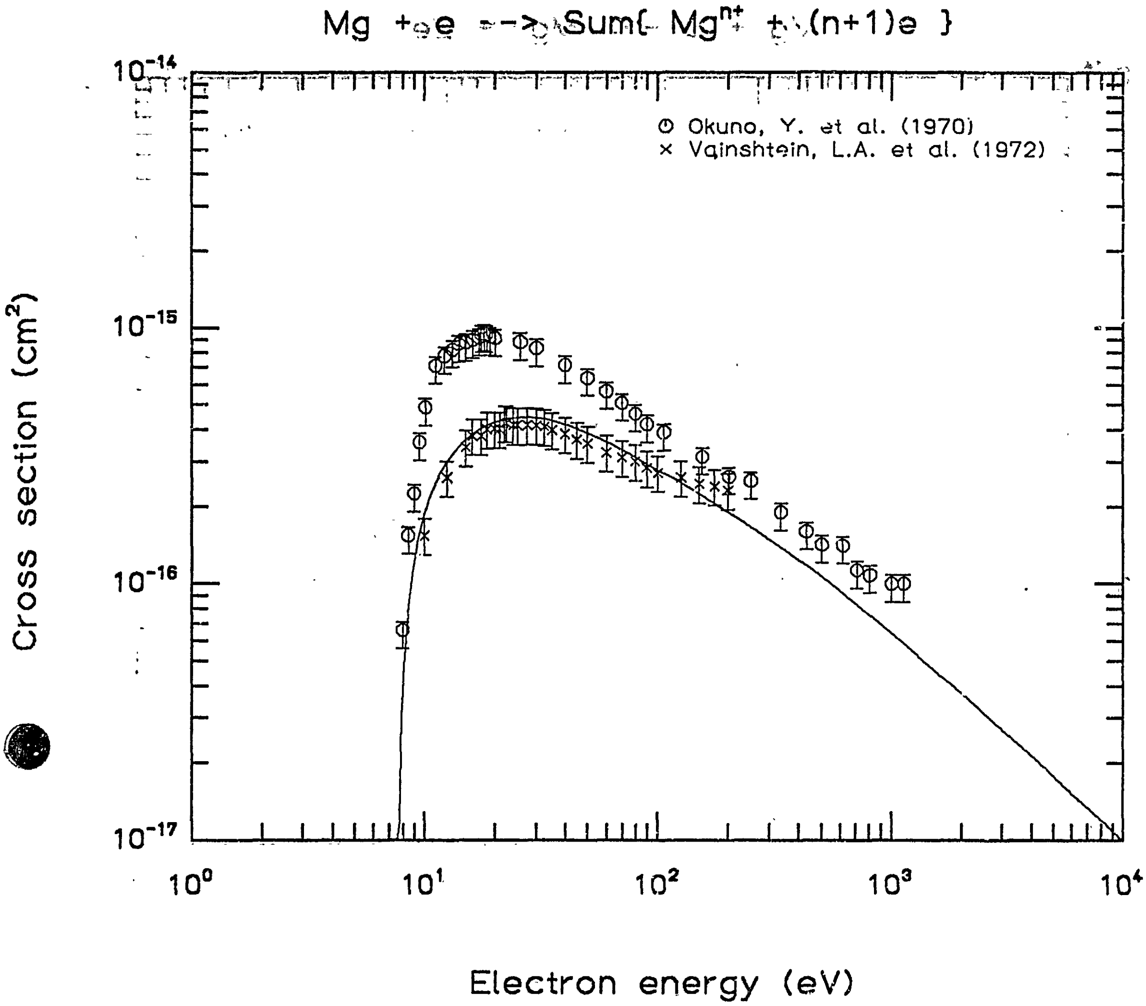


$Na^{9+} + e \dashrightarrow Na^{10+} + 2e$
Younger, S.M. (1980)
Cross section (cm^2)
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^2
10^3
10^4
10^5
Electron energy (eV)



$\times 10^{-20}$
$Na^{9+} + e \dashrightarrow Na^{10+} + 2e$
Younger, S.M. (1980)
Cross section (cm^2)
2.0
1.5
1.0
0.5
0.0
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 78



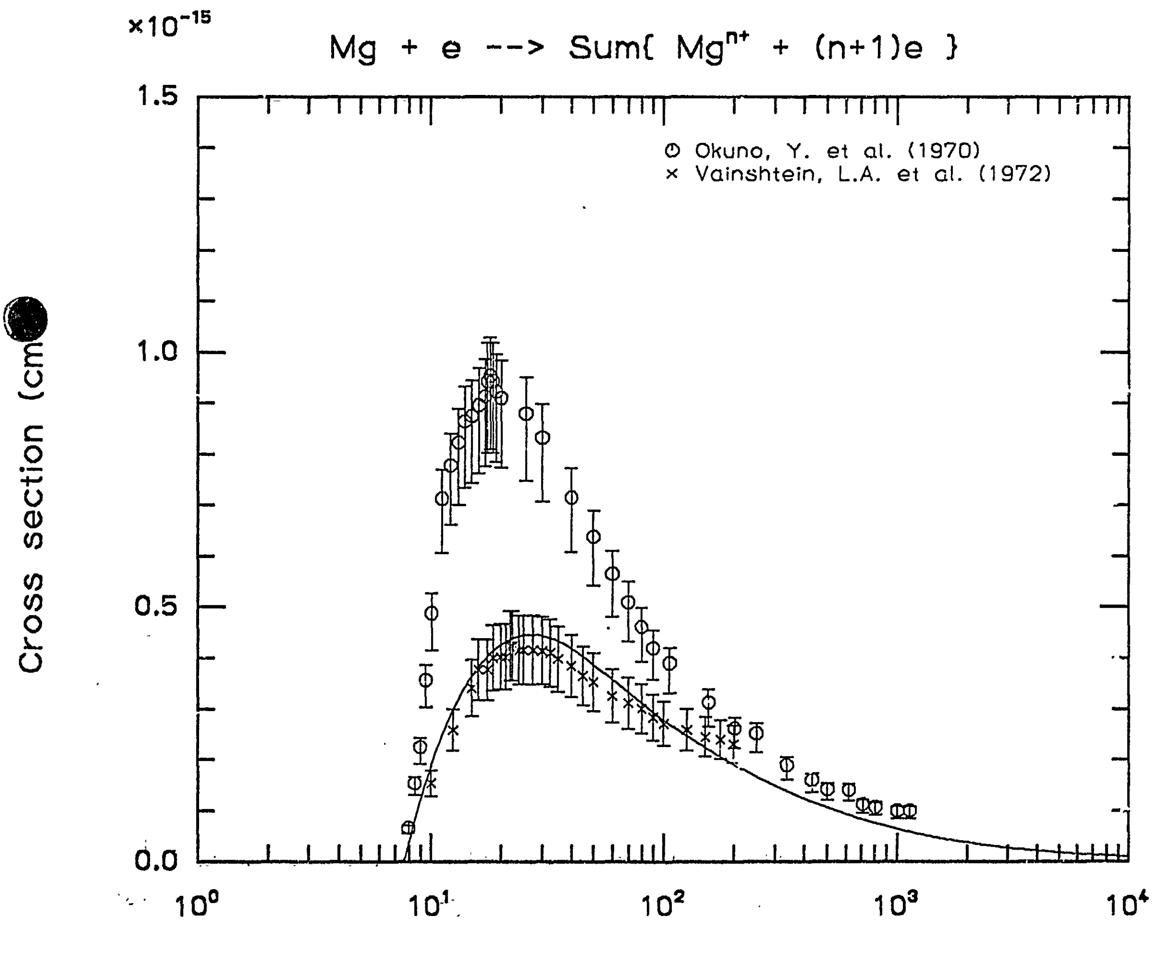
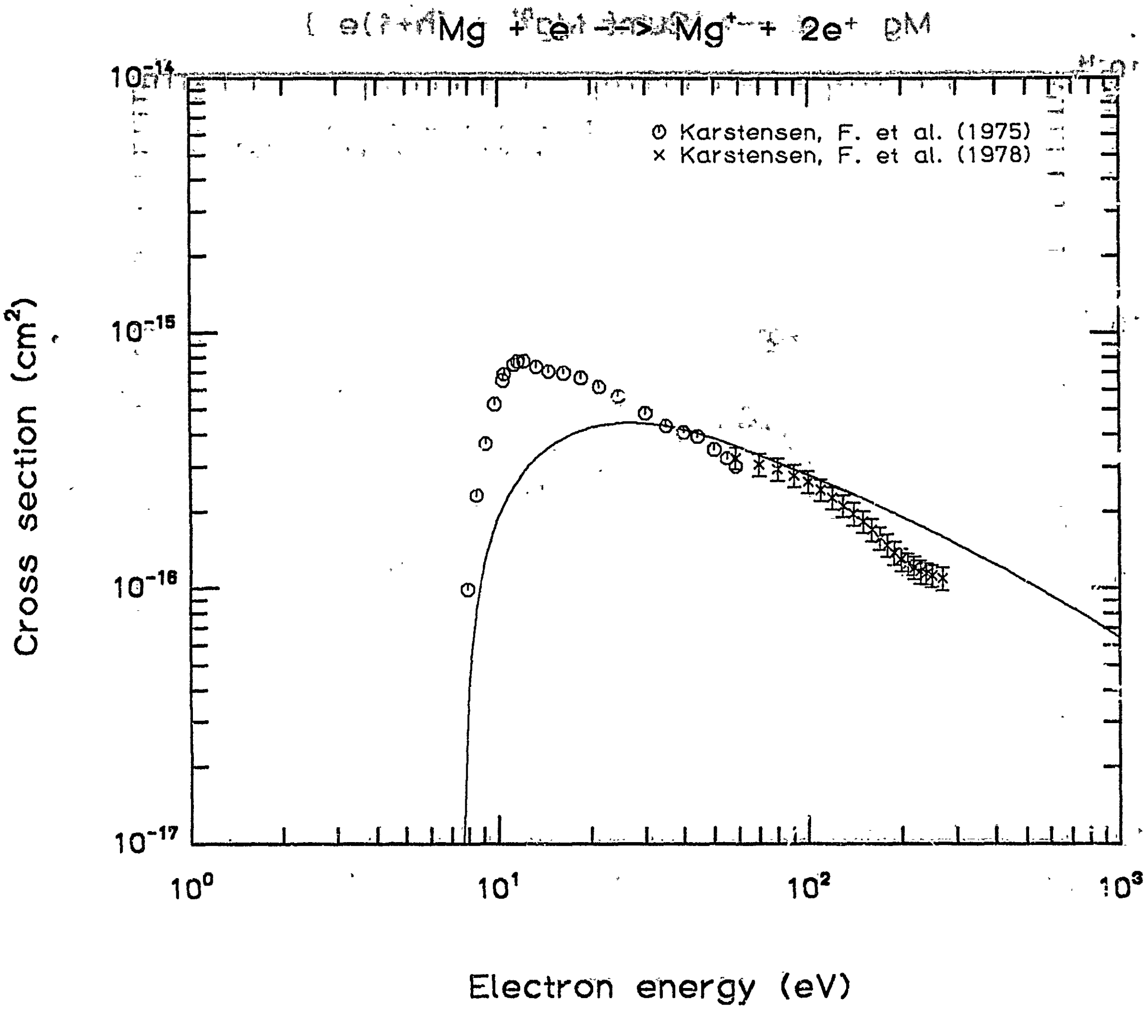


Fig. 79 Electron energy (eV)


Mg + e --> Mg+ + 2e
Karstensen, F. et al. (1975)
Karstensen, F. et al. (1978)
Cross section (cm2)
10-14
10-15
10-16
10-17
100
101
102
103
Electron energy (eV)

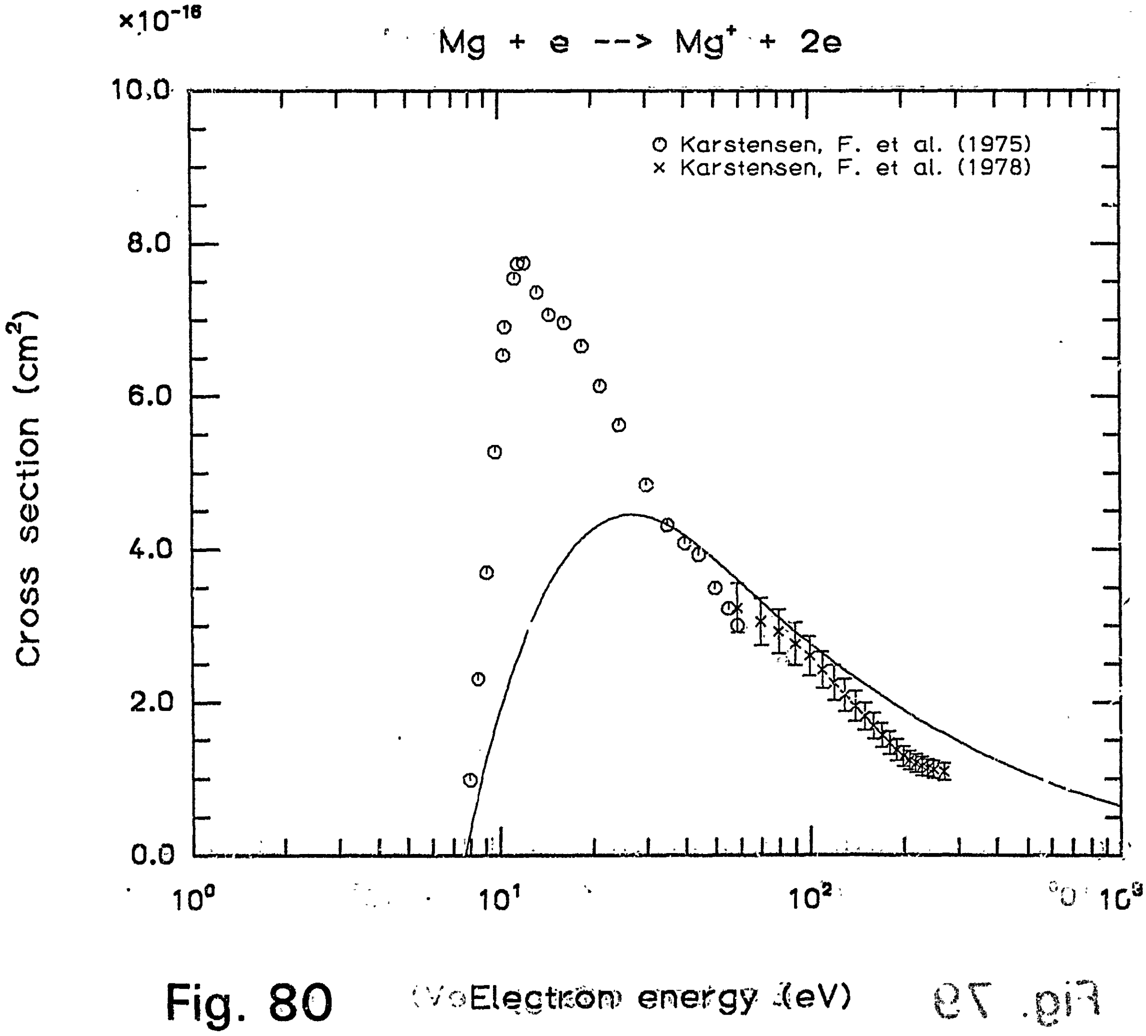
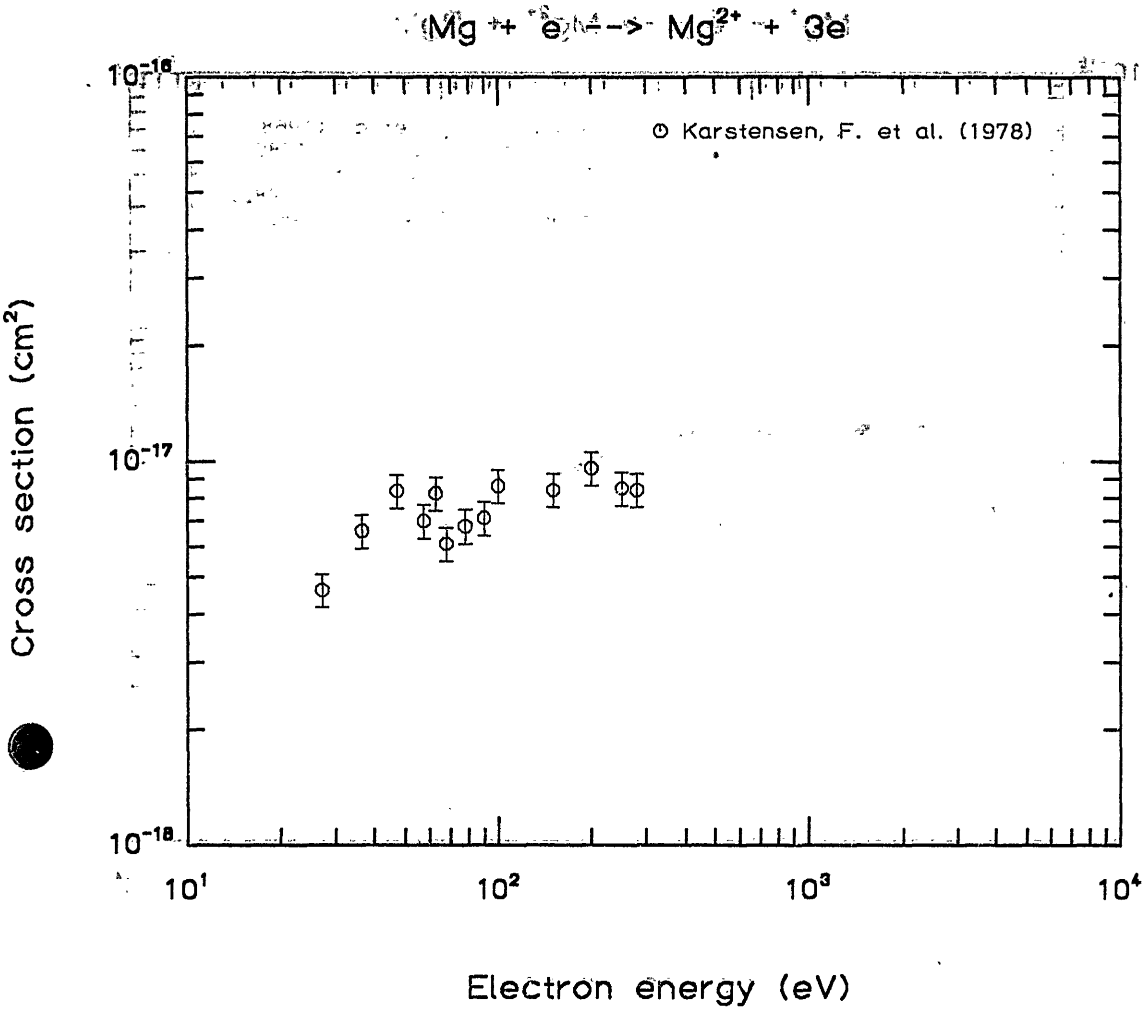
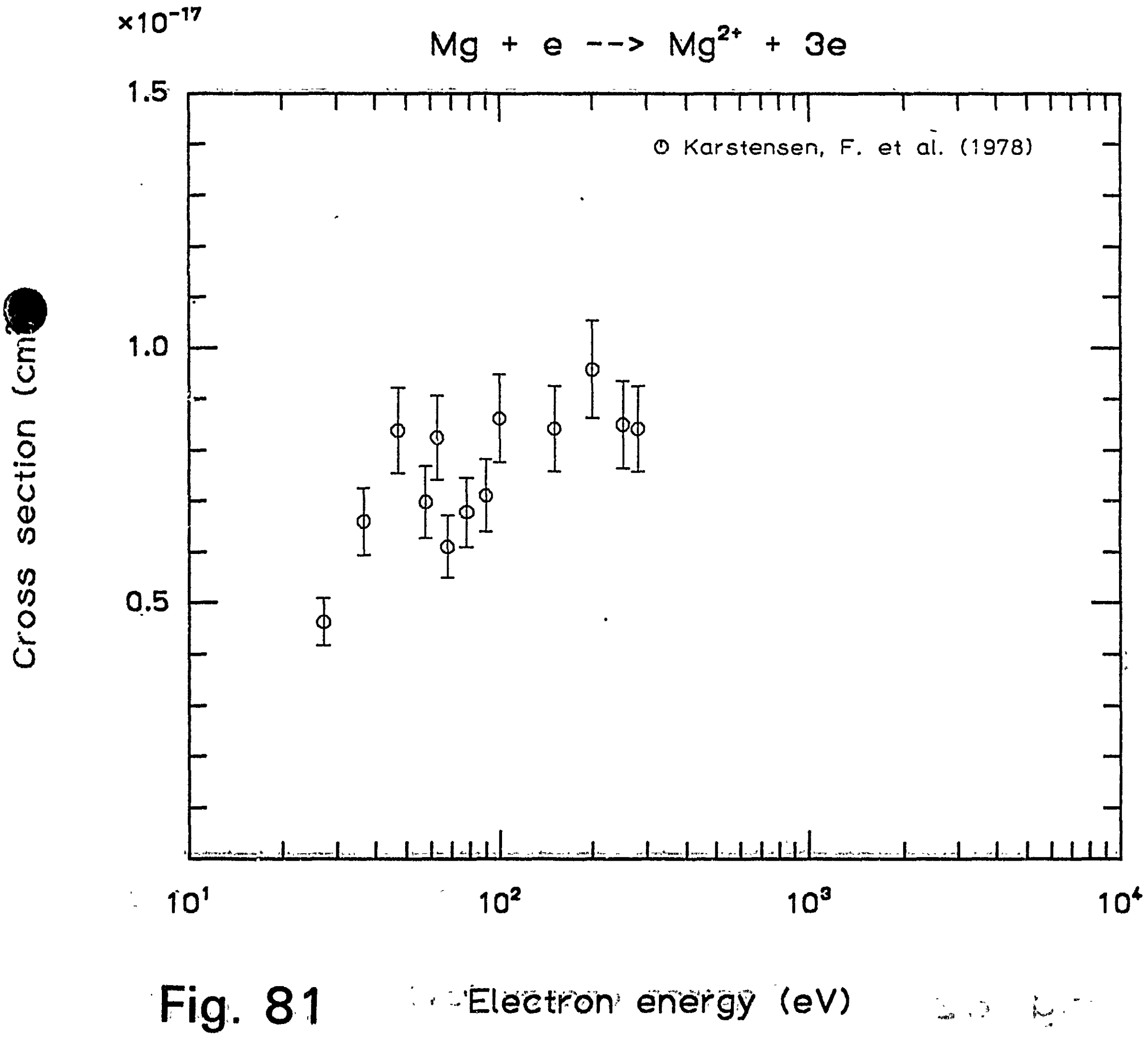

×10-16
Mg + e --> Mg+ + 2e
Karstensen, F. et al. (1975)
Karstensen, F. et al. (1978)
Cross section (cm2)
10.0
8.0
6.0
4.0
2.0
0.0
100
101
102
103
Electron energy (eV)

Fig. 80

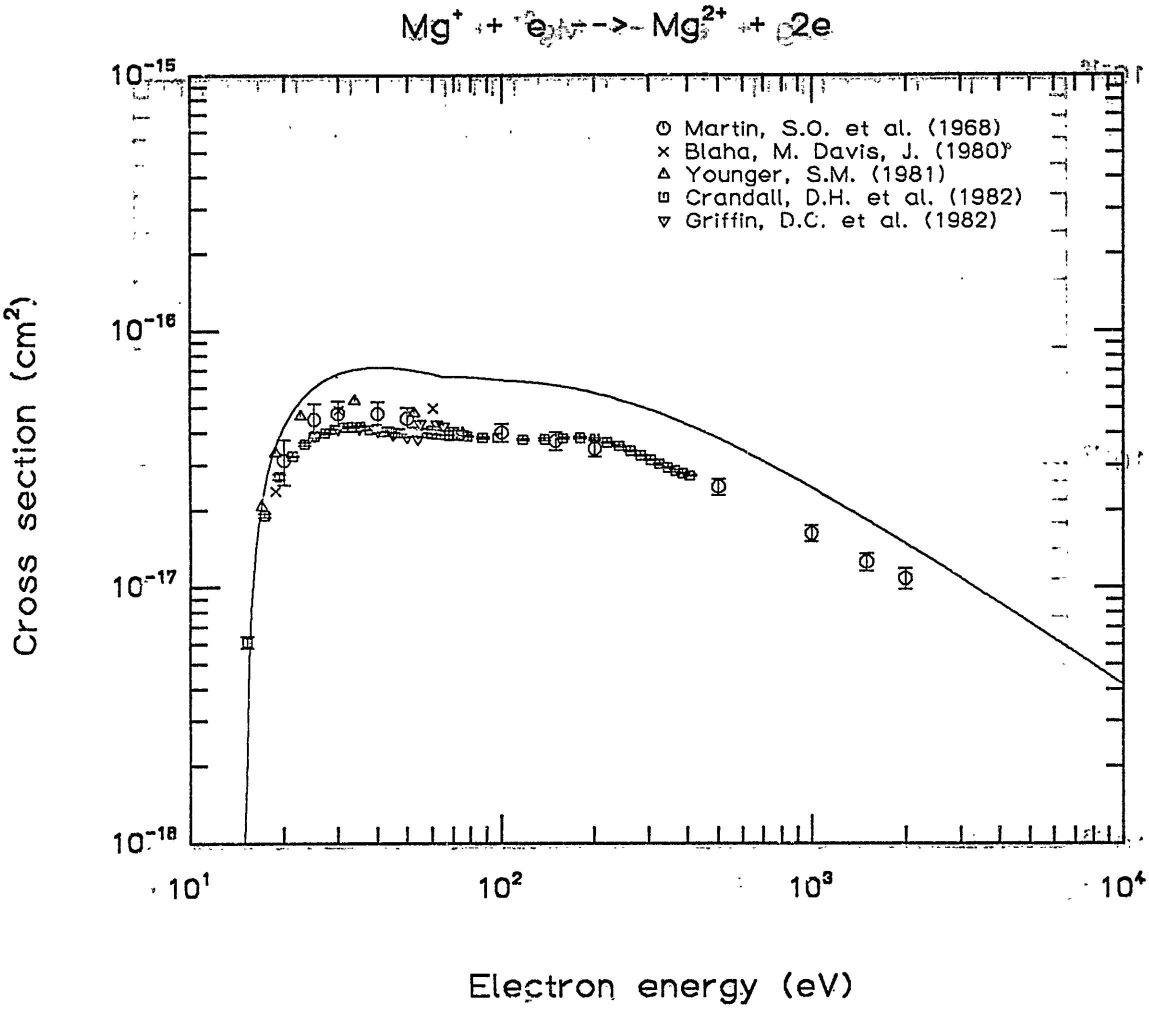


Mg + e --> Mg2+ + 3e
Karstensen, F. et al. (1978)
Cross section (cm2)
10-16
10-17
10-18
10¹
10²
10³
10⁴
Electron energy (eV)

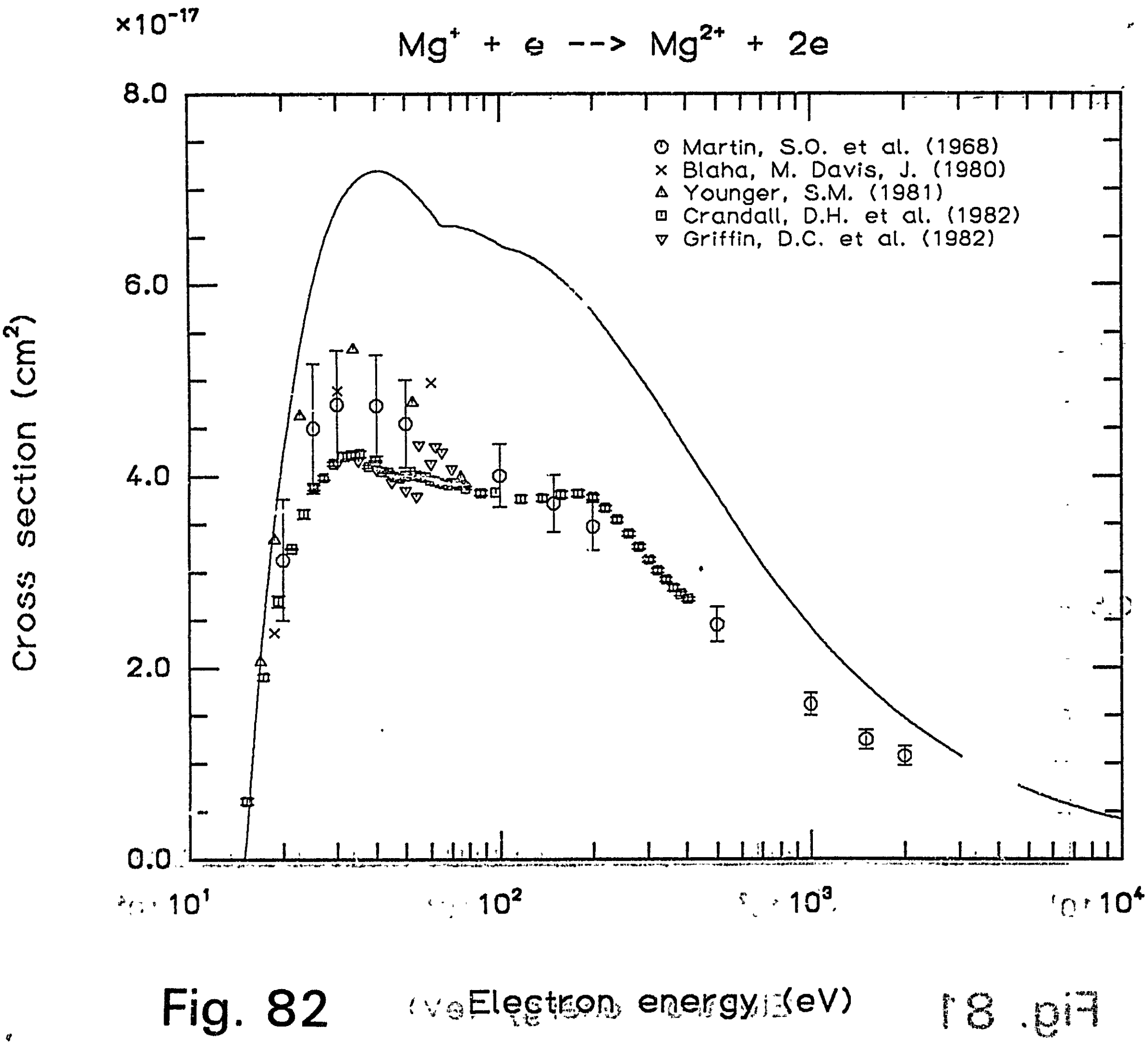


×10-17
Mg + e --> Mg2+ + 3e
Karstensen, F. et al. (1978)
Cross section (cm2)
1.5
1.0
0.5
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 81

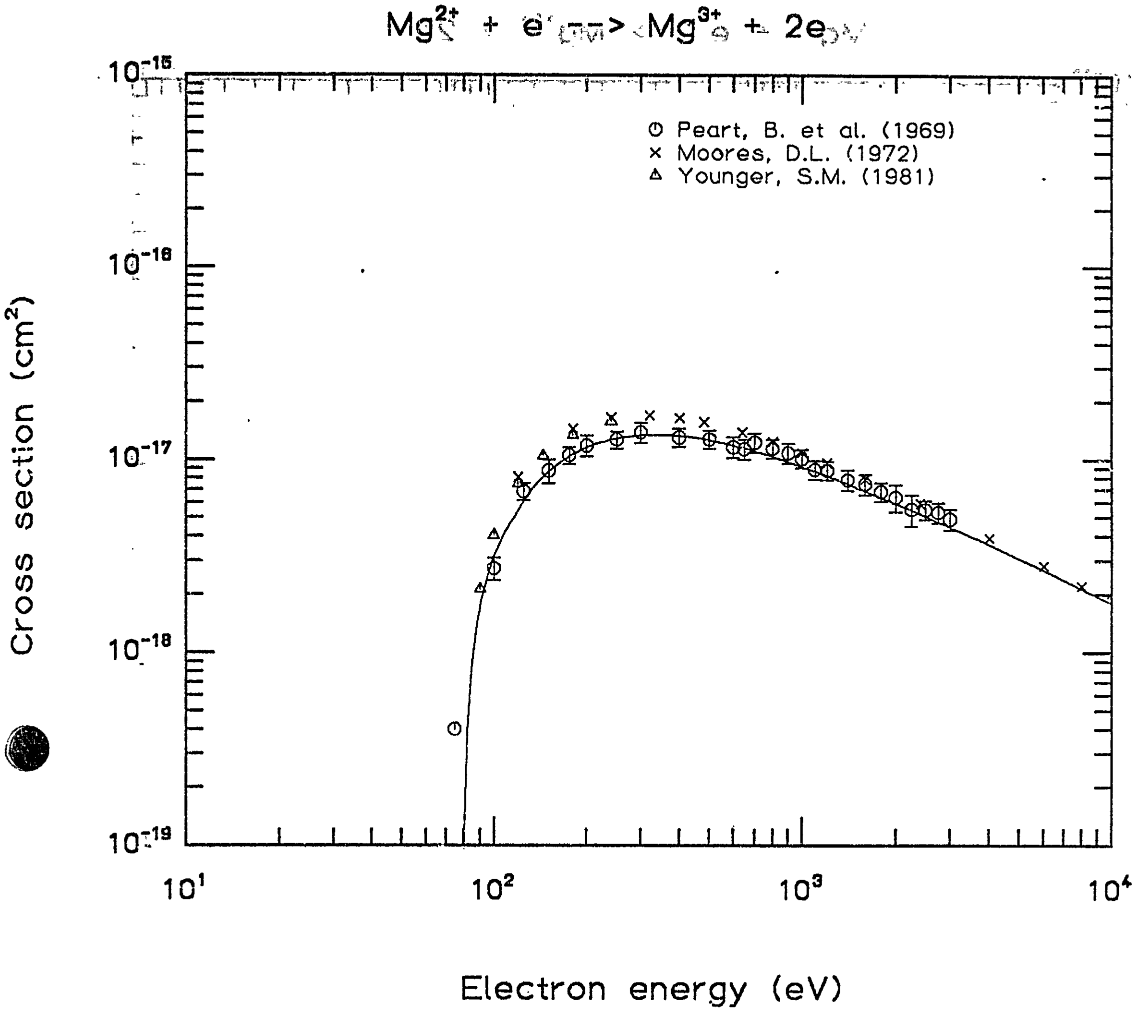


Mg⁺ + e --> Mg²⁺ + 2e
Martin, S.O. et al. (1968)
Blaha, M. Davis, J. (1980)
Younger, S.M. (1981)
Crandall, D.H. et al. (1982)
Griffin, D.C. et al. (1982)
Cross section (cm²)
Electron energy (eV)

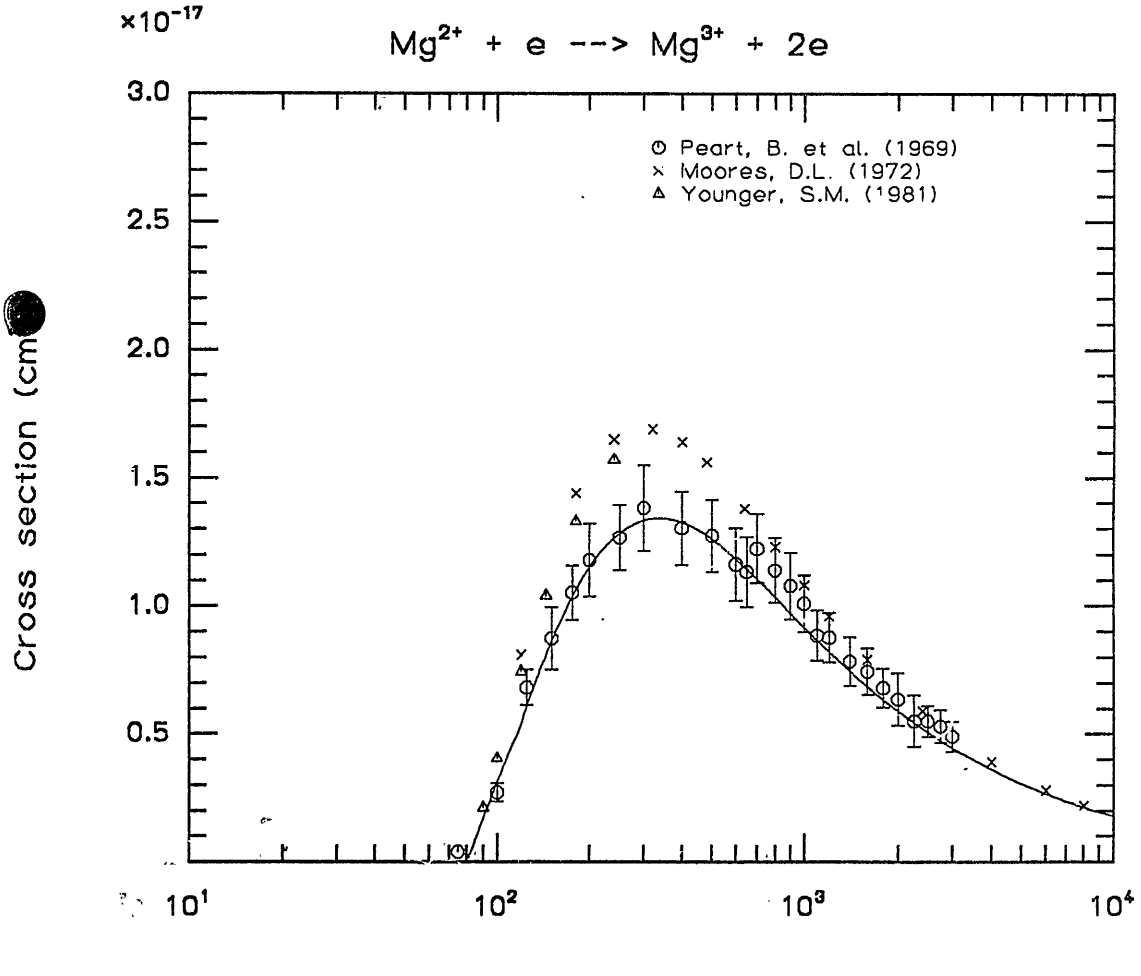


×10⁻¹⁷
Mg⁺ + e --> Mg²⁺ + 2e
Martin, S.O. et al. (1968)
Blaha, M. Davis, J. (1980)
Younger, S.M. (1981)
Crandall, D.H. et al. (1982)
Griffin, D.C. et al. (1982)
Cross section (cm²)
Electron energy (eV)

Fig. 82

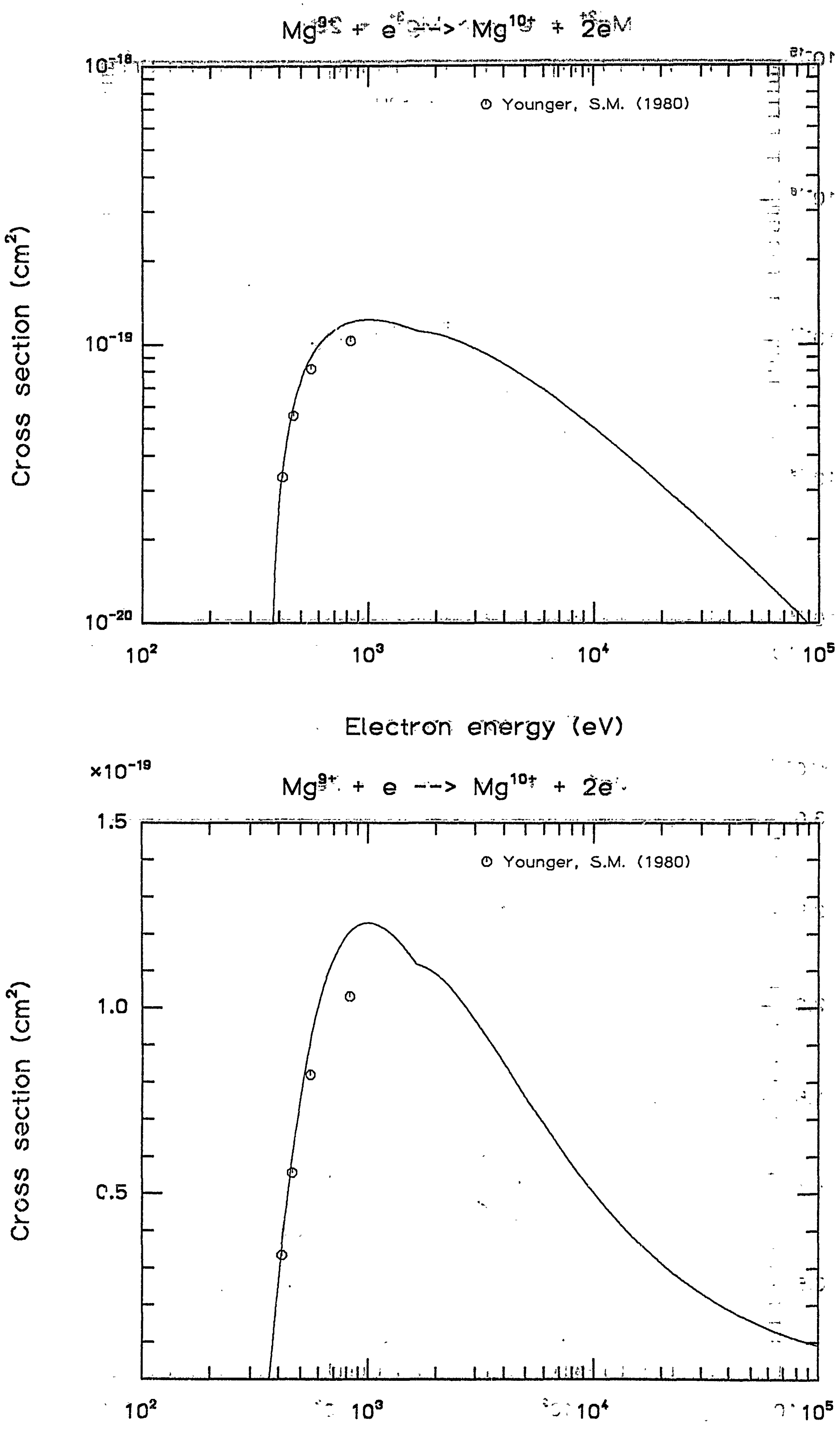


Mg2+ + e --> Mg3+ + 2e
Peart, B. et al. (1969)
Moores, D.L. (1972)
Younger, S.M. (1981)
Cross section (cm2)
Electron energy (eV)



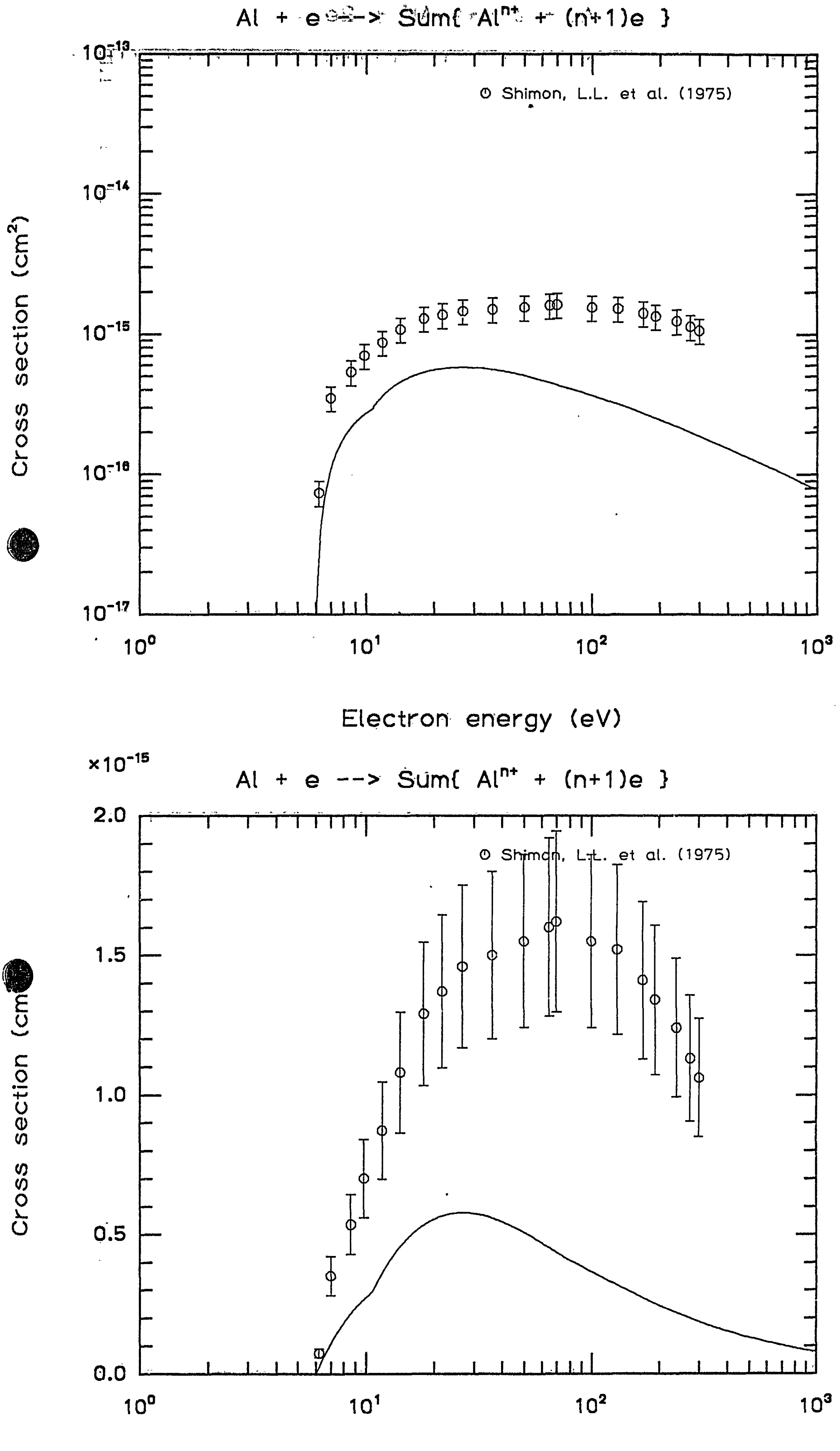
×10-17
Mg2+ + e --> Mg3+ + 2e
Peart, B. et al. (1969)
Moores, D.L. (1972)
Younger, S.M. (1981)
Cross section (cm2)
Electron energy (eV)

Fig. 83



Mg9+ + e --> Mg10+ + 2e
Younger, S.M. (1980)
Cross section (cm2)
Electron energy (eV)
10-18
10-19
10-20
10^2
10^3
10^4
10^5
×10-19
Mg9+ + e --> Mg10+ + 2e
Younger, S.M. (1980)
Cross section (cm2)
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 84



Al + e --> Sum{ Al^{n+} + (n+1)e }
Shimon, L.L. et al. (1975)
Cross section (cm^2)
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^0
10^1
10^2
10^3
Electron energy (eV)
×10^{-15}
Al + e --> Sum{ Al^{n+} + (n+1)e }
Shimon, L.L. et al. (1975)
2.0
1.5
1.0
0.5
0.0
Cross section (cm^2)
10^0
10^1
10^2
10^3
Electron energy (eV)

Fig. 85

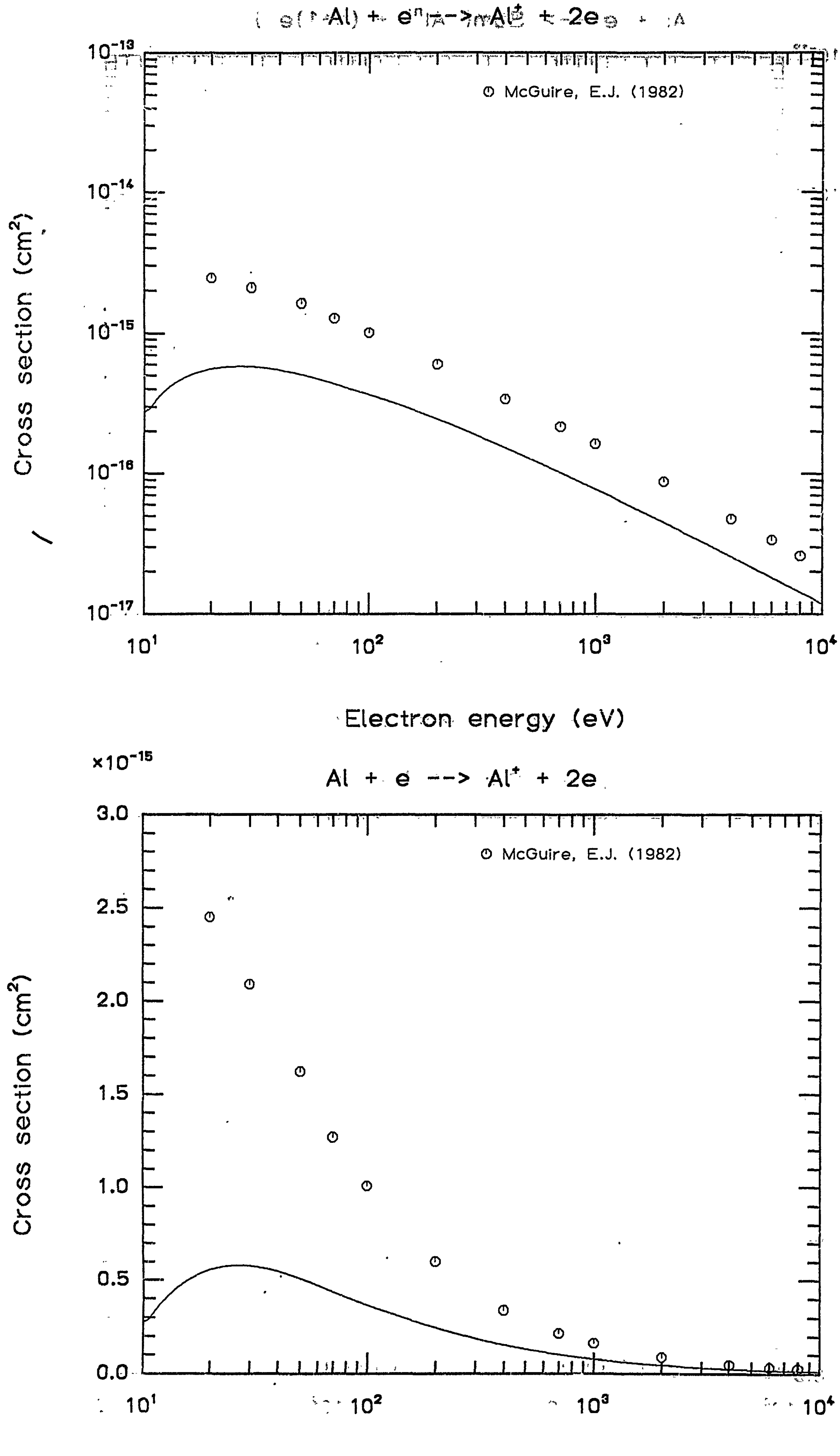
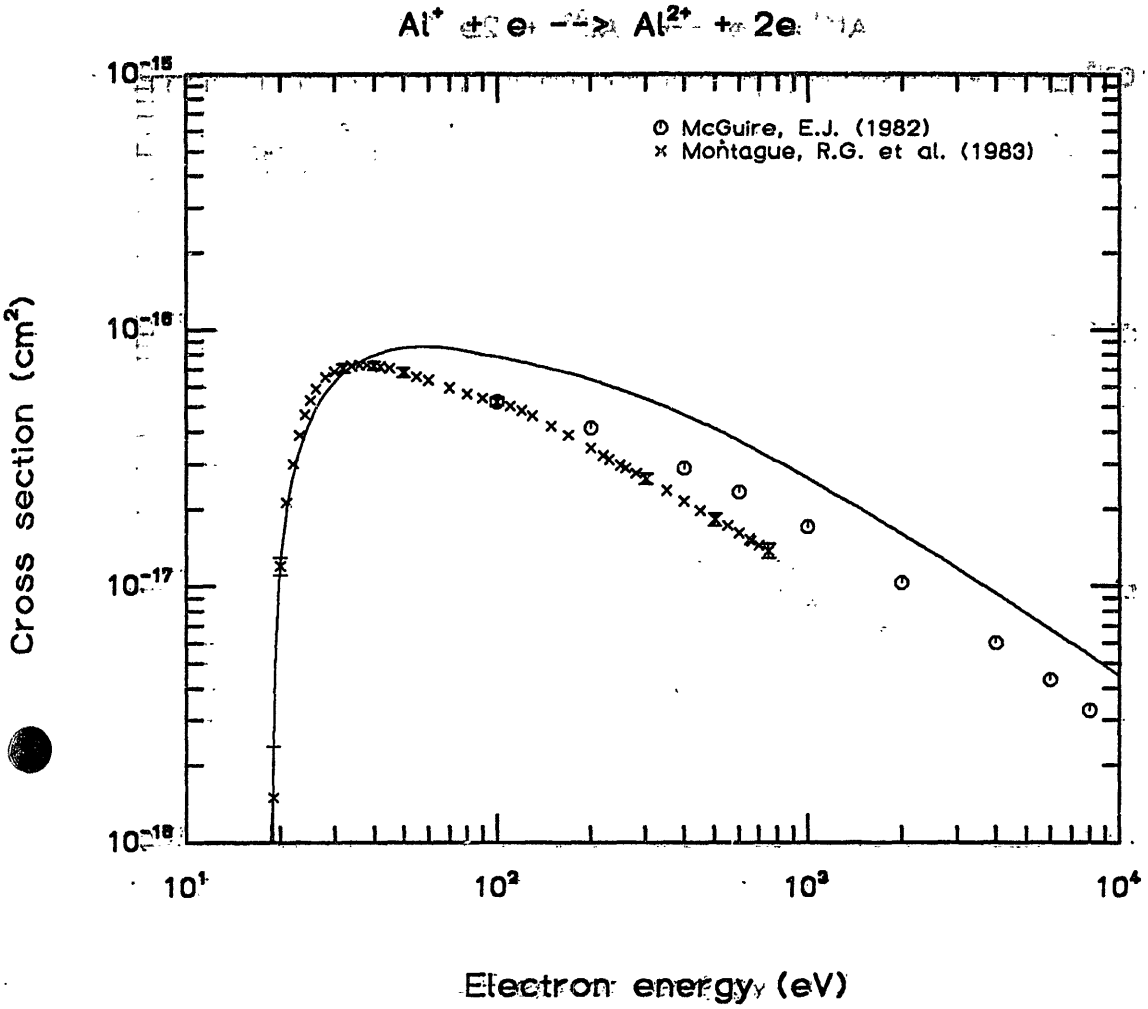

Al + e --> Al+ + 2e
McGuire, E.J. (1982)
Cross section (cm2)
Electron energy (eV)
×10-15
Al + e --> Al+ + 2e
McGuire, E.J. (1982)
Cross section (cm2)
Electron energy (eV)

Fig. 86



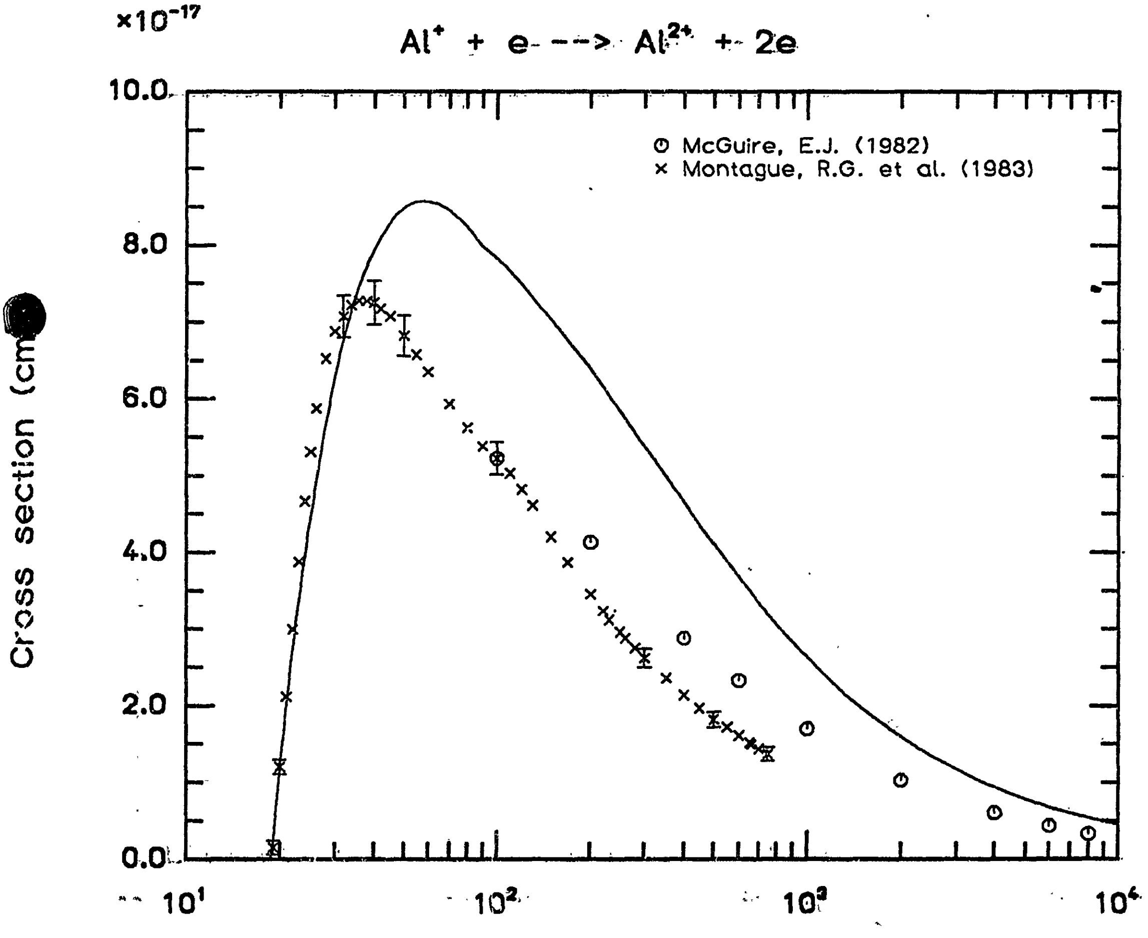
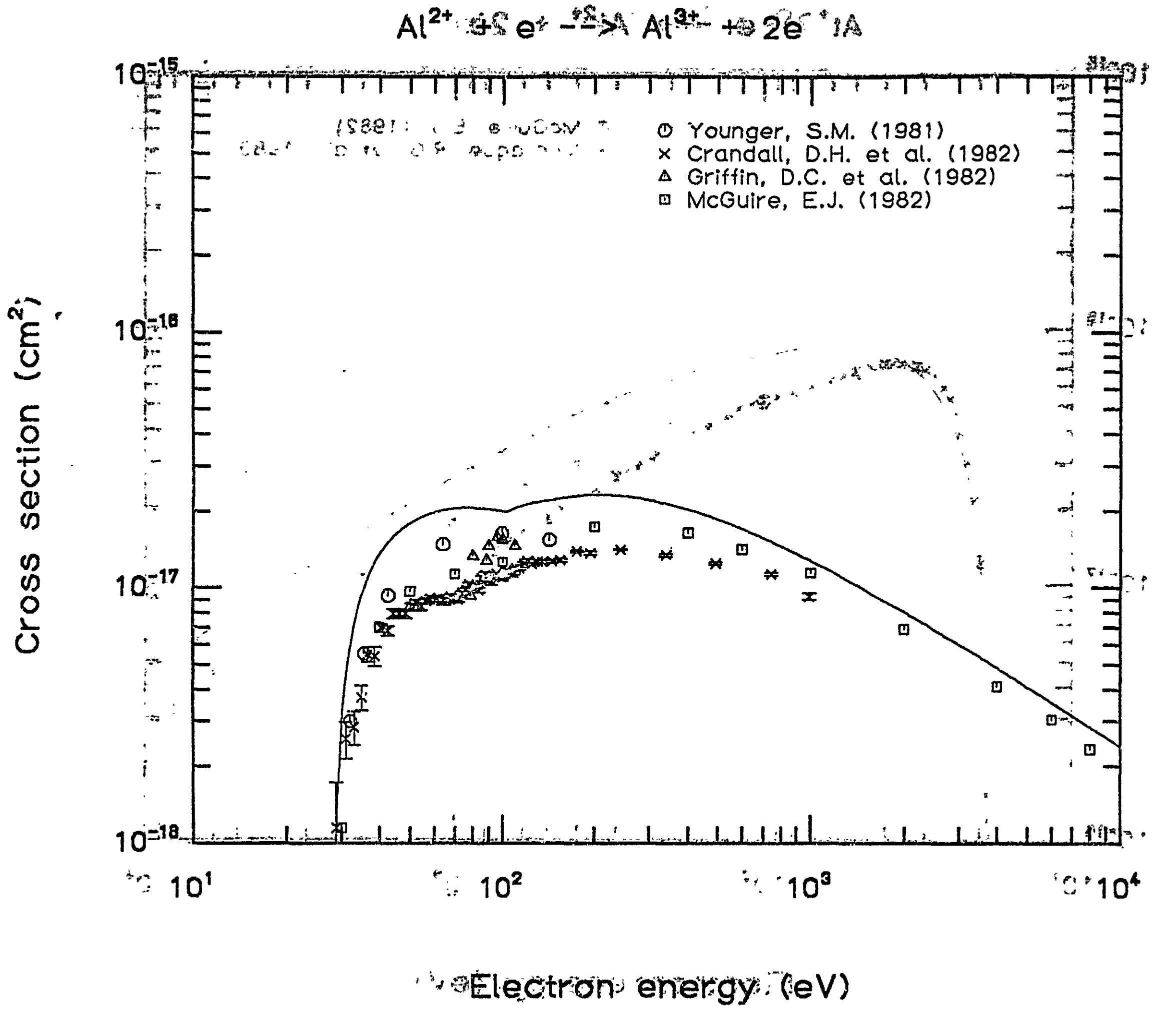
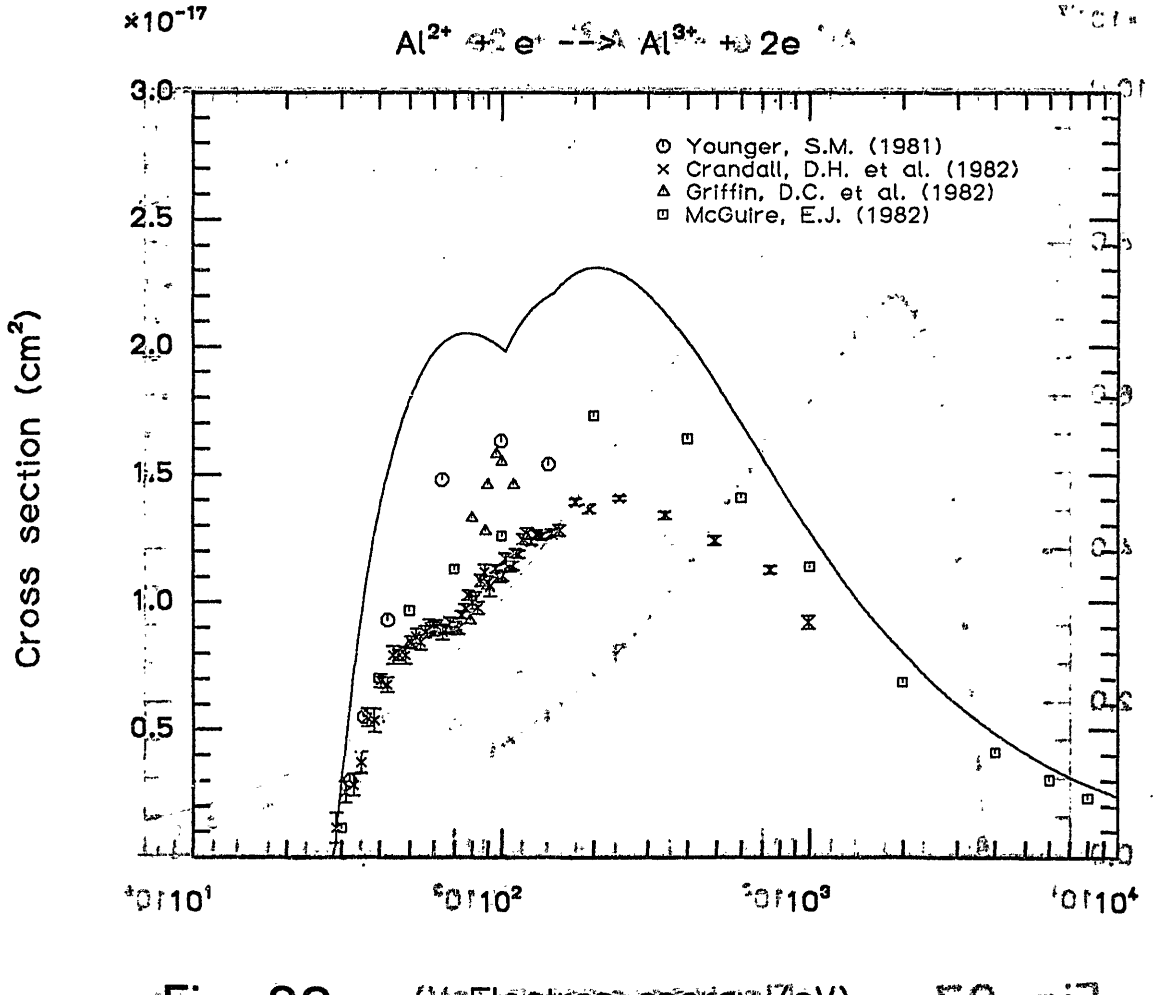


Fig. 87 Electron energy (eV)

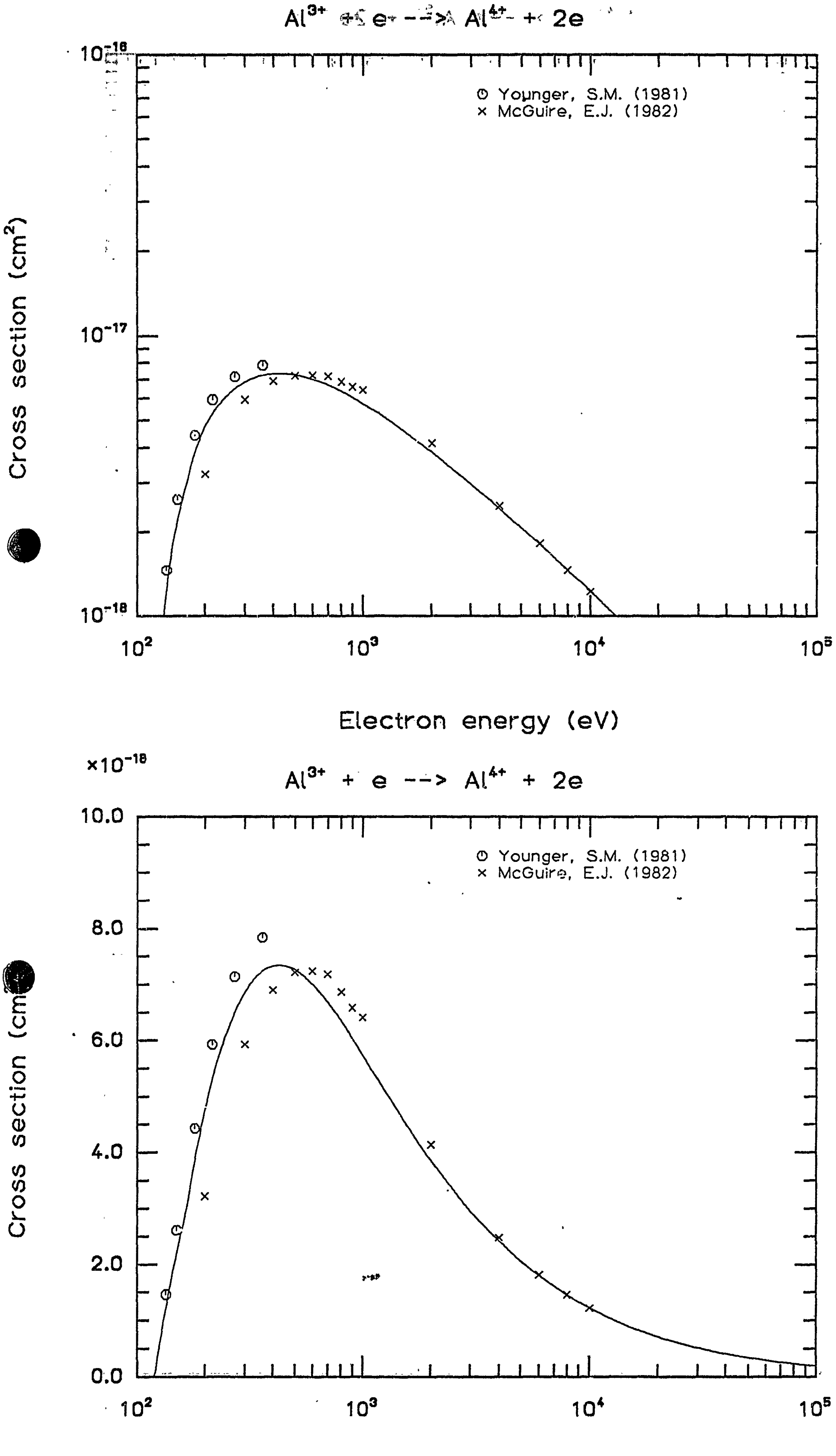


Al^{2+} + e -> Al^{3+} + 2e
Younger, S.M. (1981)
Crandall, D.H. et al. (1982)
Griffin, D.C. et al. (1982)
McGuire, E.J. (1982)
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^1
10^2
10^3
10^4
Electron energy (eV)



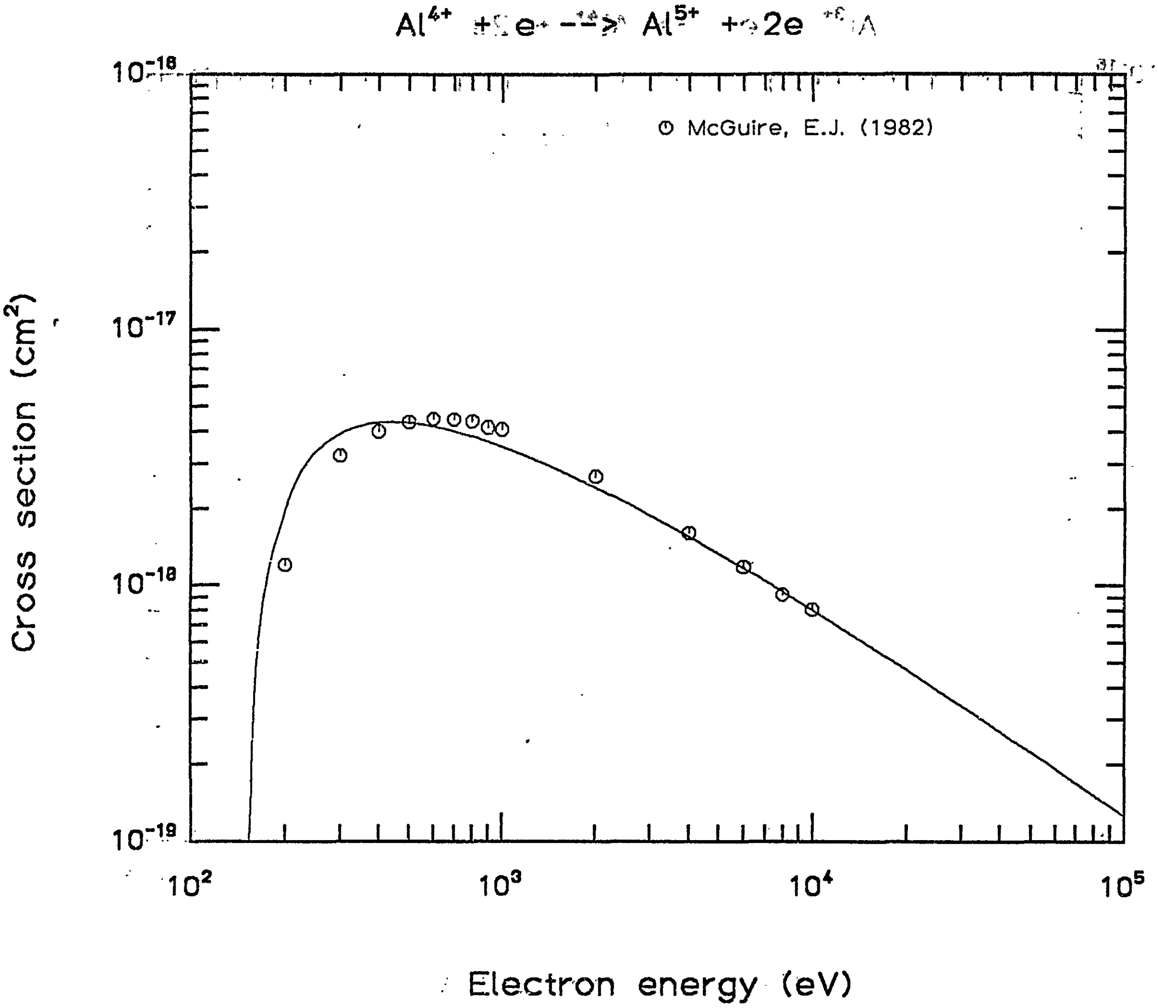
$\times 10^{-17}$
Al^{2+} + e -> Al^{3+} + 2e
Younger, S.M. (1981)
Crandall, D.H. et al. (1982)
Griffin, D.C. et al. (1982)
McGuire, E.J. (1982)
Cross section (cm^2)
3.0
2.5
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 88



$Al^{3+} + e \rightarrow Al^{4+} + 2e$
Younger, S.M. (1981)
McGuire, E.J. (1982)
Cross section (cm²)
10^{-16}
10^{-17}
10^{-18}
10^{2}
10^{3}
10^{4}
10^{5}
Electron energy (eV)
$\times 10^{-18}$
$Al^{3+} + e \rightarrow Al^{4+} + 2e$
Younger, S.M. (1981)
McGuire, E.J. (1982)
10.0
8.0
6.0
4.0
2.0
0.0
10^{2}
10^{3}
10^{4}
10^{5}
Cross section (cm²)
Electron energy (eV)

Fig. 89


Al^{4+} + e --> Al^{5+} + 2e
McGuire, E.J. (1982)
Cross section (cm^2)
Electron energy (eV)

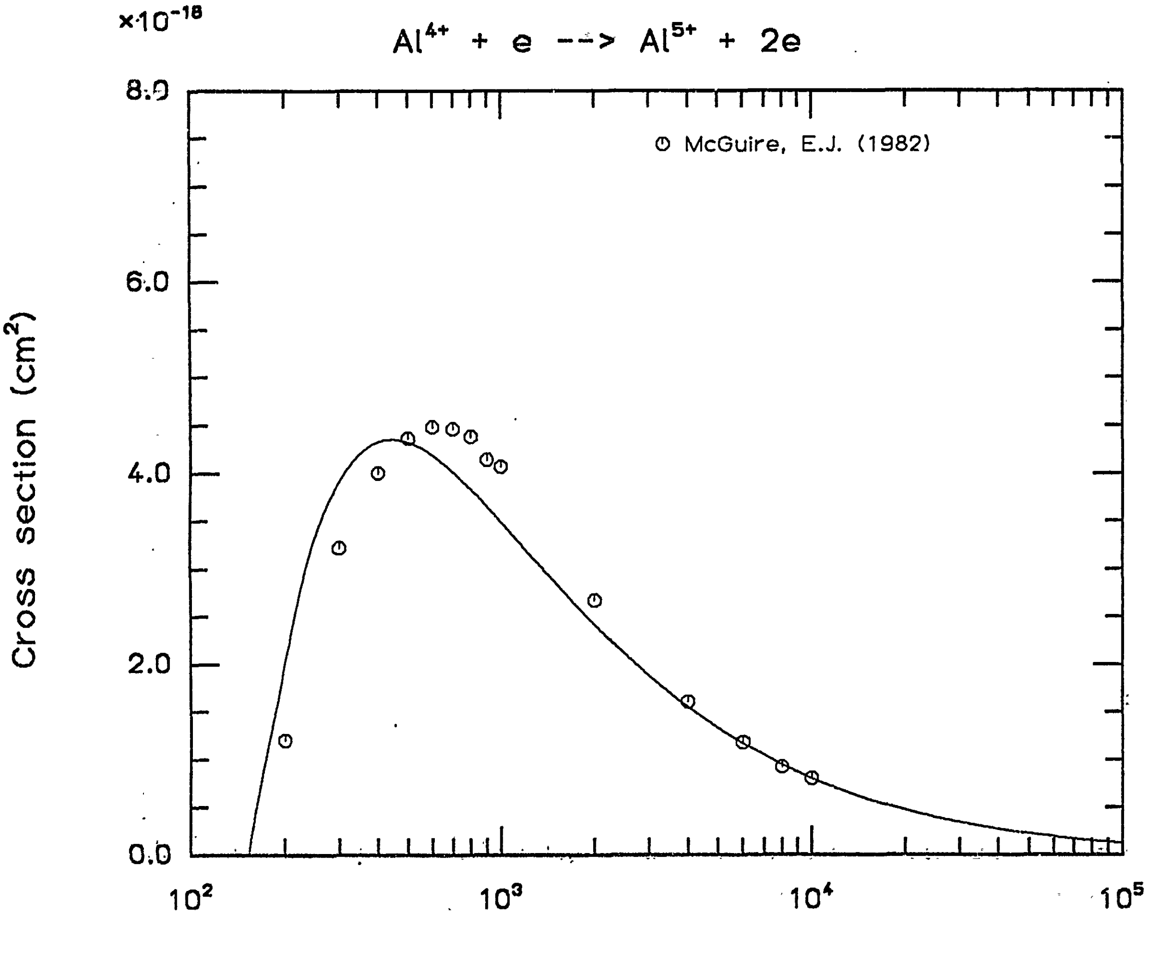
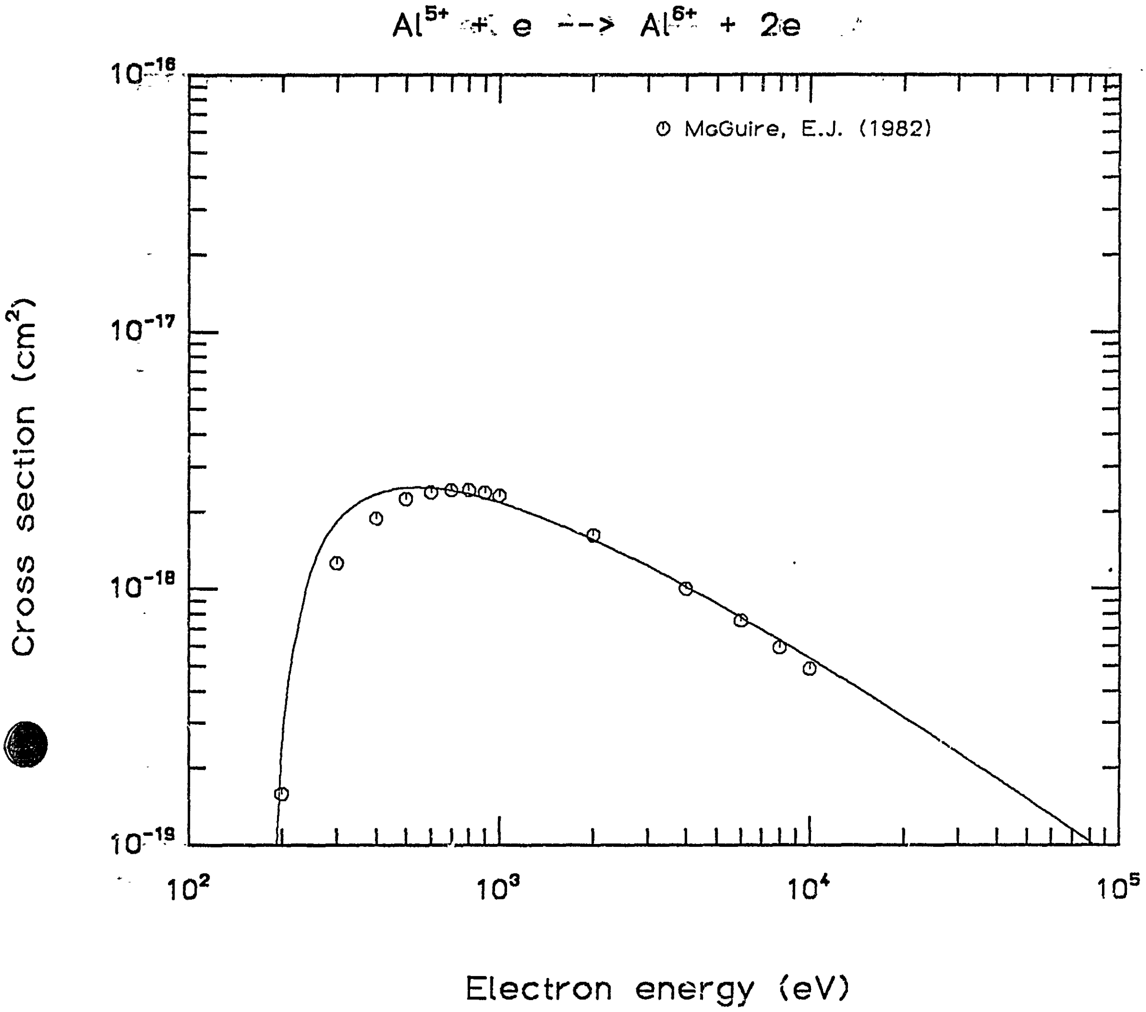
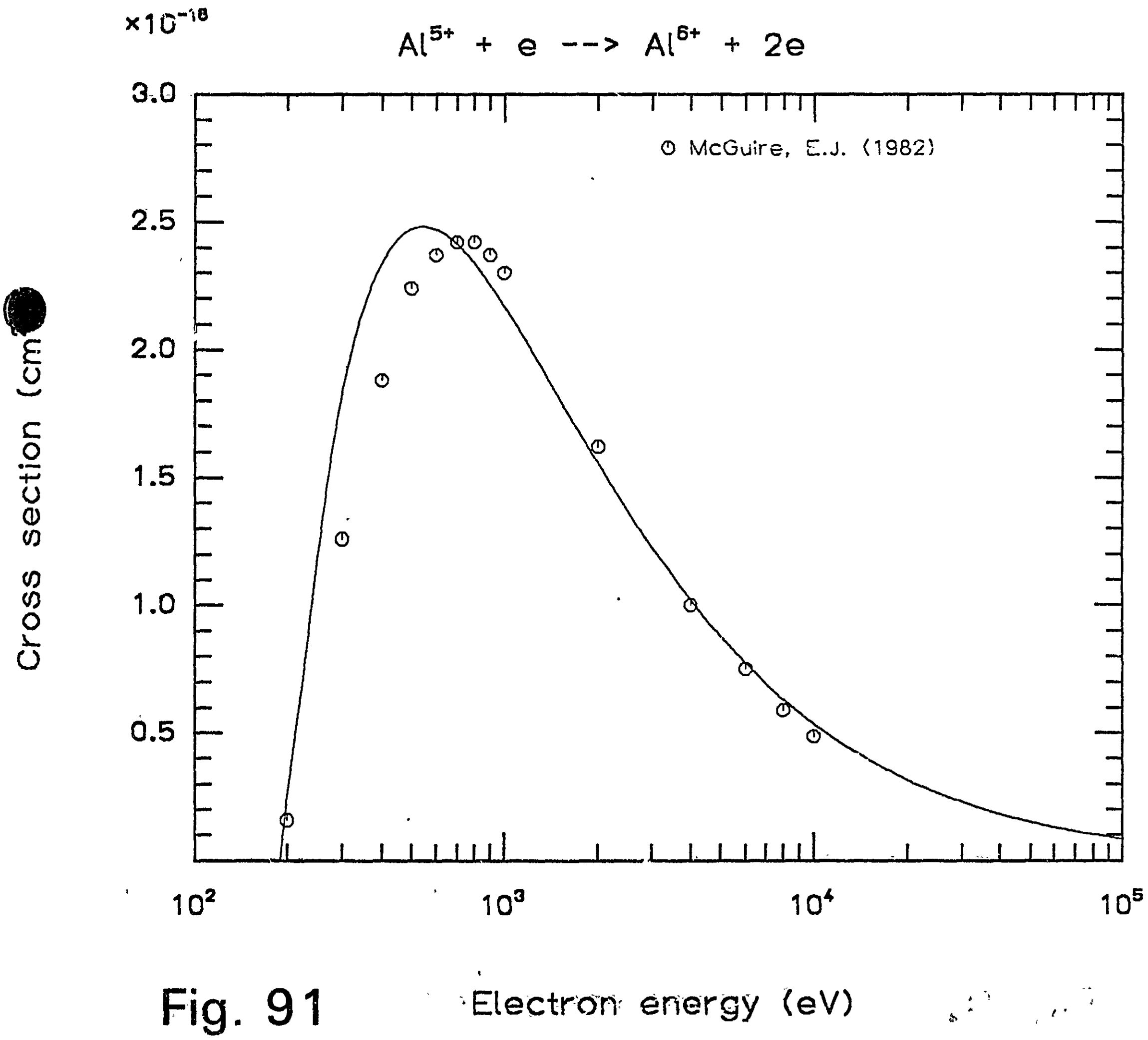

×10^{-18}
Al^{4+} + e --> Al^{5+} + 2e
McGuire, E.J. (1982)
Cross section (cm^2)
Electron energy (eV)

Fig. 90



Al5+ + e --> Al6+ + 2e
McGuire, E.J. (1982)
10-16
10-17
10-18
10-19
Cross section (cm2)
10²
10³
10⁴
10⁵
Electron energy (eV)



×10-18
Al5+ + e --> Al6+ + 2e
McGuire, E.J. (1982)
3.0
2.5
2.0
1.5
1.0
0.5
Cross section (cm2)
10²
10³
10⁴
10⁵
Electron energy (eV)

Fig. 91

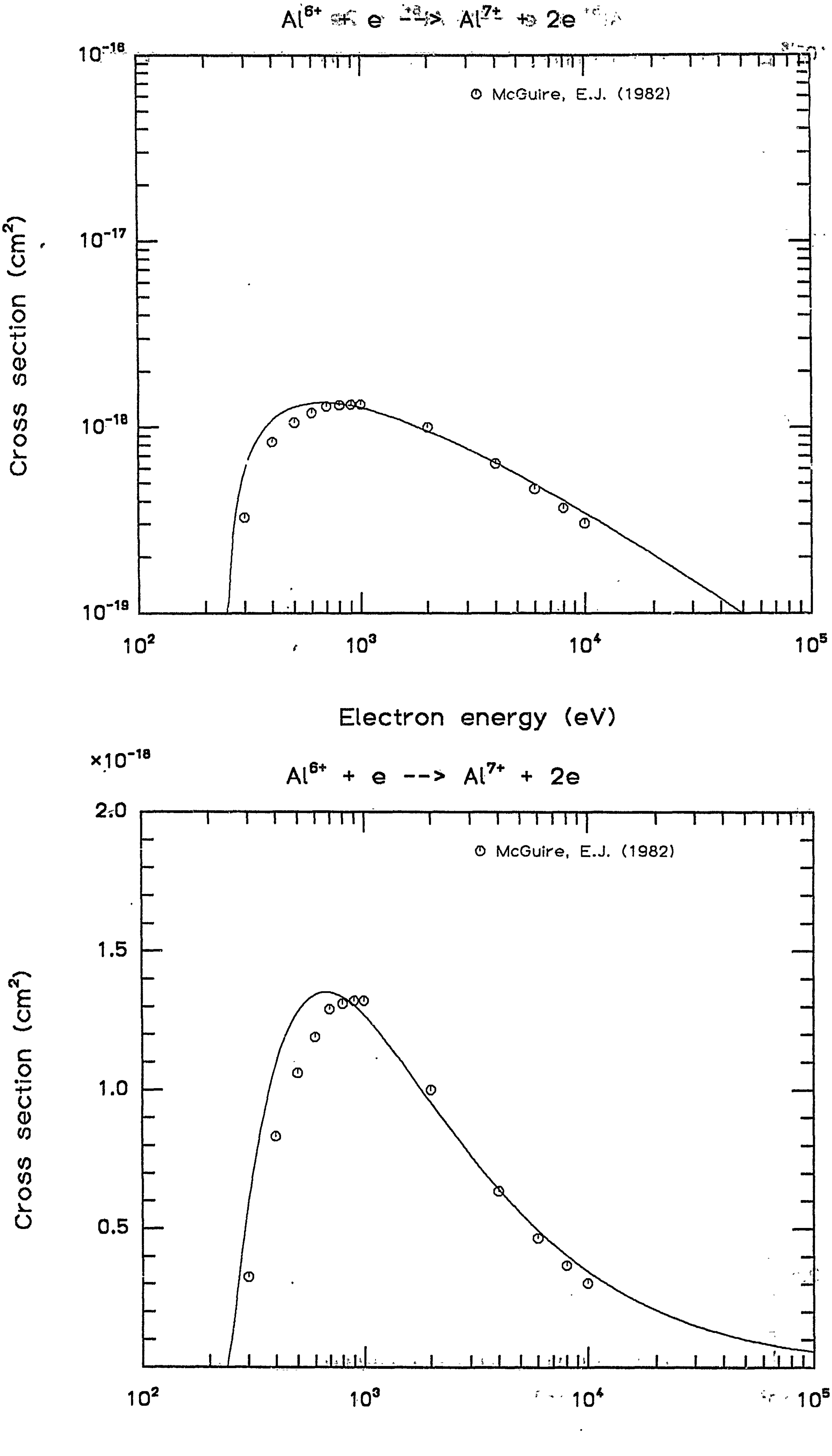

$Al^{6+} + e \rightarrow Al^{7+} + 2e$
10^{-16}
10^{-17}
10^{-18}
10^{-19}
Cross section (cm^2)
McGuire, E.J. (1982)
10^2
10^3
10^4
10^5
Electron energy (eV)
$\times 10^{-18}$
Al^{6+} + e --> Al^{7+} + 2e
2.0
1.5
1.0
0.5
Cross section (cm^2)
McGuire, E.J. (1982)
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 92

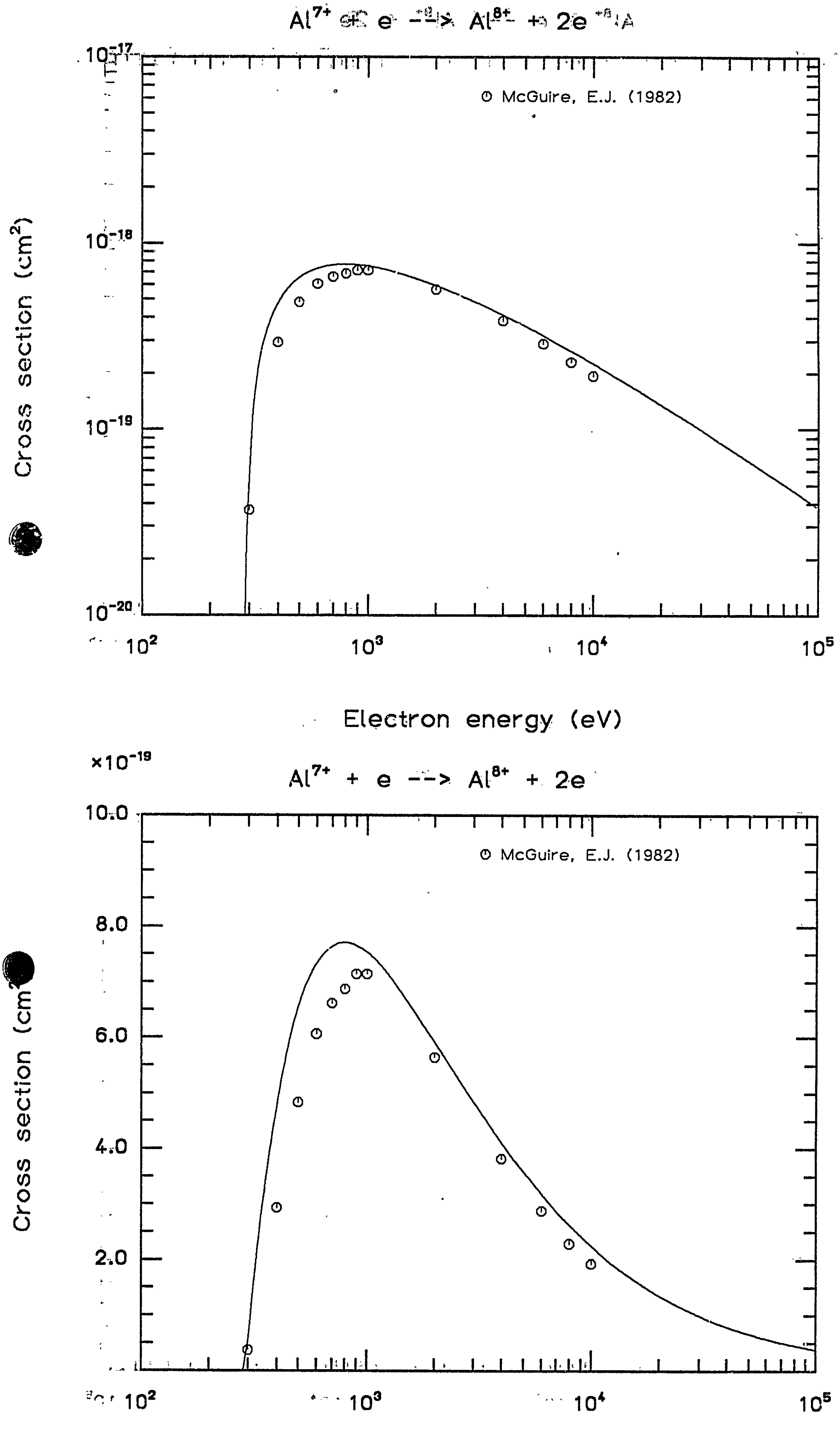
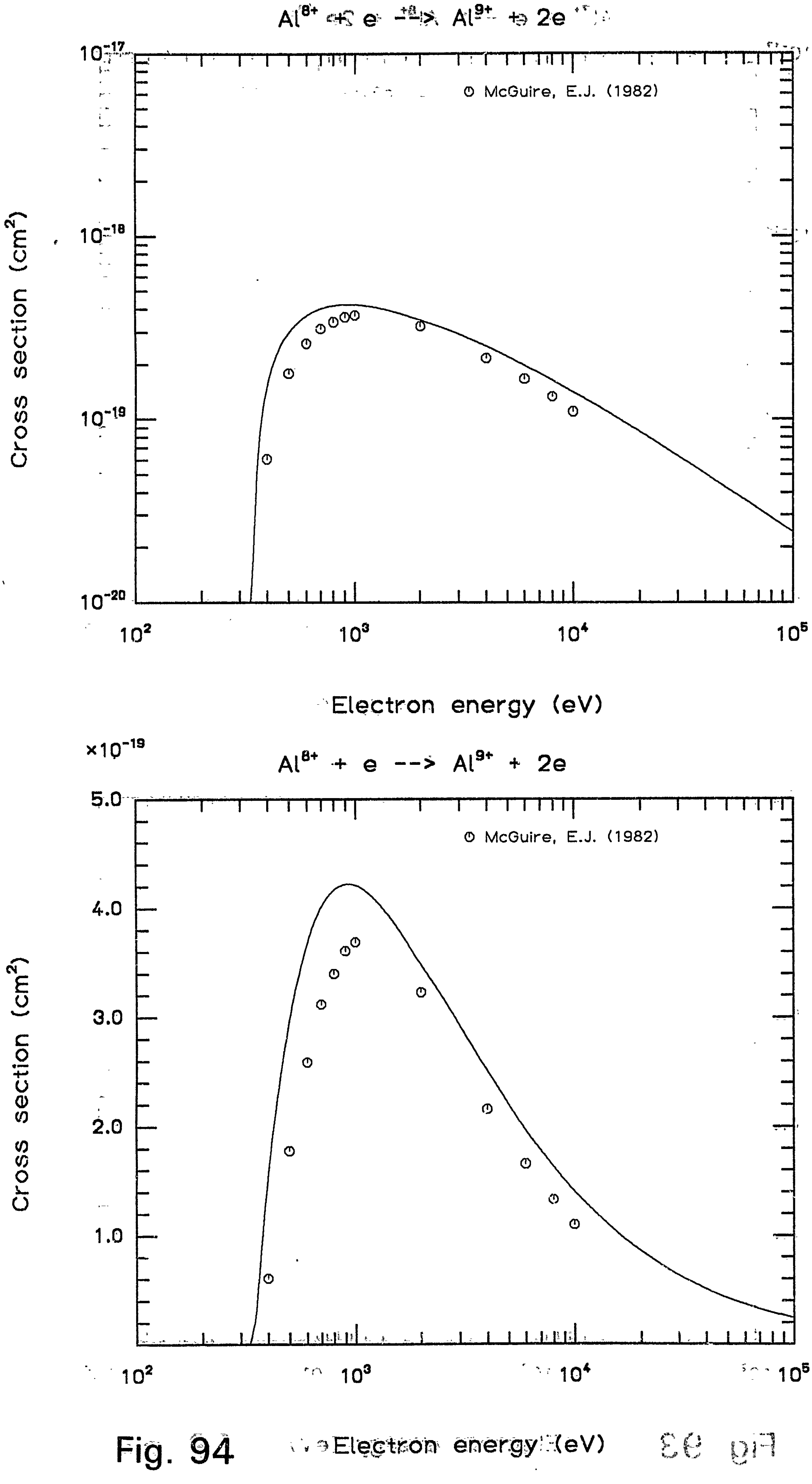
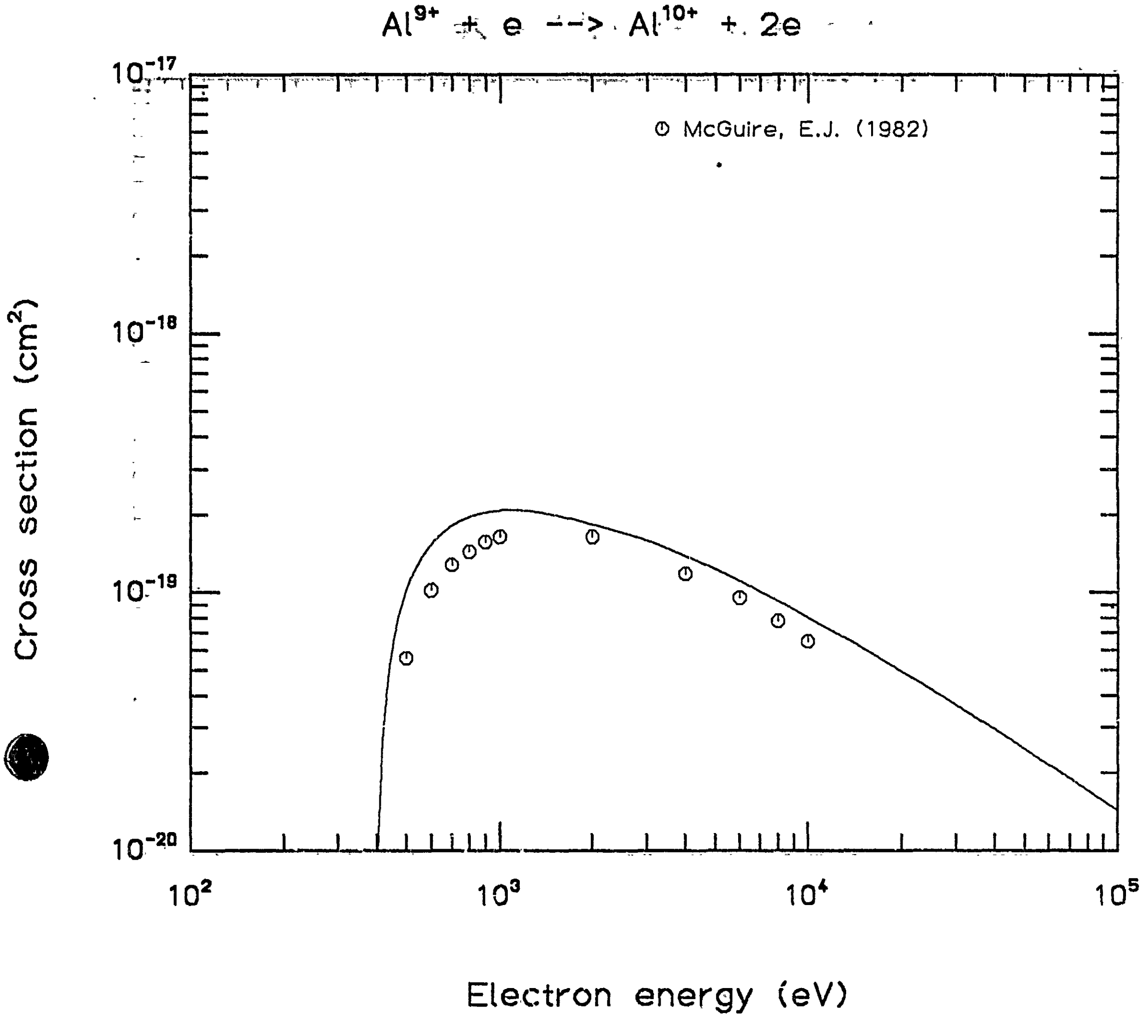


Fig. 93 Electron energy (eV)

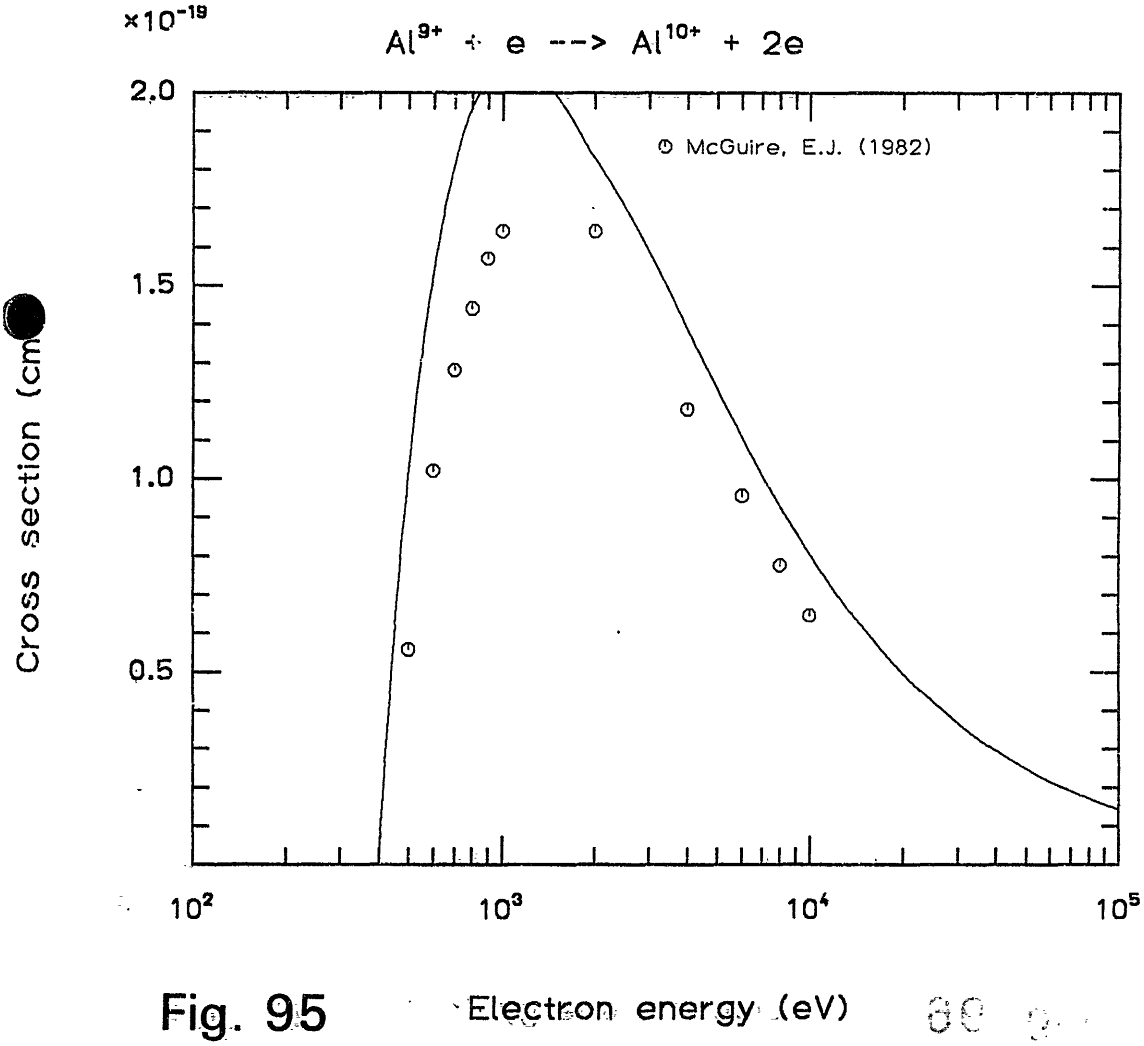


Al8+ + e --> Al9+ + 2e
McGuire, E.J. (1982)
Cross section (cm2)
Electron energy (eV)
×10-19
Al8+ + e --> Al9+ + 2e
McGuire, E.J. (1982)
5.0
4.0
3.0
2.0
1.0
Cross section (cm2)

Fig. 94

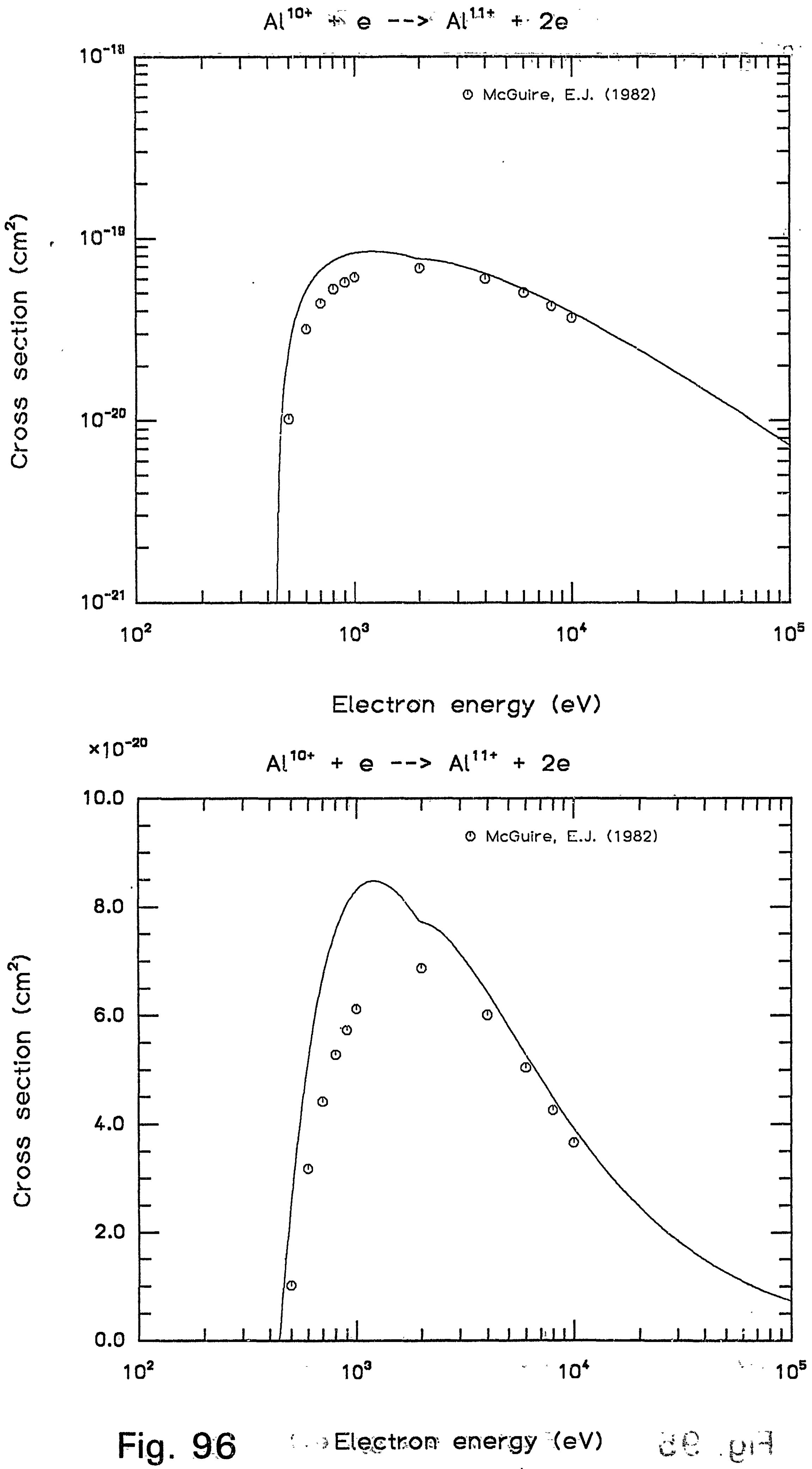


Al9+ + e --> Al10+ + 2e
McGuire, E.J. (1982)
Cross section (cm2)
10-17
10-18
10-19
10-20
102
103
104
105
Electron energy (eV)



x10-19
Al9+ + e --> Al10+ + 2e
McGuire, E.J. (1982)
Cross section (cm2)
2.0
1.5
1.0
0.5
102
103
104
105
Electron energy (eV)

Fig. 95



Al10+ + e --> Al11+ + 2e
10-18
10-19
10-20
10-21
McGuire, E.J. (1982)
Cross section (cm2)
102
103
104
105
Electron energy (eV)
×10-20
Al10+ + e --> Al11+ + 2e
10.0
8.0
6.0
4.0
2.0
0.0
McGuire, E.J. (1982)
Cross section (cm2)
102
103
104
105
Electron energy (eV)

Fig. 96

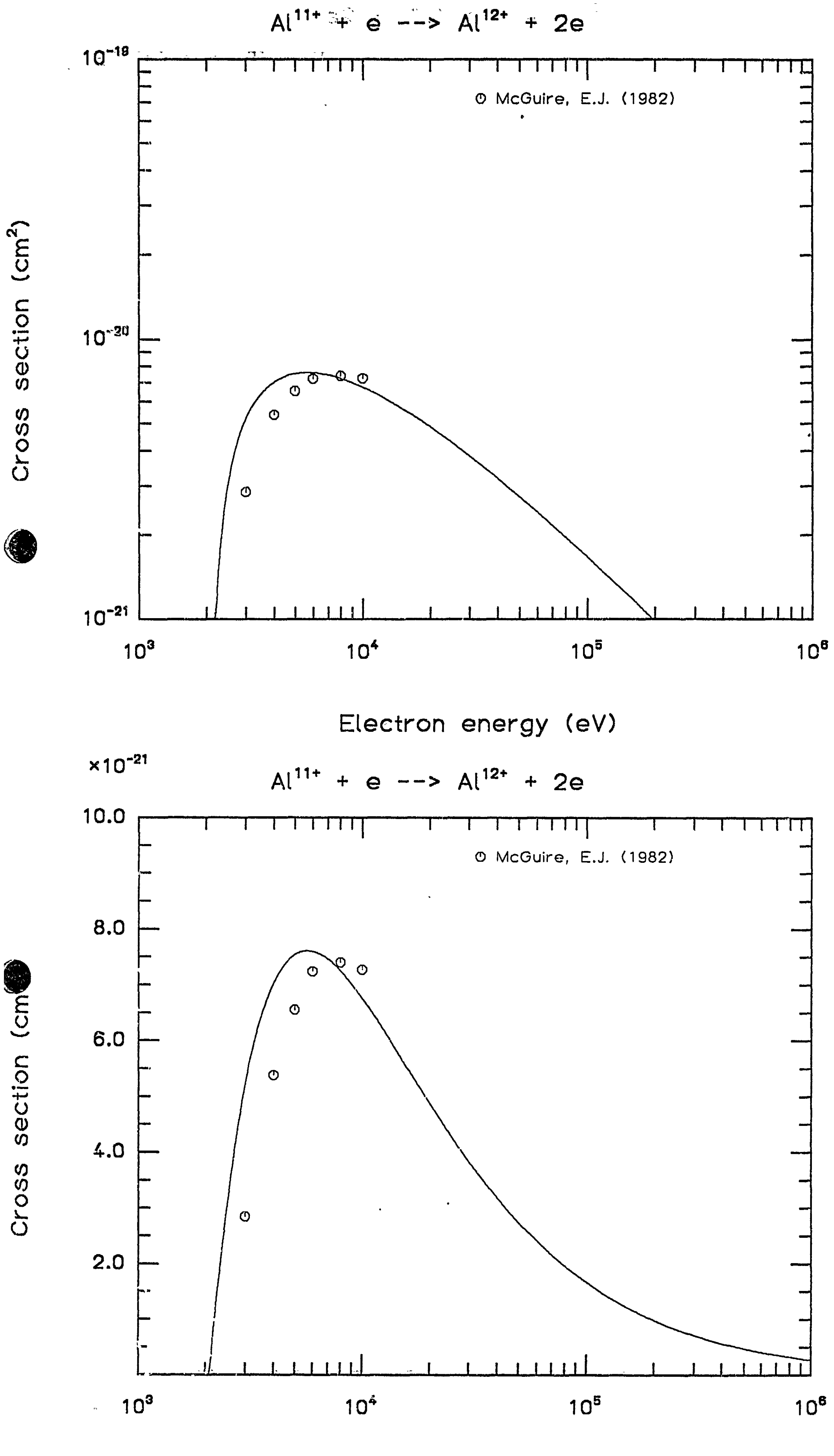


Fig. 97 Electron energy (eV)

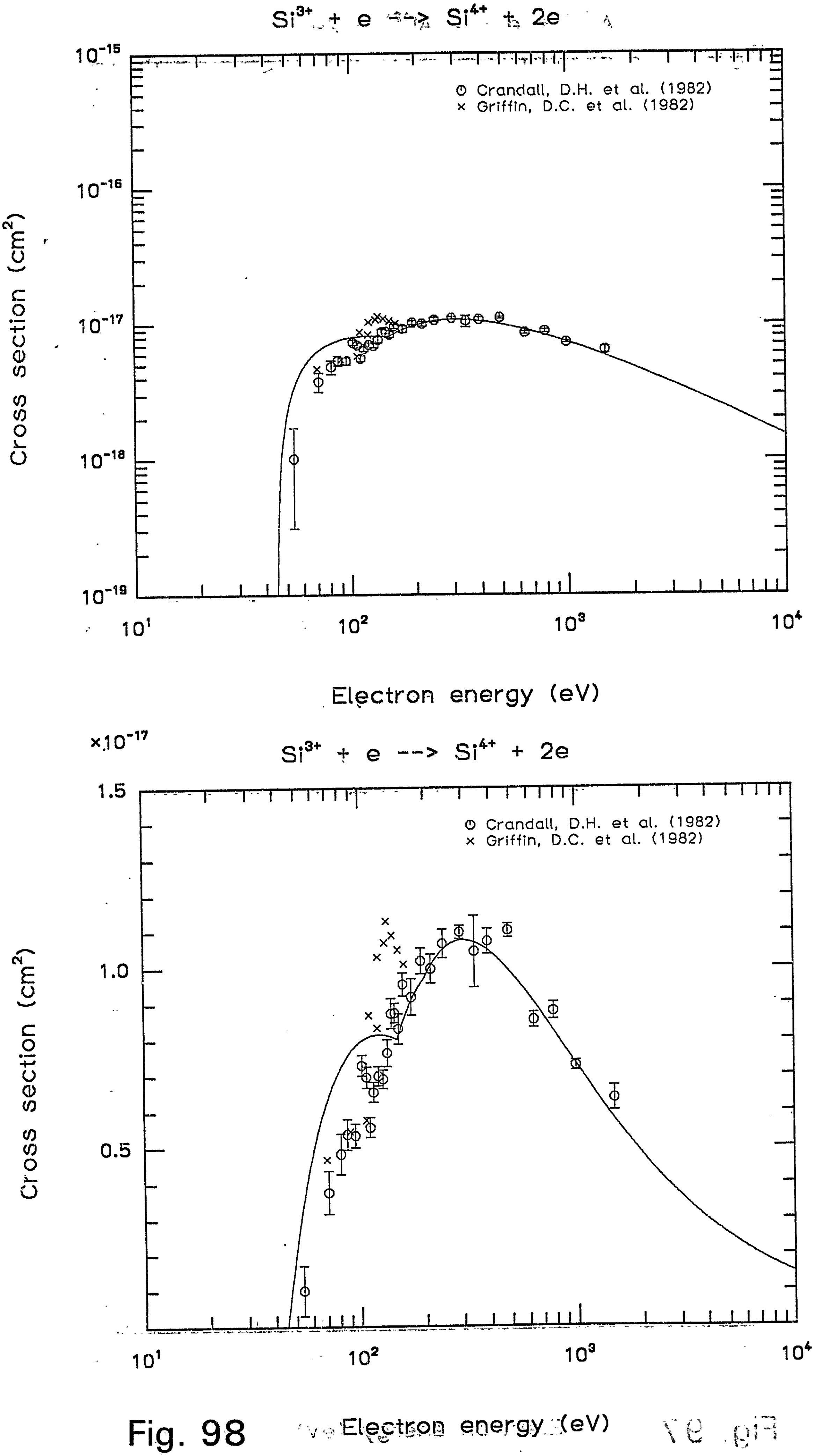
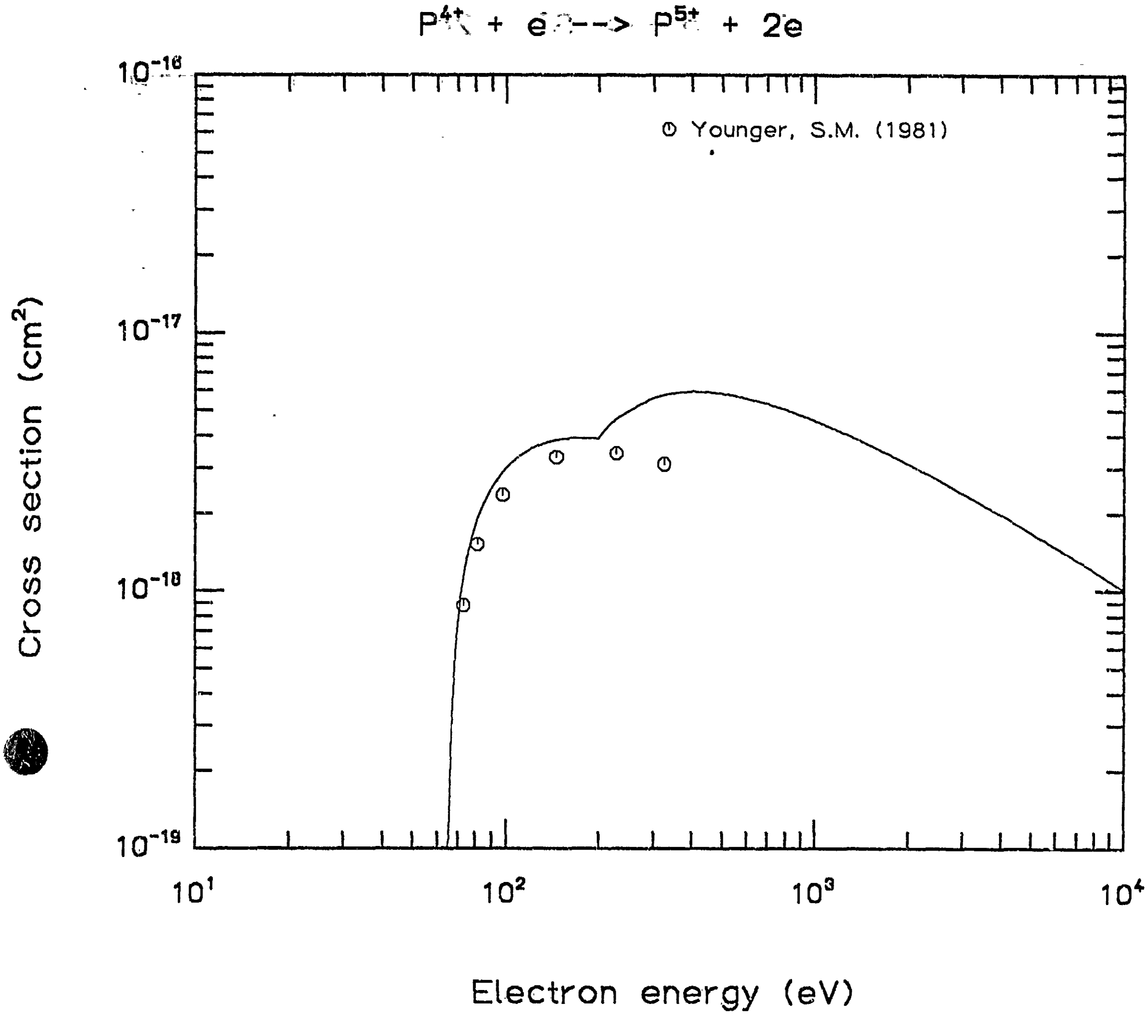

Si^{3+} + e --> Si^{4+} + 2e
Crandall, D.H. et al. (1982)
Griffin, D.C. et al. (1982)
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^1
10^2
10^3
10^4
Electron energy (eV)
$\times 10^{-17}$
Si^{3+} + e --> Si^{4+} + 2e
Crandall, D.H. et al. (1982)
Griffin, D.C. et al. (1982)
Cross section (cm^2)
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 98



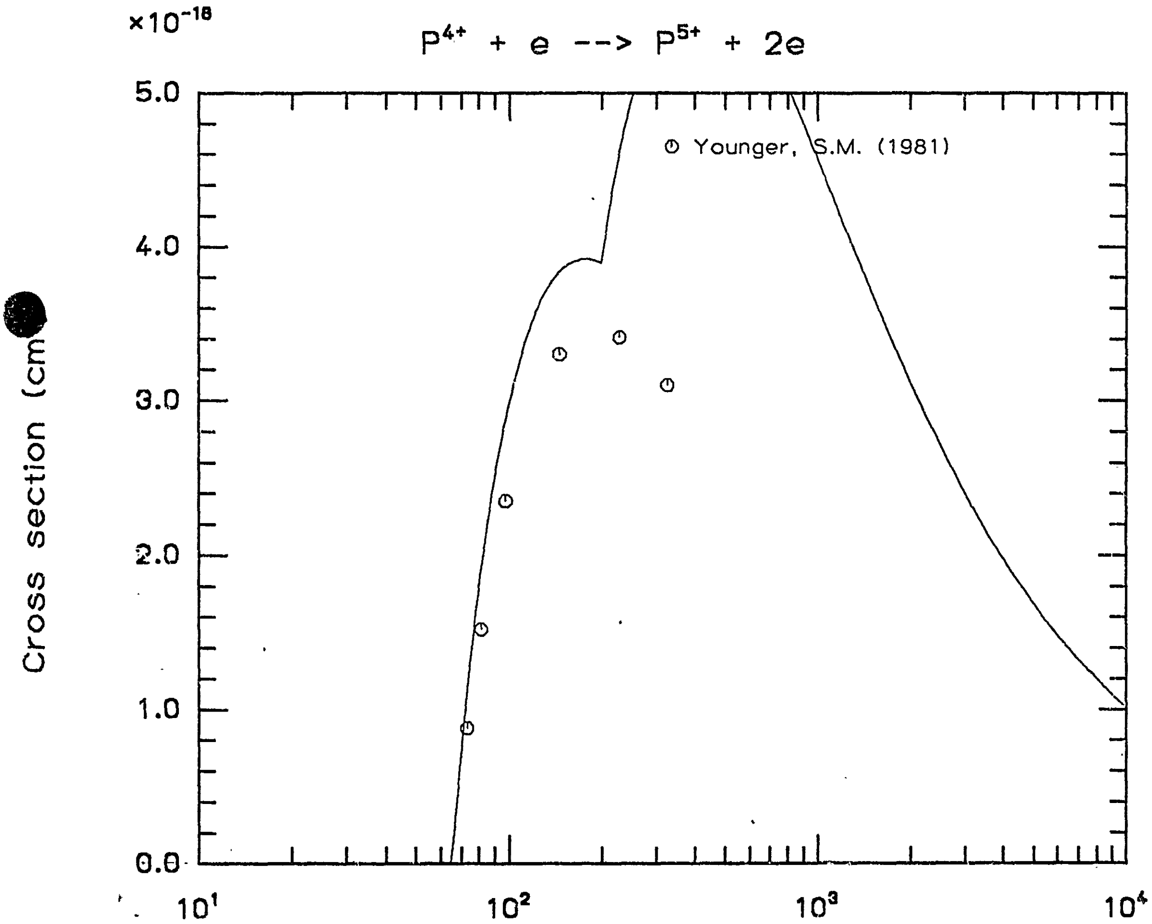
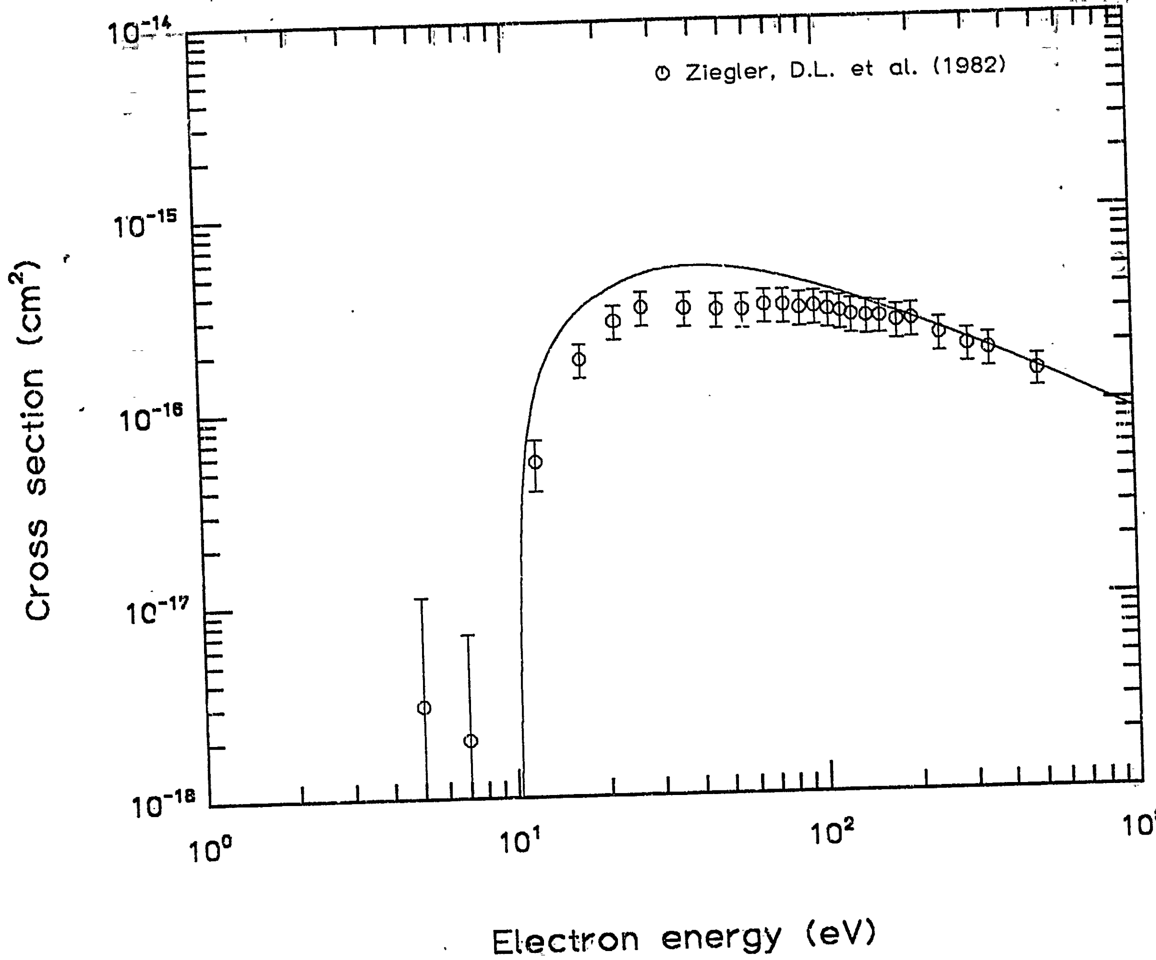


Fig. 99 Electron energy (eV)

S + e --> S⁺ + 2e



S + e --> S⁺ + 2e

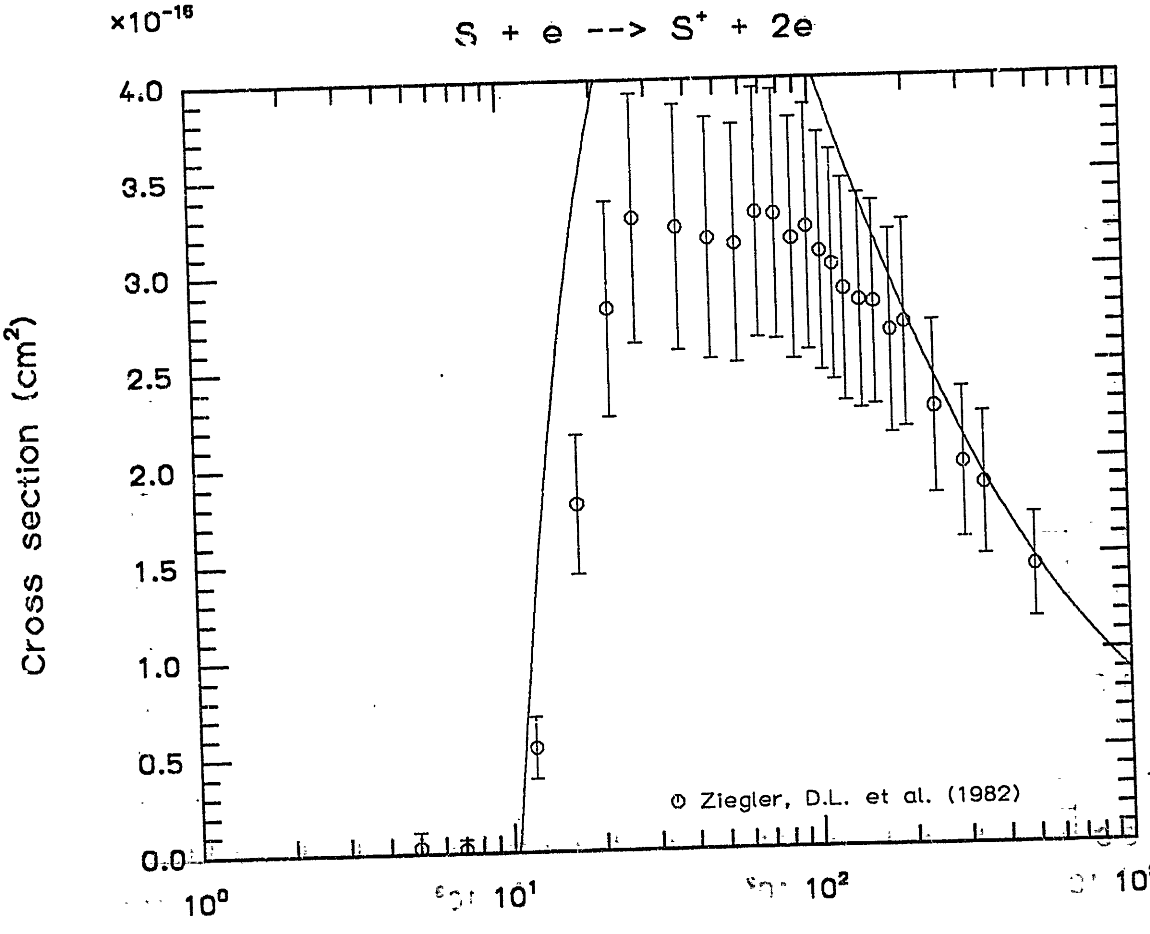
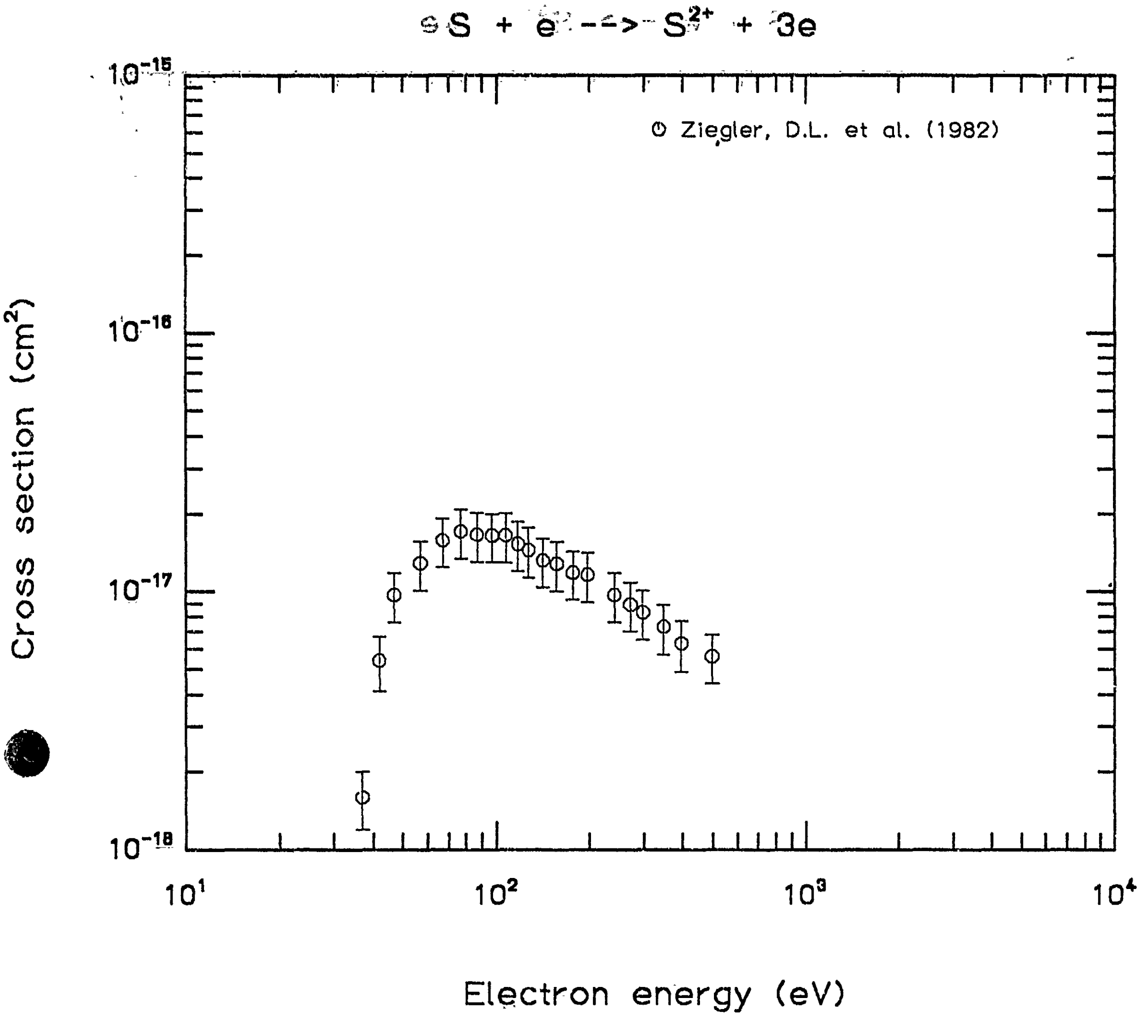


Fig. 100 Electron energy (eV)


S + e --> S^{2+} + 3e
Ziegler, D.L. et al. (1982)
Cross section (cm²)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^1
10^2
10^3
10^4
Electron energy (eV)

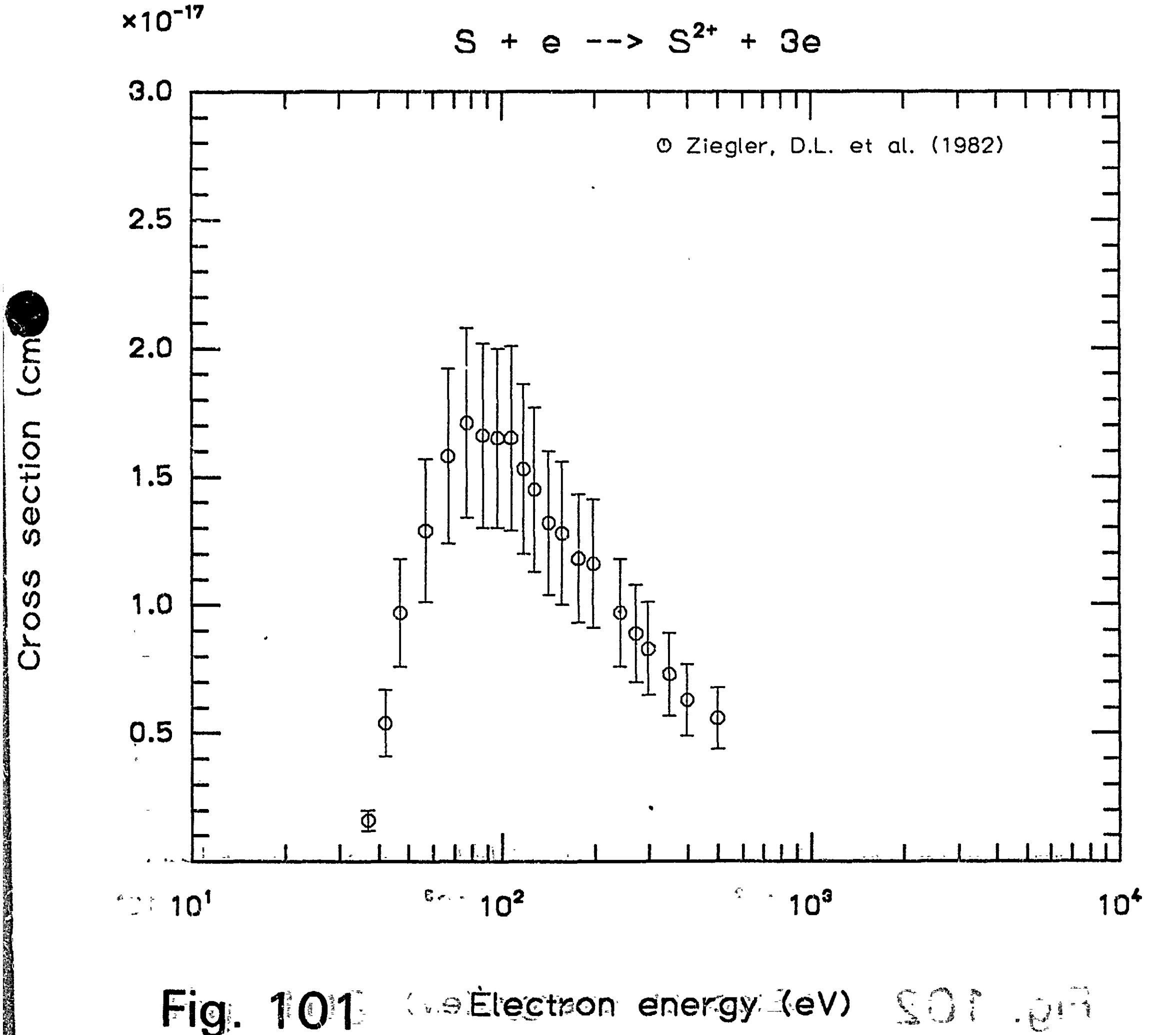

×10^{-17}
S + e --> S^{2+} + 3e
Ziegler, D.L. et al. (1982)
Cross section (cm
3.0
2.5
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 101

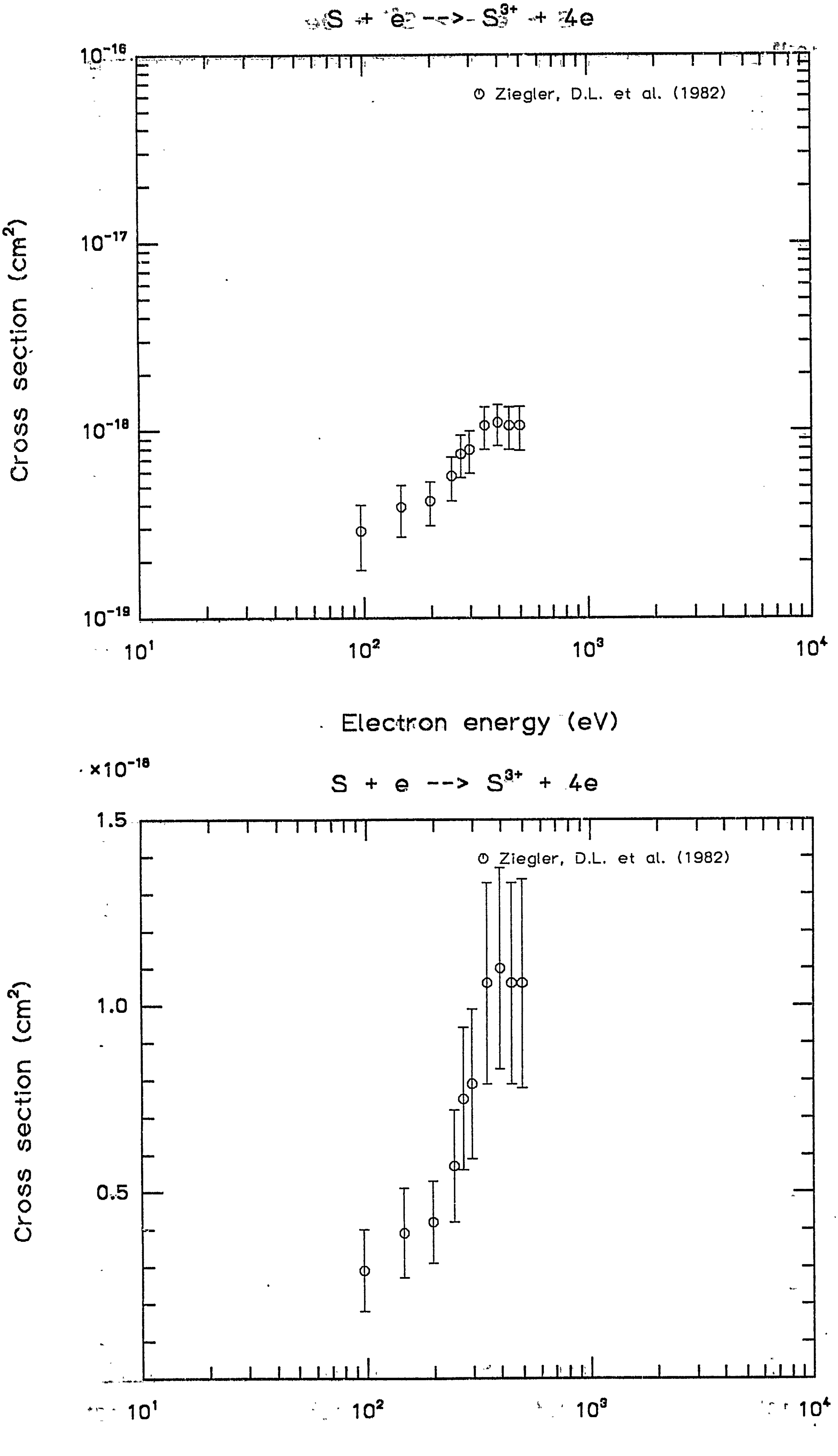


Fig. 102 Electron energy (eV)

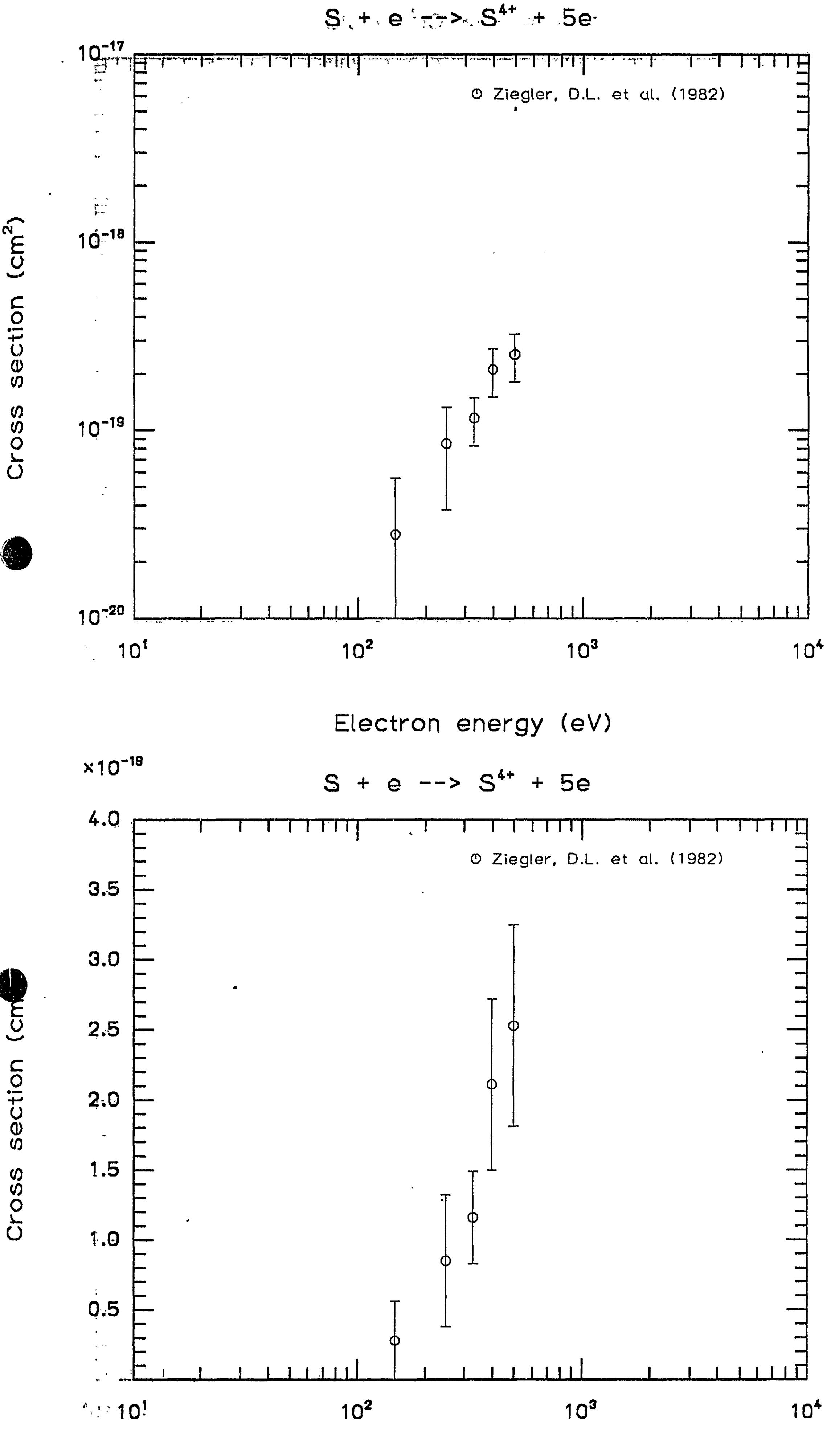
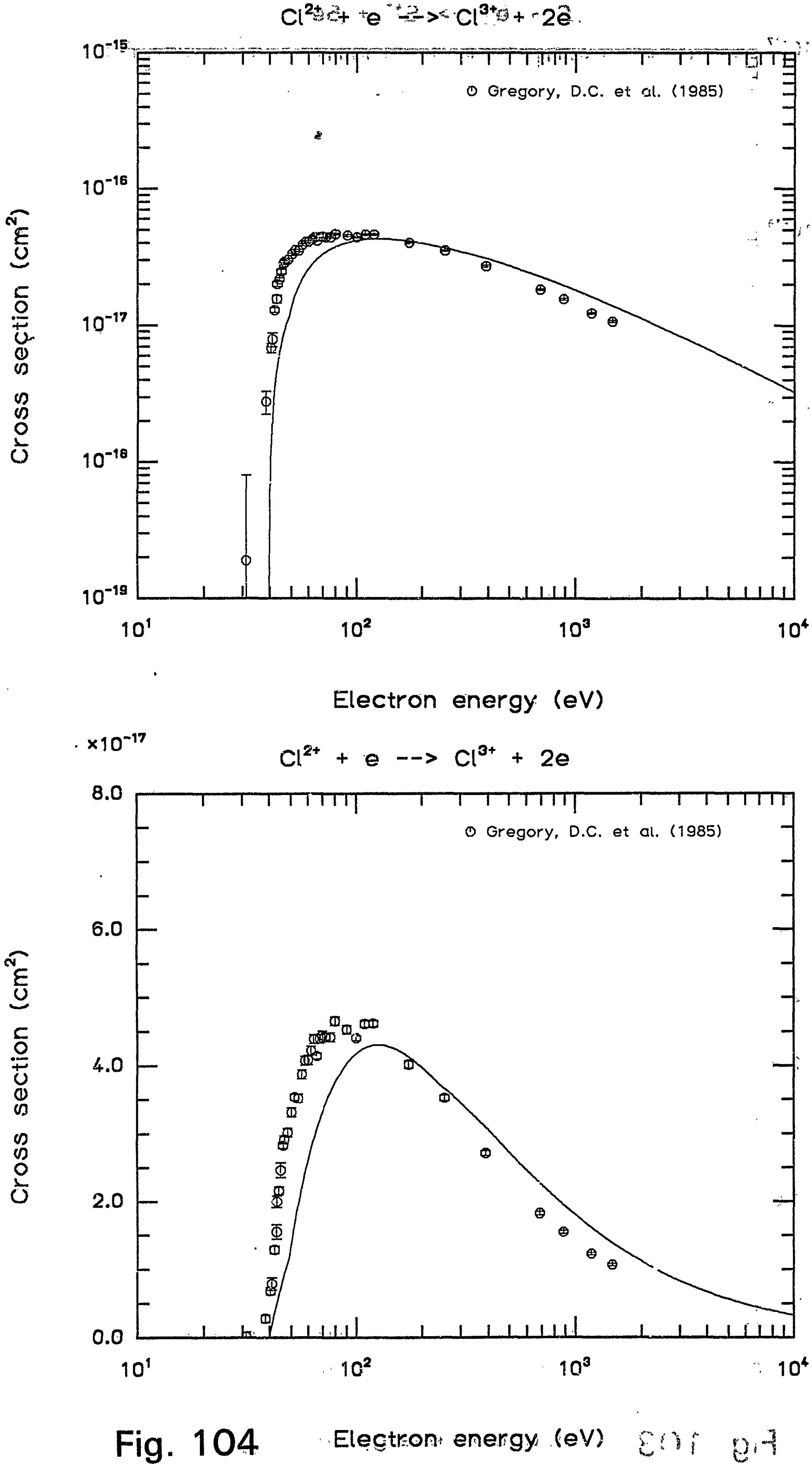


Fig. 103 Electron energy (eV)



Cl2+ + e --> Cl3+ + 2e
Gregory, D.C. et al. (1985)
Cross section (cm2)
10-15
10-16
10-17
10-18
10-19
101
102
103
104
Electron energy (eV)
x10-17
Cl2+ + e --> Cl3+ + 2e
Gregory, D.C. et al. (1985)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
101
102
103
104
Electron energy (eV)

Fig. 104

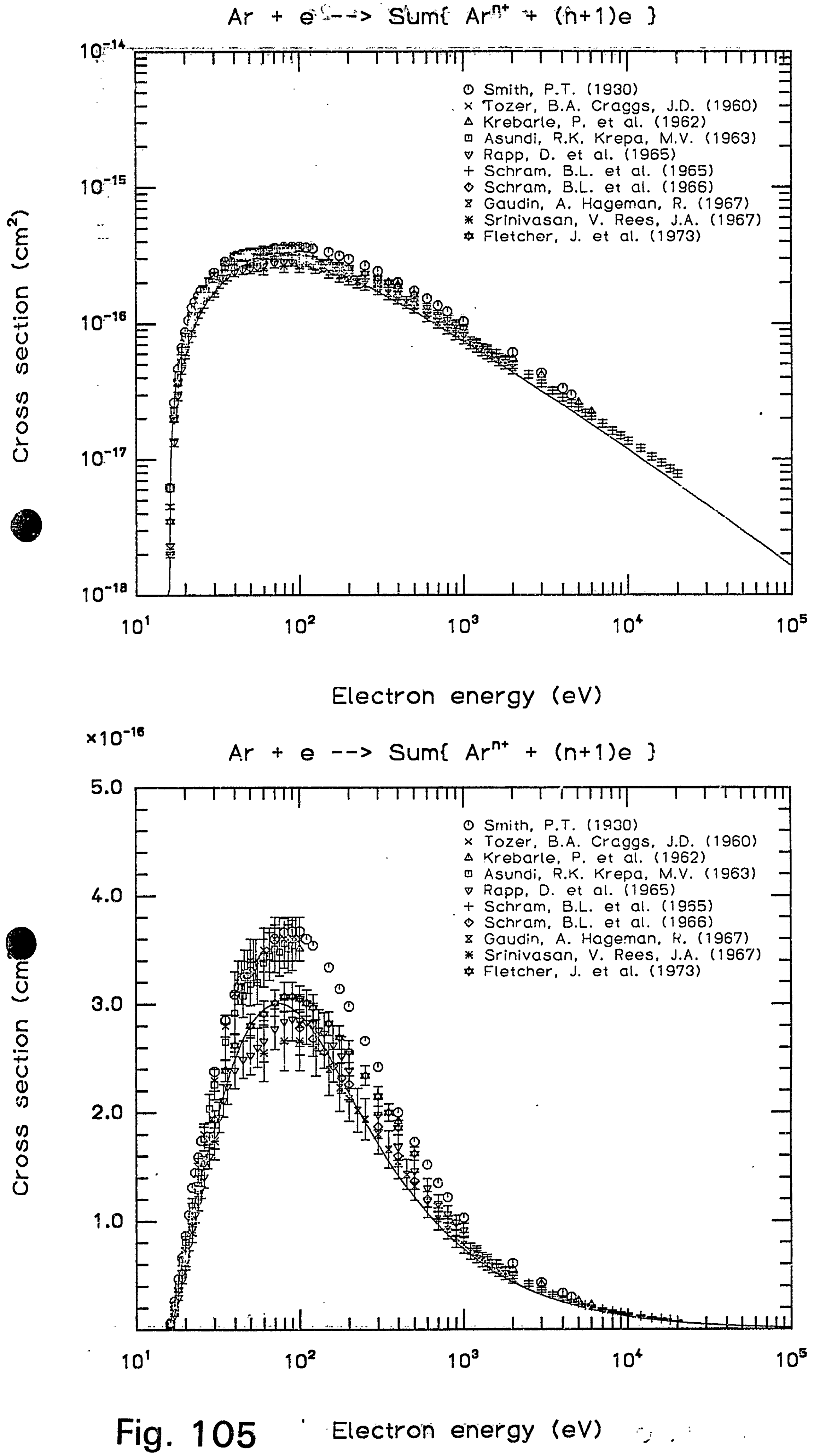
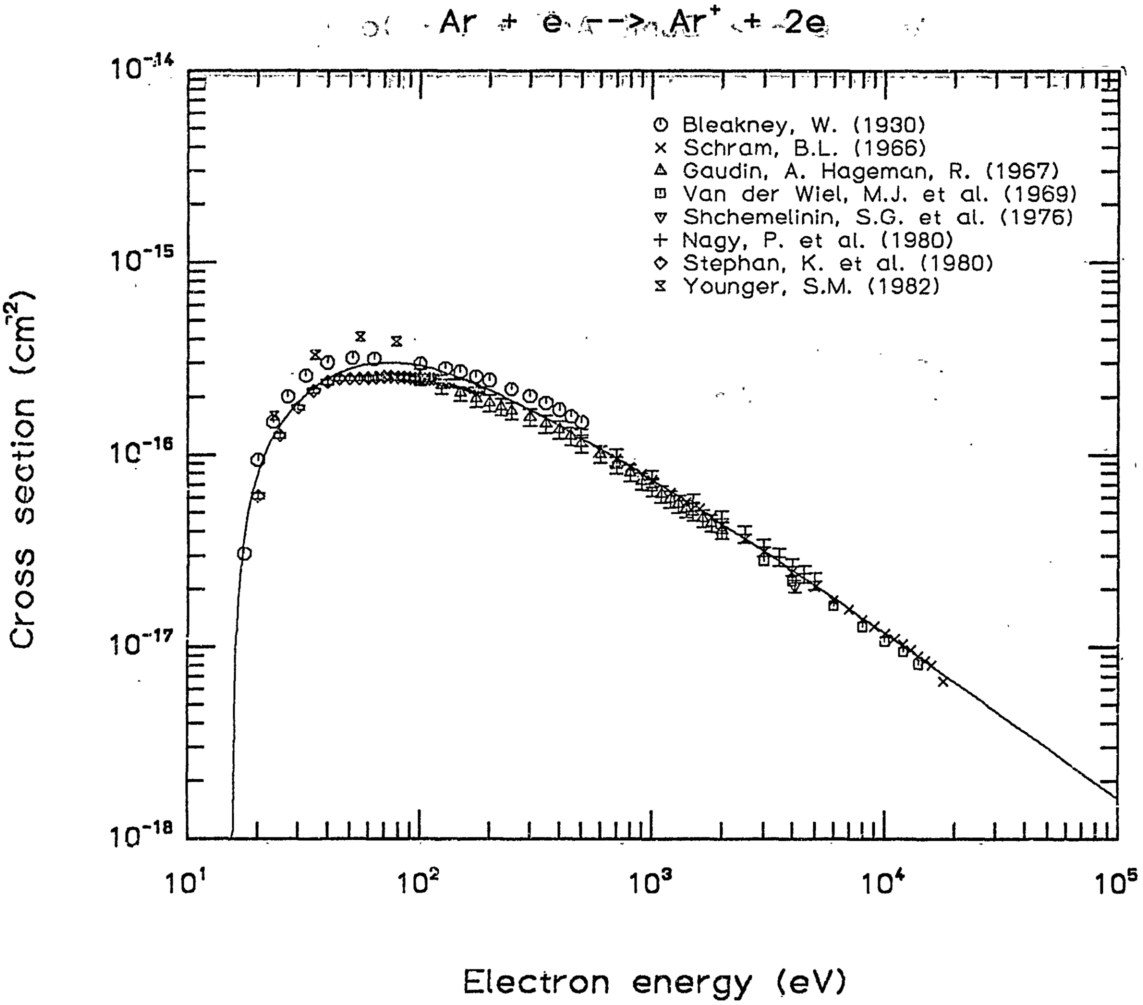

Ar + e --> Sum{ Ar^n+ + (n+1)e }
10^-14
10^-15
10^-16
10^-17
10^-18
Cross section (cm^2)
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)
Smith, P.T. (1930)
Tozer, B.A. Craggs, J.D. (1960)
Krebarle, P. et al. (1962)
Asundi, R.K. Krepa, M.V. (1963)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Gaudin, A. Hageman, R. (1967)
Srinivasan, V. Rees, J.A. (1967)
Fletcher, J. et al. (1973)
×10^-16
Ar + e --> Sum{ Ar^n+ + (n+1)e }
5.0
4.0
3.0
2.0
1.0
Cross section (cm^2)
10^1
10^2
10^3
10^4
10^5
Smith, P.T. (1930)
Tozer, B.A. Craggs, J.D. (1960)
Krebarle, P. et al. (1962)
Asundi, R.K. Krepa, M.V. (1963)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Gaudin, A. Hageman, R. (1967)
Srinivasan, V. Rees, J.A. (1967)
Fletcher, J. et al. (1973)
Electron energy (eV)

Fig. 105


Ar + e --> Ar⁺ + 2e
Cross section (cm²)
Electron energy (eV)
Bleakney, W. (1930)
Schram, B.L. (1966)
Gaudin, A. Hageman, R. (1967)
Van der Wiel, M.J. et al. (1969)
Shchemelinin, S.G. et al. (1976)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
Younger, S.M. (1982)

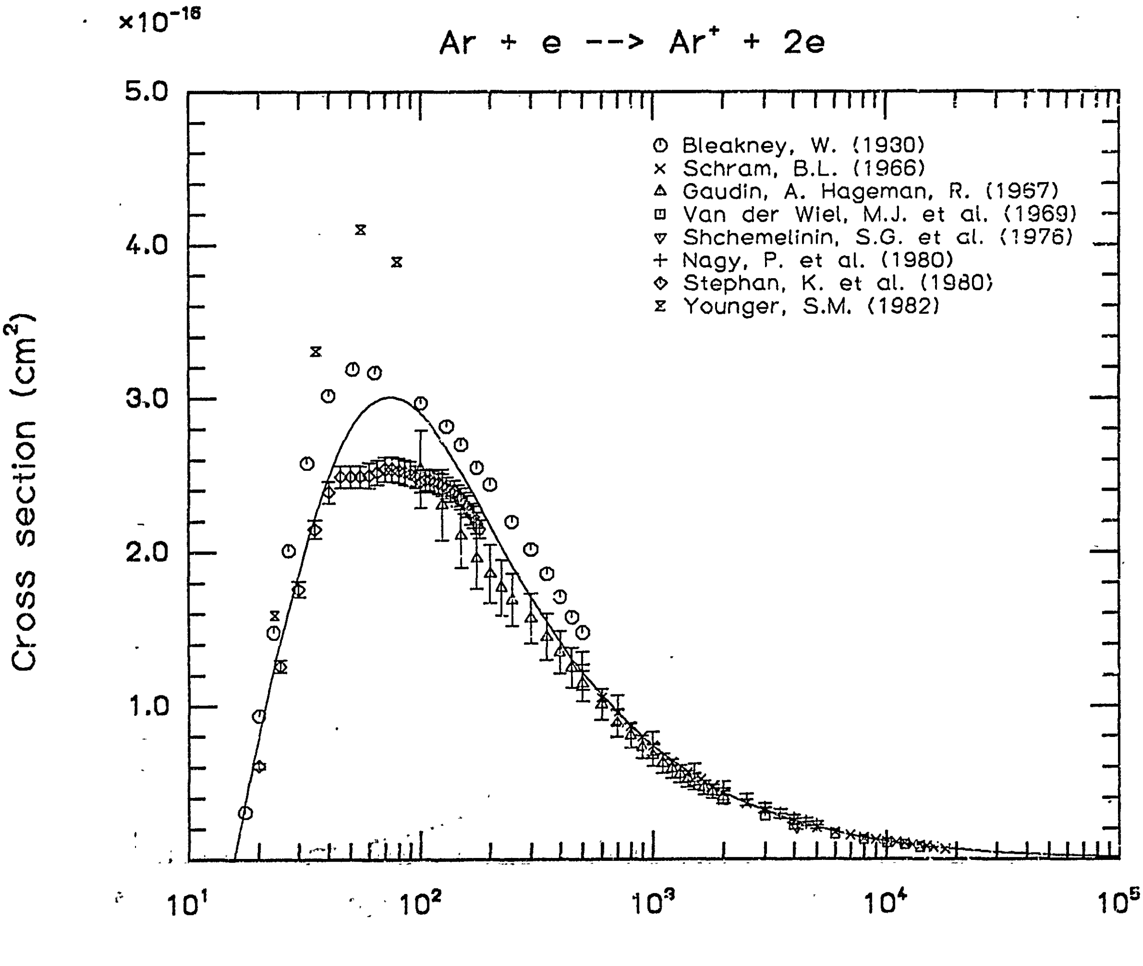
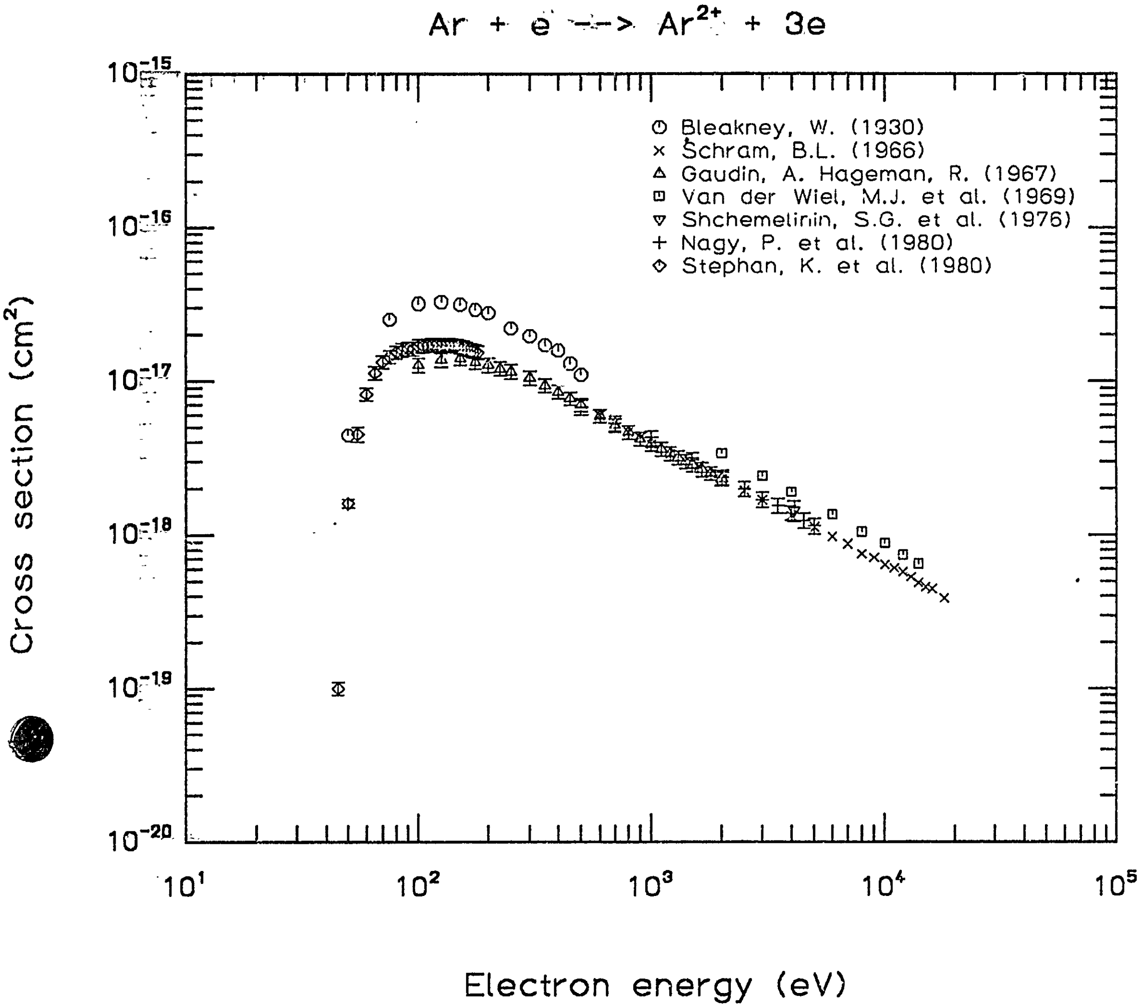

×10⁻¹⁶
Ar + e --> Ar⁺ + 2e
Cross section (cm²)
Electron energy (eV)
Bleakney, W. (1930)
Schram, B.L. (1966)
Gaudin, A. Hageman, R. (1967)
Van der Wiel, M.J. et al. (1969)
Shchemelinin, S.G. et al. (1976)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
Younger, S.M. (1982)

Fig. 106


Ar + e --> Ar2+ + 3e
Bleakney, W. (1930)
Schram, B.L. (1966)
Gaudin, A. Hageman, R. (1967)
Van der Wiel, M.J. et al. (1969)
Shchemelinin, S.G. et al. (1976)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
Cross section (cm2)
Electron energy (eV)

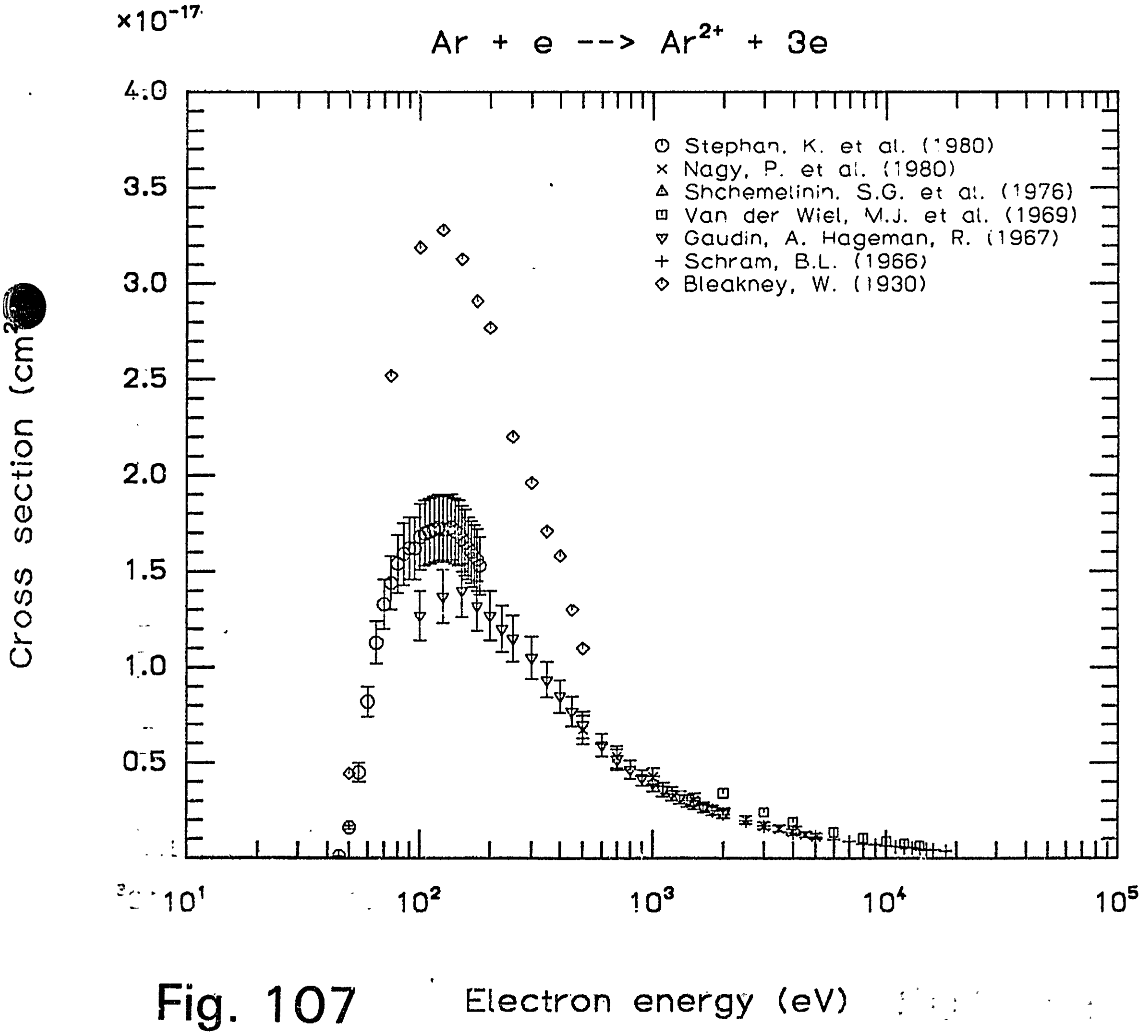

×10-17
Ar + e --> Ar2+ + 3e
Stephan, K. et al. (1980)
Nagy, P. et al. (1980)
Shchemelinin, S.G. et al. (1976)
Van der Wiel, M.J. et al. (1969)
Gaudin, A. Hageman, R. (1967)
Schram, B.L. (1966)
Bleakney, W. (1930)
Cross section (cm2)
Electron energy (eV)

Fig. 107

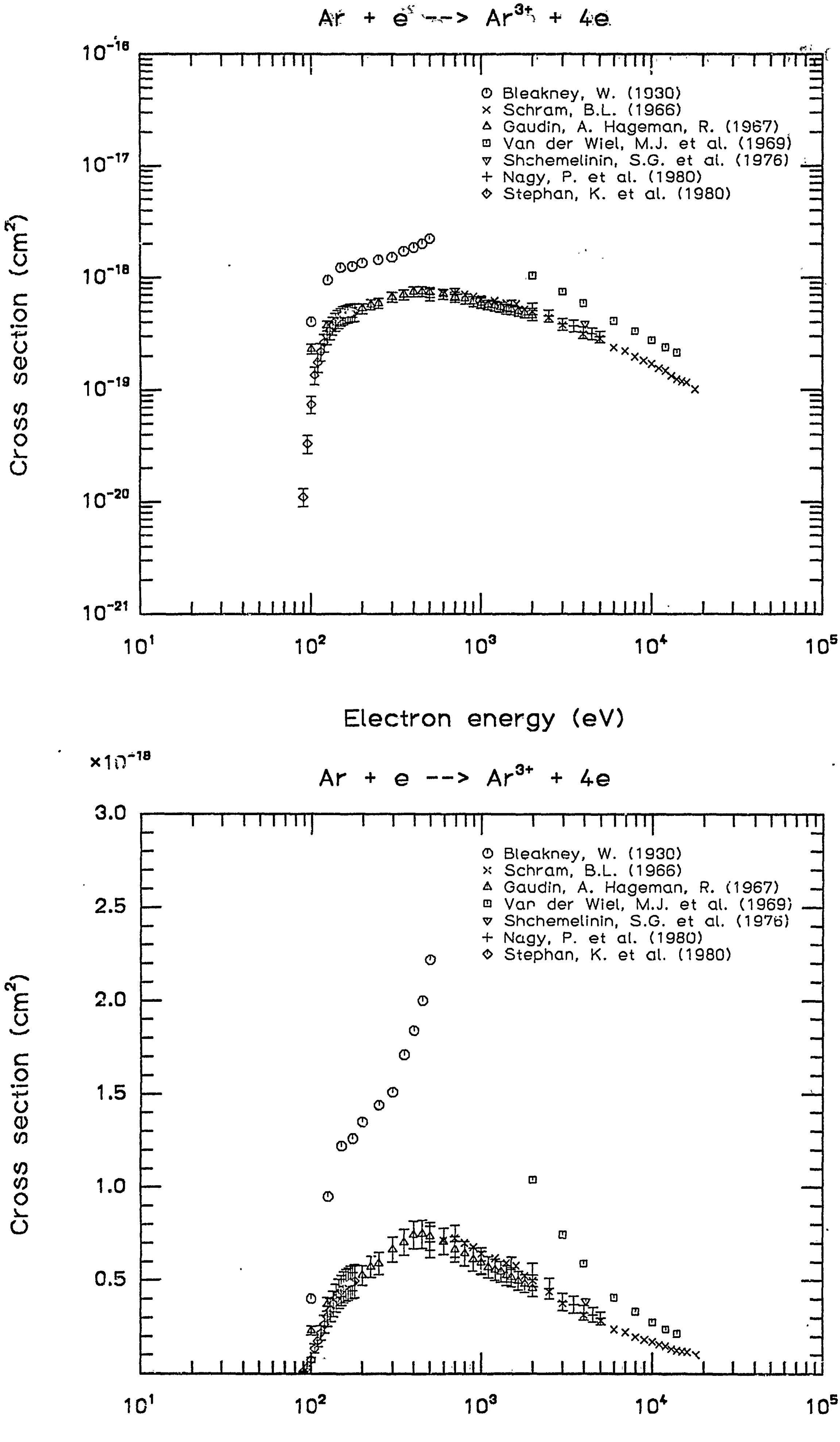
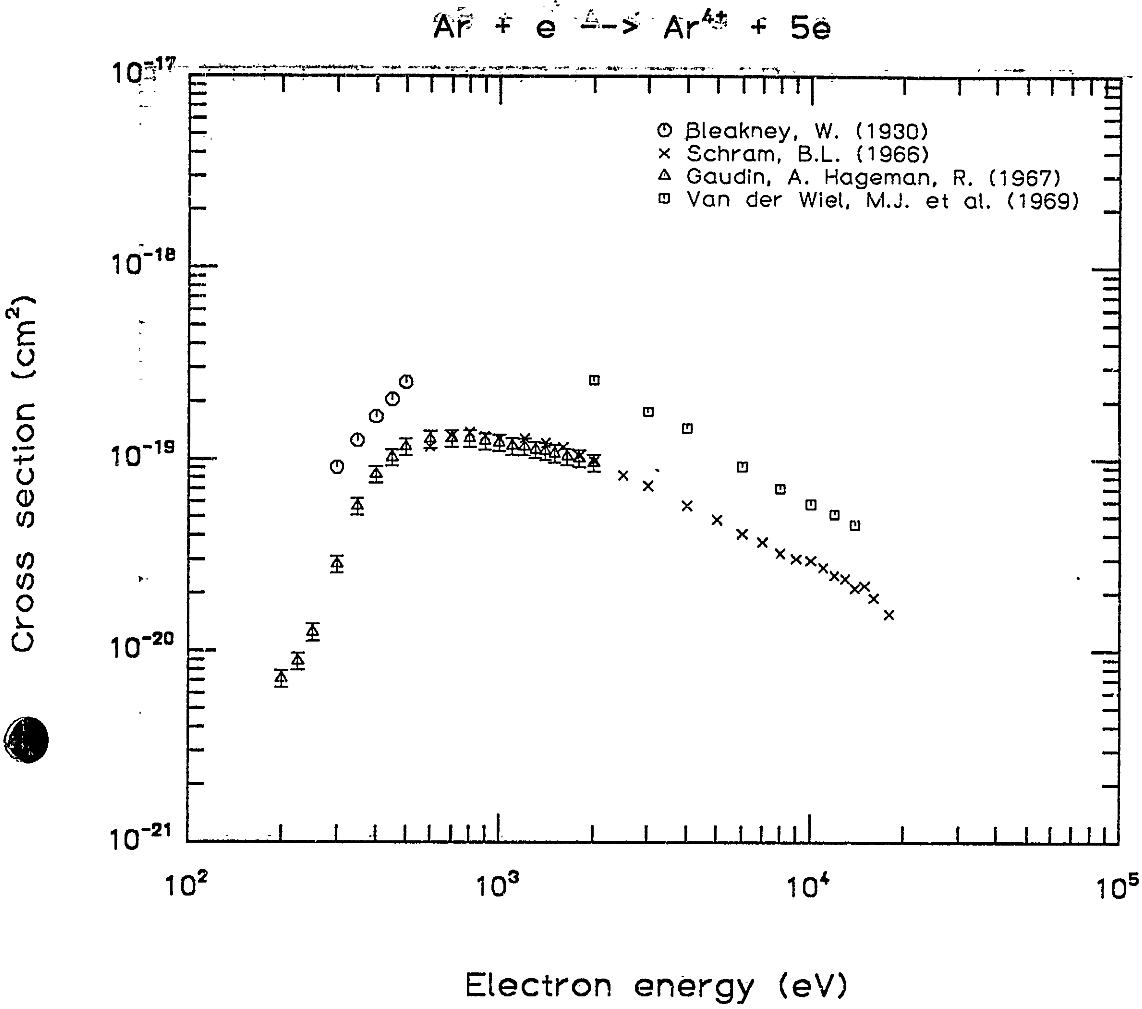


Fig. 108 Electron energy (eV)


Ar + e --> Ar^{4+} + 5e
Bleakney, W. (1930)
Schram, B.L. (1966)
Gaudin, A. Hageman, R. (1967)
Van der Wiel, M.J. et al. (1969)
Cross section (cm^2)
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^2
10^3
10^4
10^5
Electron energy (eV)

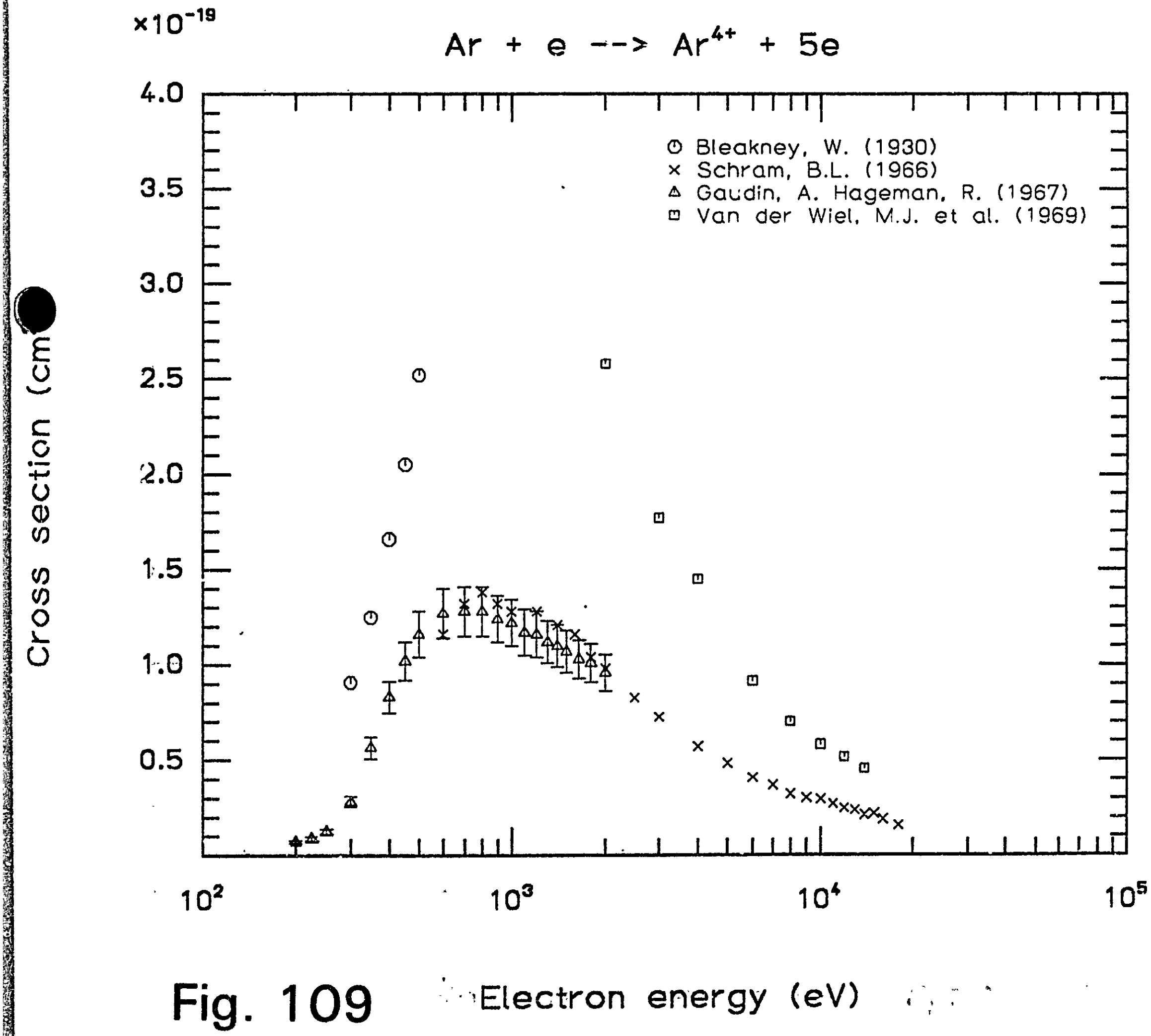
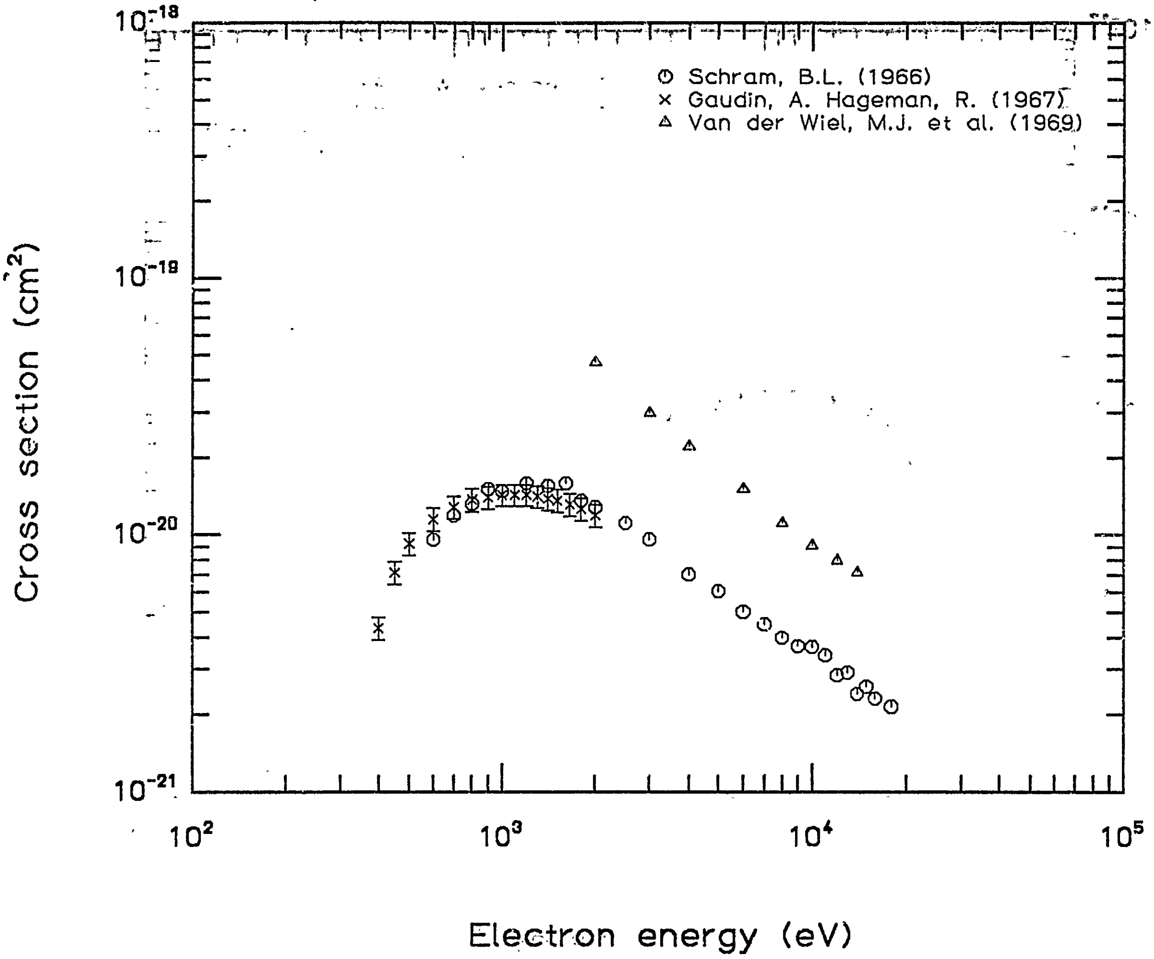

$\times 10^{-19}$
Ar + e --> Ar^{4+} + 5e
Bleakney, W. (1930)
Schram, B.L. (1966)
Gaudin, A. Hageman, R. (1967)
Van der Wiel, M.J. et al. (1969)
Cross section (cm^2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 109

$Ar + e \rightarrow Ar^{5+} + 6e$



$Ar + e \rightarrow Ar^{5+} + 6e$

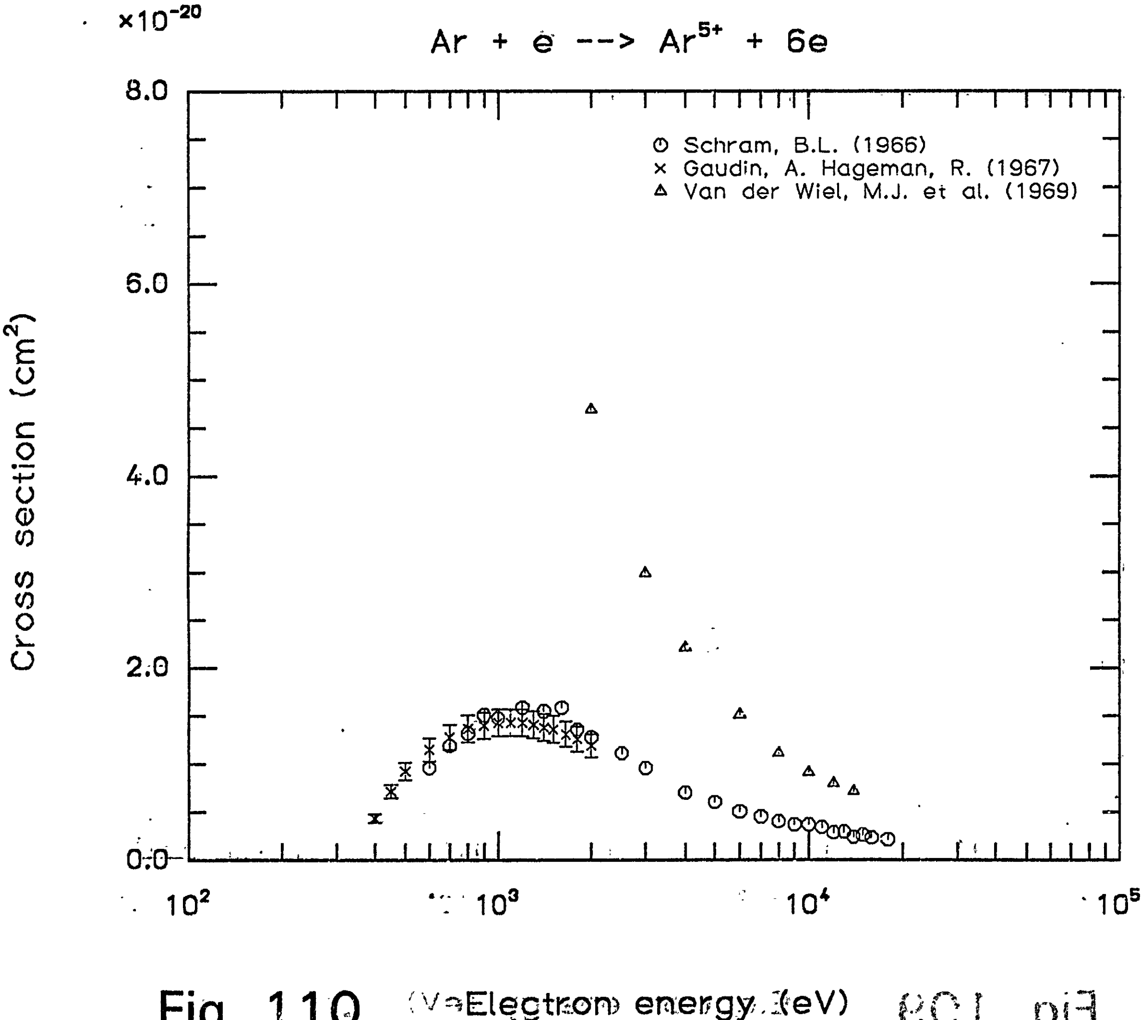
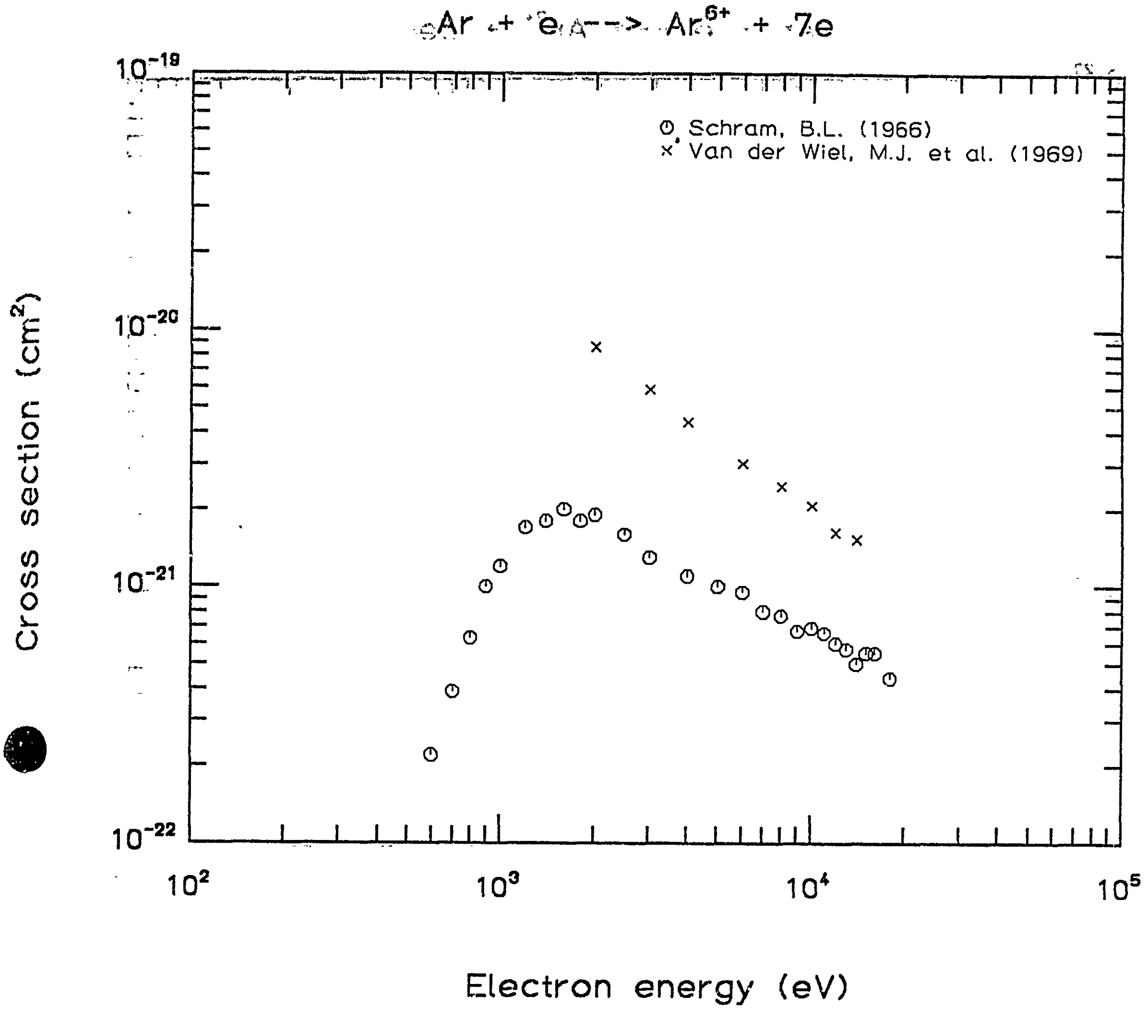
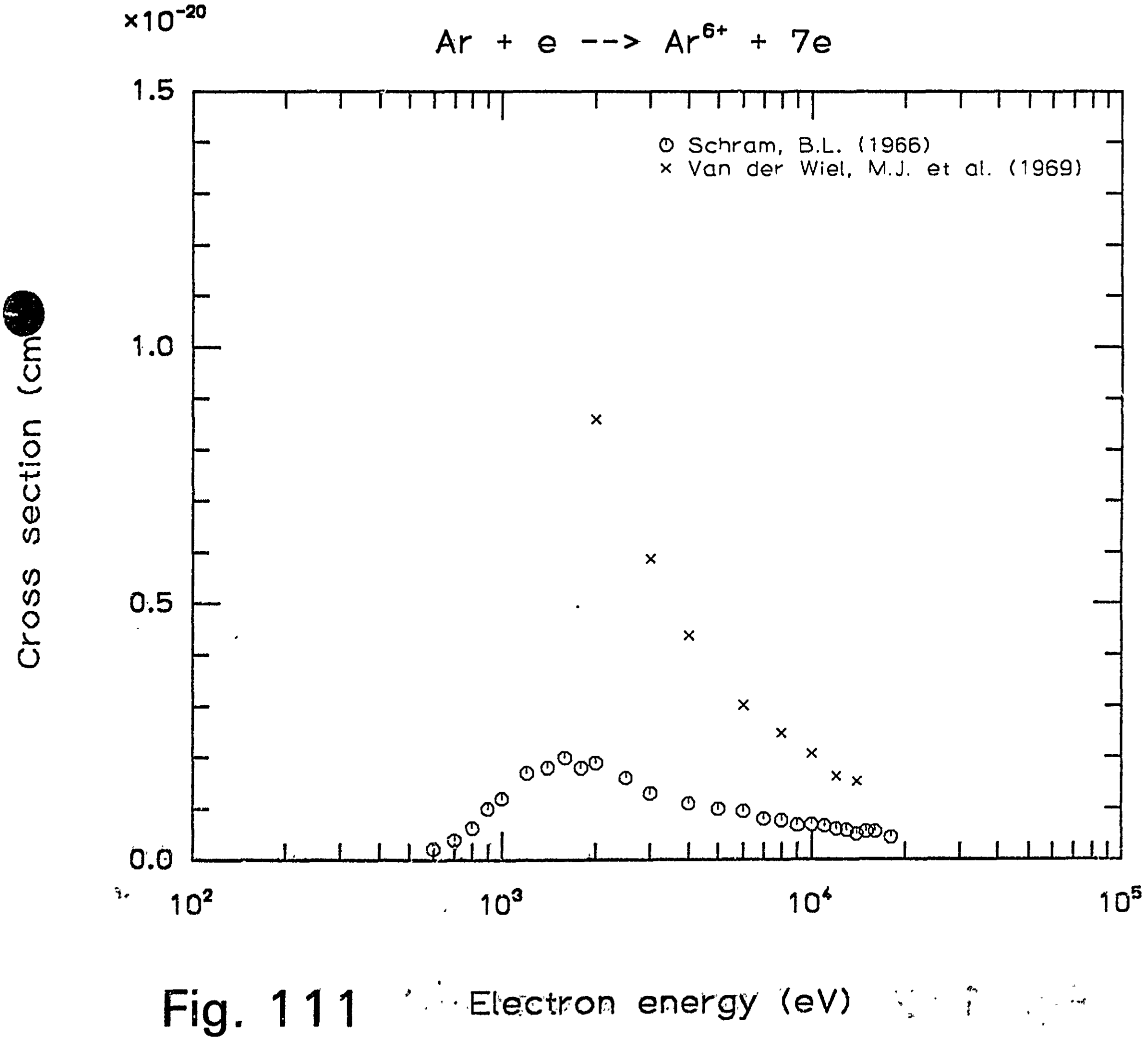


Fig. 110



Ar + e --> Ar^{6+} + 7e
Schram, B.L. (1966)
Van der Wiel, M.J. et al. (1969)
Cross section (cm^2)
Electron energy (eV)



×10^{-20}
Ar + e --> Ar^{6+} + 7e
Schram, B.L. (1966)
Van der Wiel, M.J. et al. (1969)
Cross section (cm
Electron energy (eV)

Fig. 111

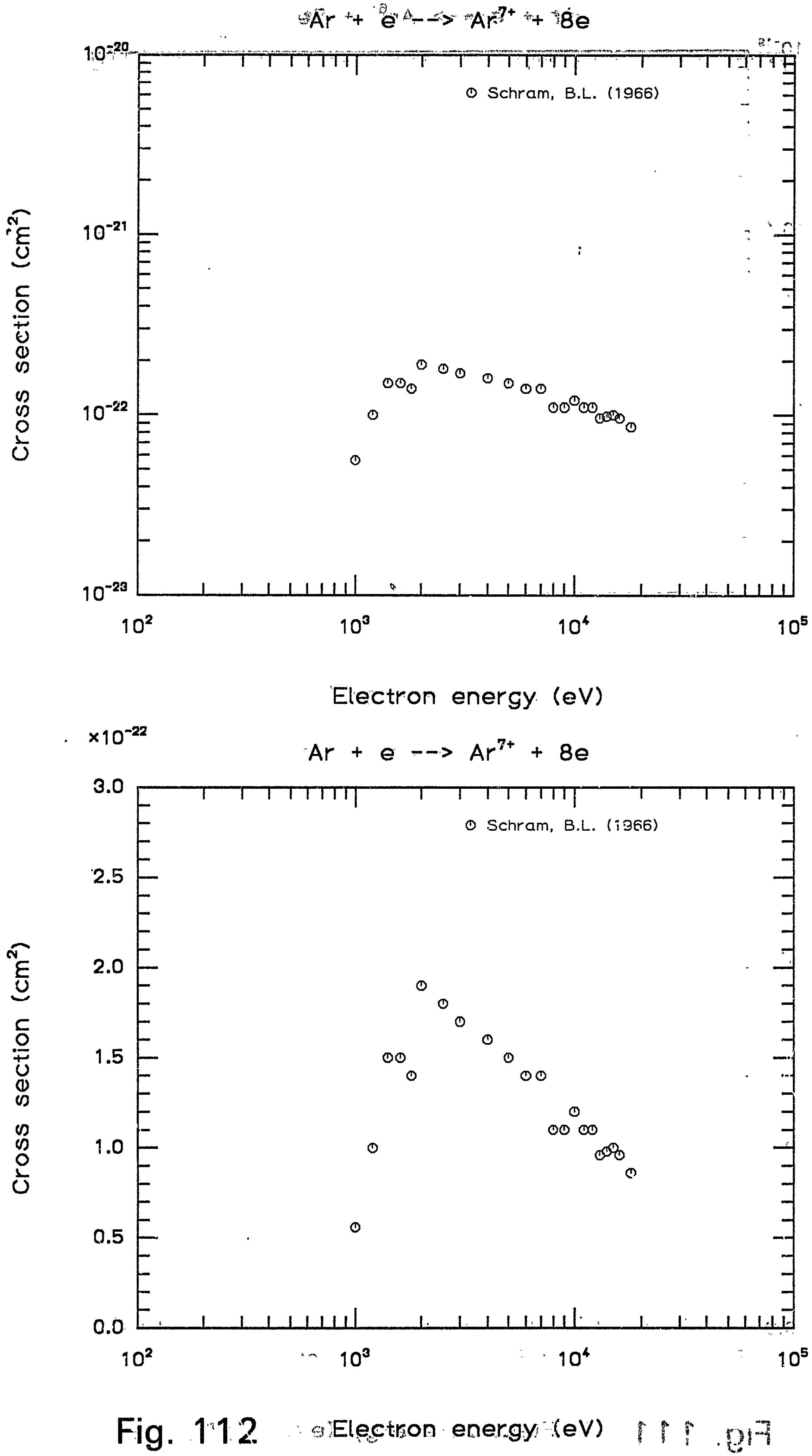
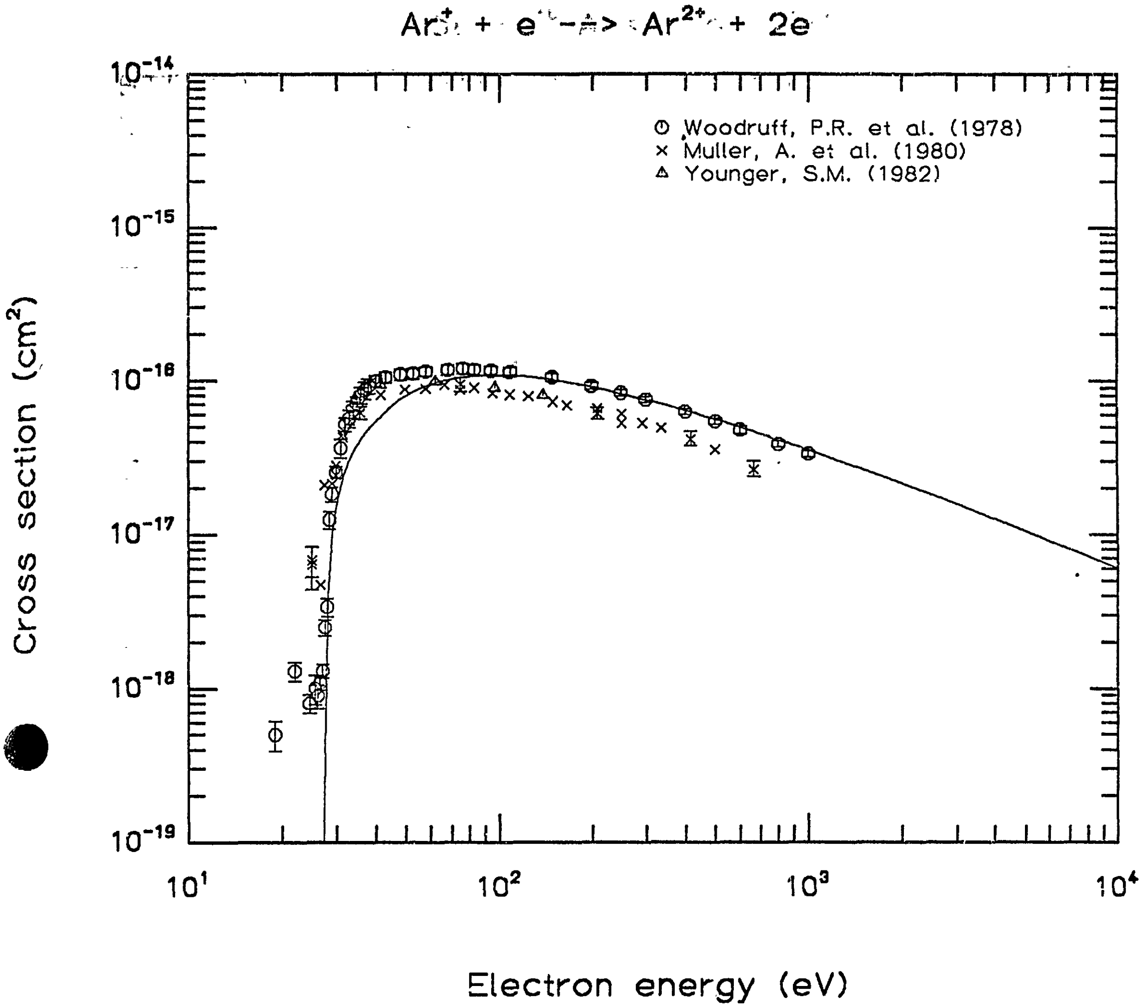

Ar + e --> Ar7+ + 8e
Schram, B.L. (1966)
Cross section (cm2)
10-20
10-21
10-22
10-23
102
103
104
105
Electron energy (eV)
×10-22
Ar + e --> Ar7+ + 8e
Schram, B.L. (1966)
Cross section (cm2)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
102
103
104
105
Electron energy (eV)

Fig. 112


Ar+ + e --> Ar2+ + 2e
Woodruff, P.R. et al. (1978)
Muller, A. et al. (1980)
Younger, S.M. (1982)
Cross section (cm2)
Electron energy (eV)

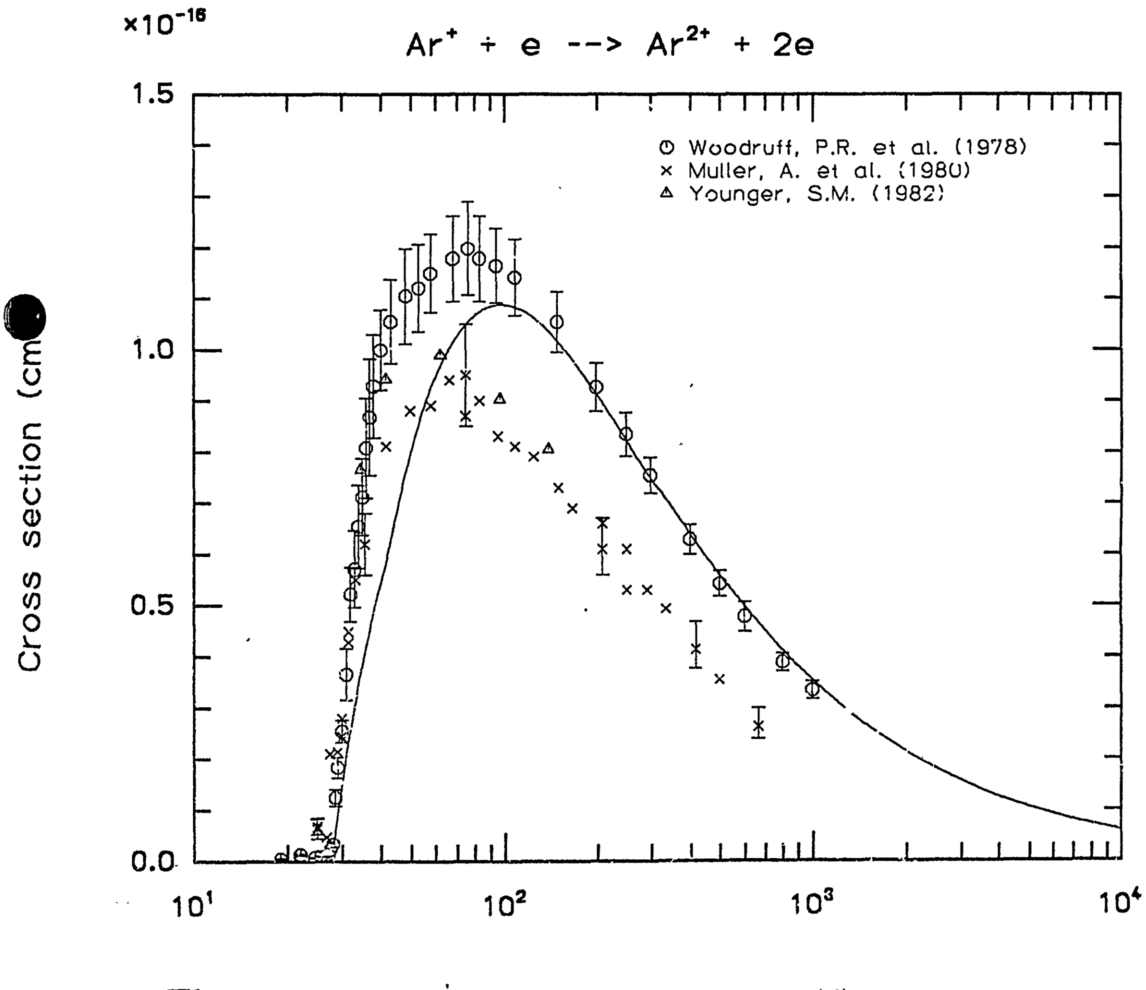
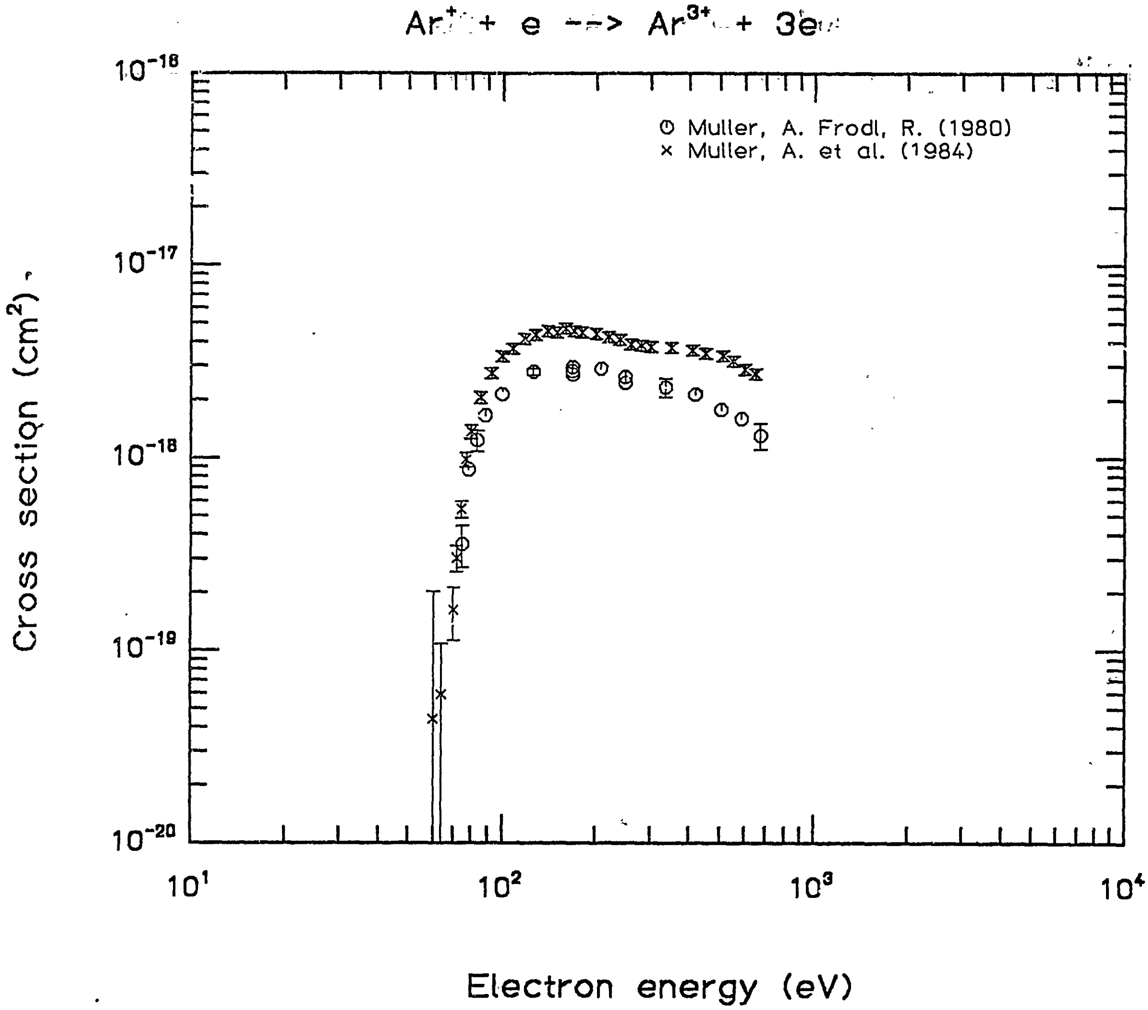
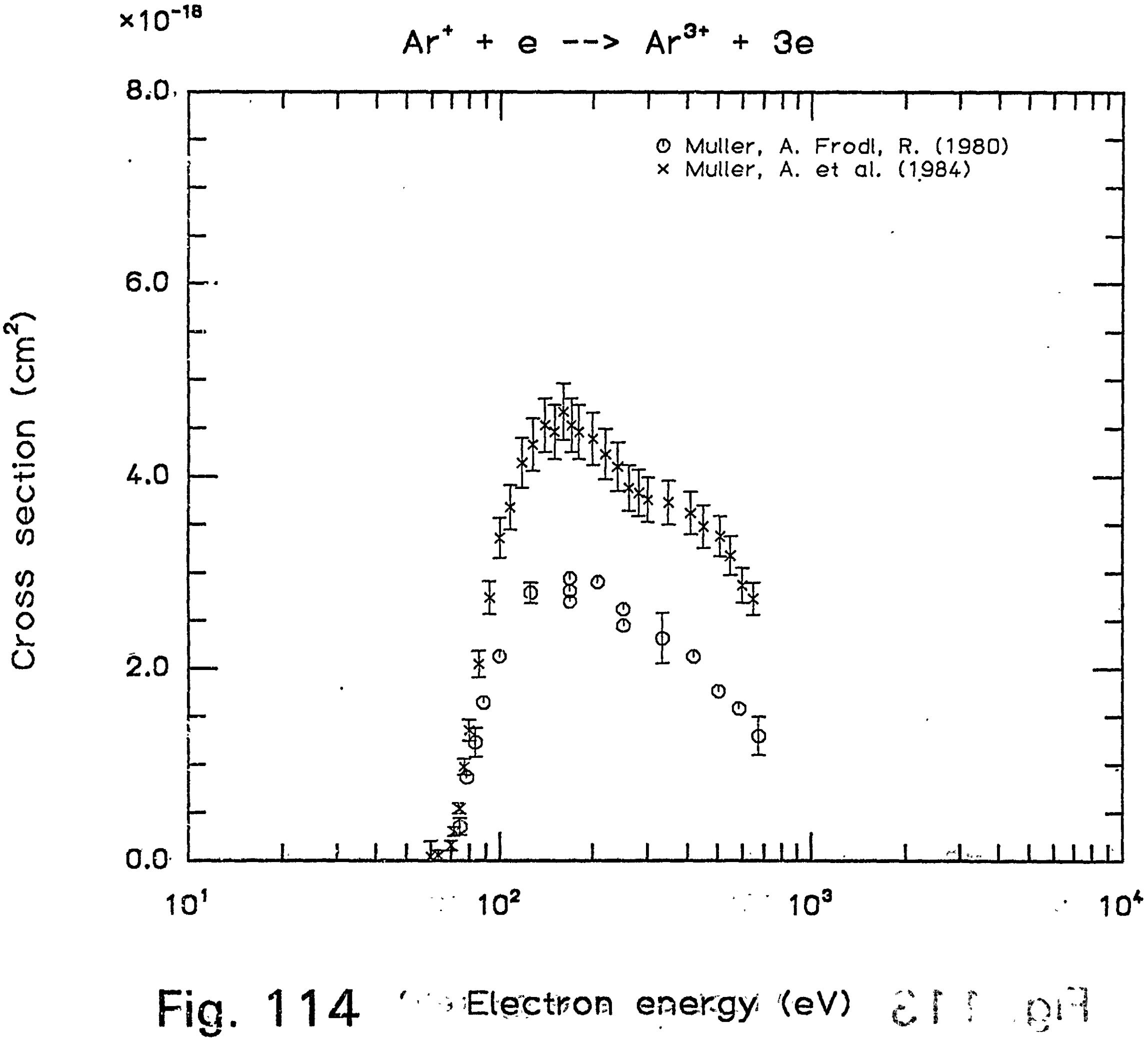

×10-16
Ar+ + e --> Ar2+ + 2e
Woodruff, P.R. et al. (1978)
Muller, A. et al. (1980)
Younger, S.M. (1982)
Cross section (cm
Electron energy (eV)

Fig. 113

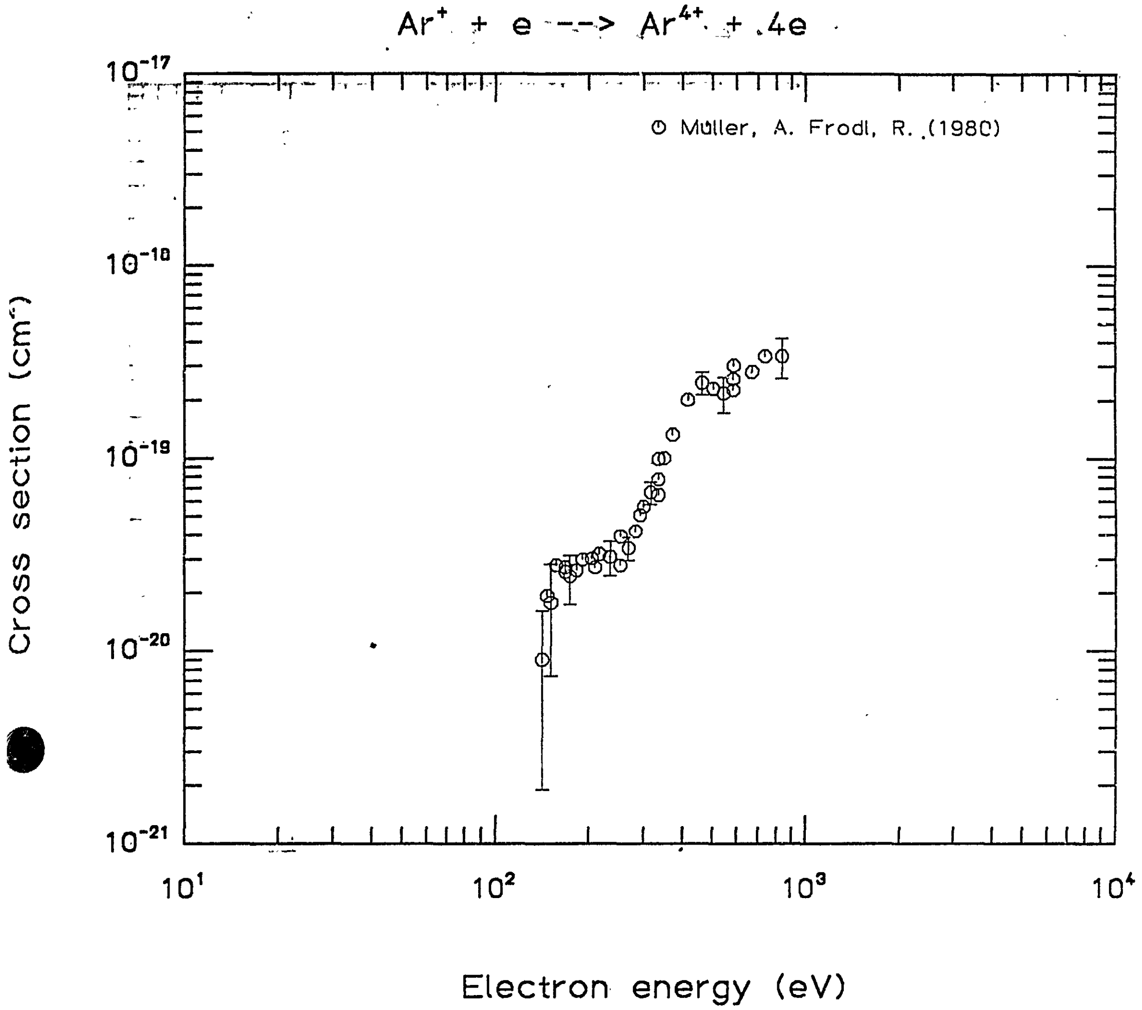


Ar+ + e --> Ar3+ + 3e
Muller, A. Frodl, R. (1980)
× Muller, A. et al. (1984)
Cross section (cm2)
Electron energy (eV)



×10-18
Ar+ + e --> Ar3+ + 3e
Muller, A. Frodl, R. (1980)
× Muller, A. et al. (1984)
Cross section (cm2)
Electron energy (eV)

Fig. 114



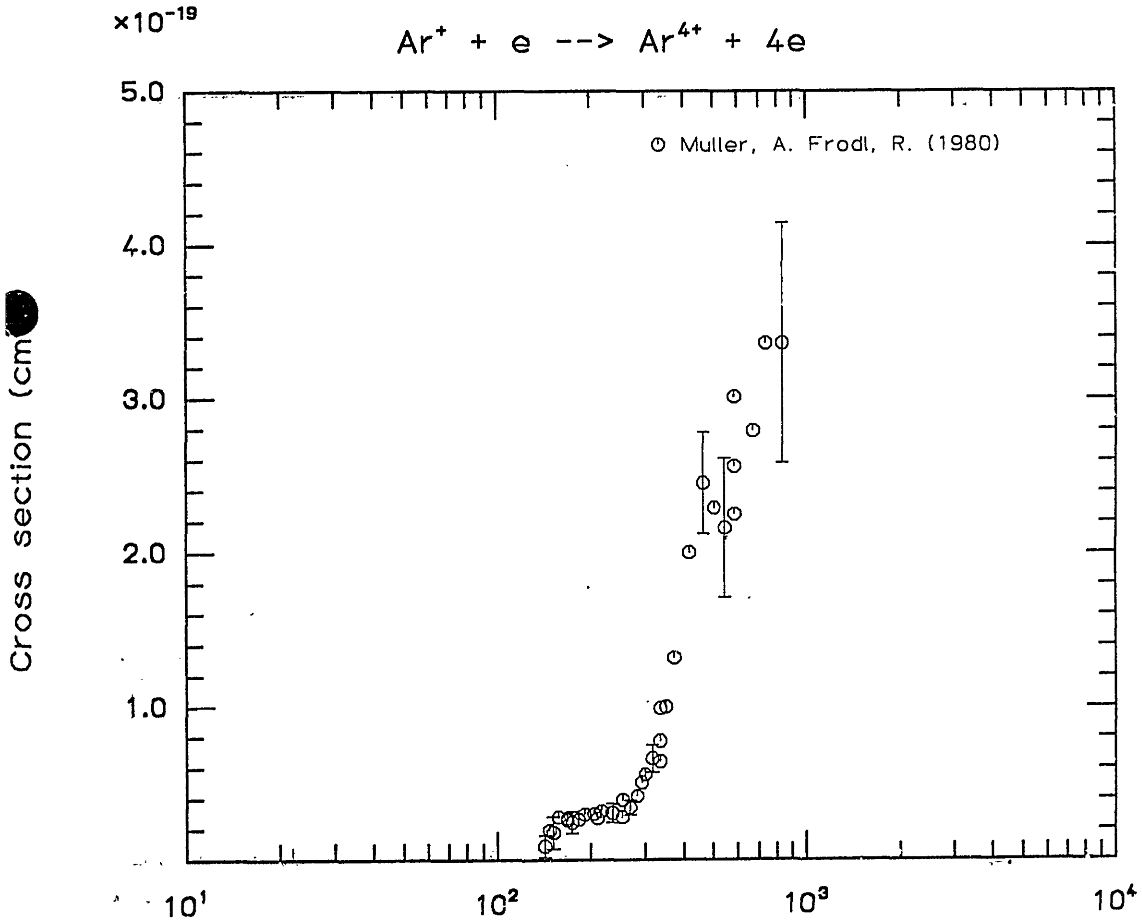
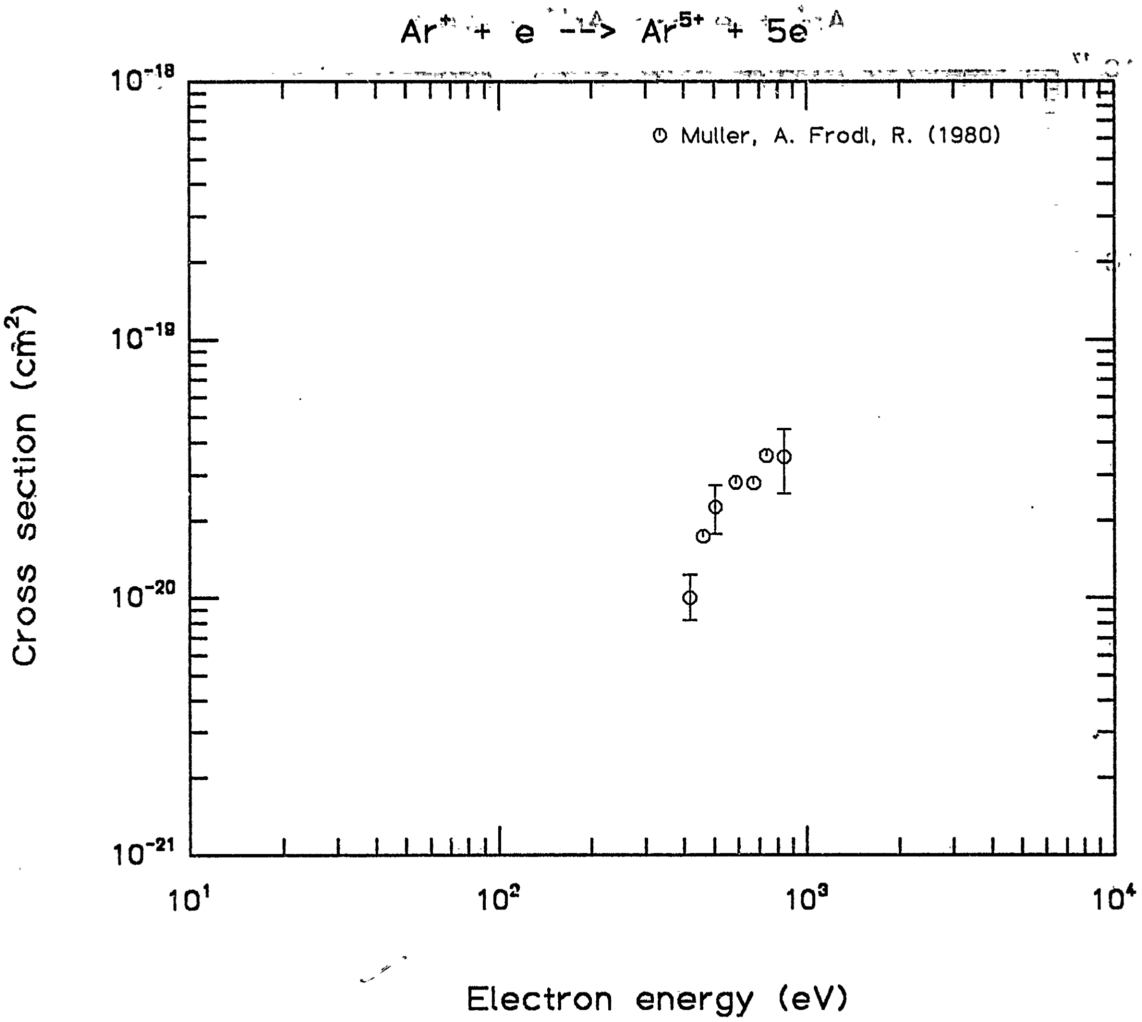


Fig. 115 Electron energy (eV)


Ar+ + e --> Ar5+ + 5e
Muller, A. Frodl, R. (1980)
Cross section (cm2)
10-18
10-19
10-20
10-21
101
102
103
104
Electron energy (eV)

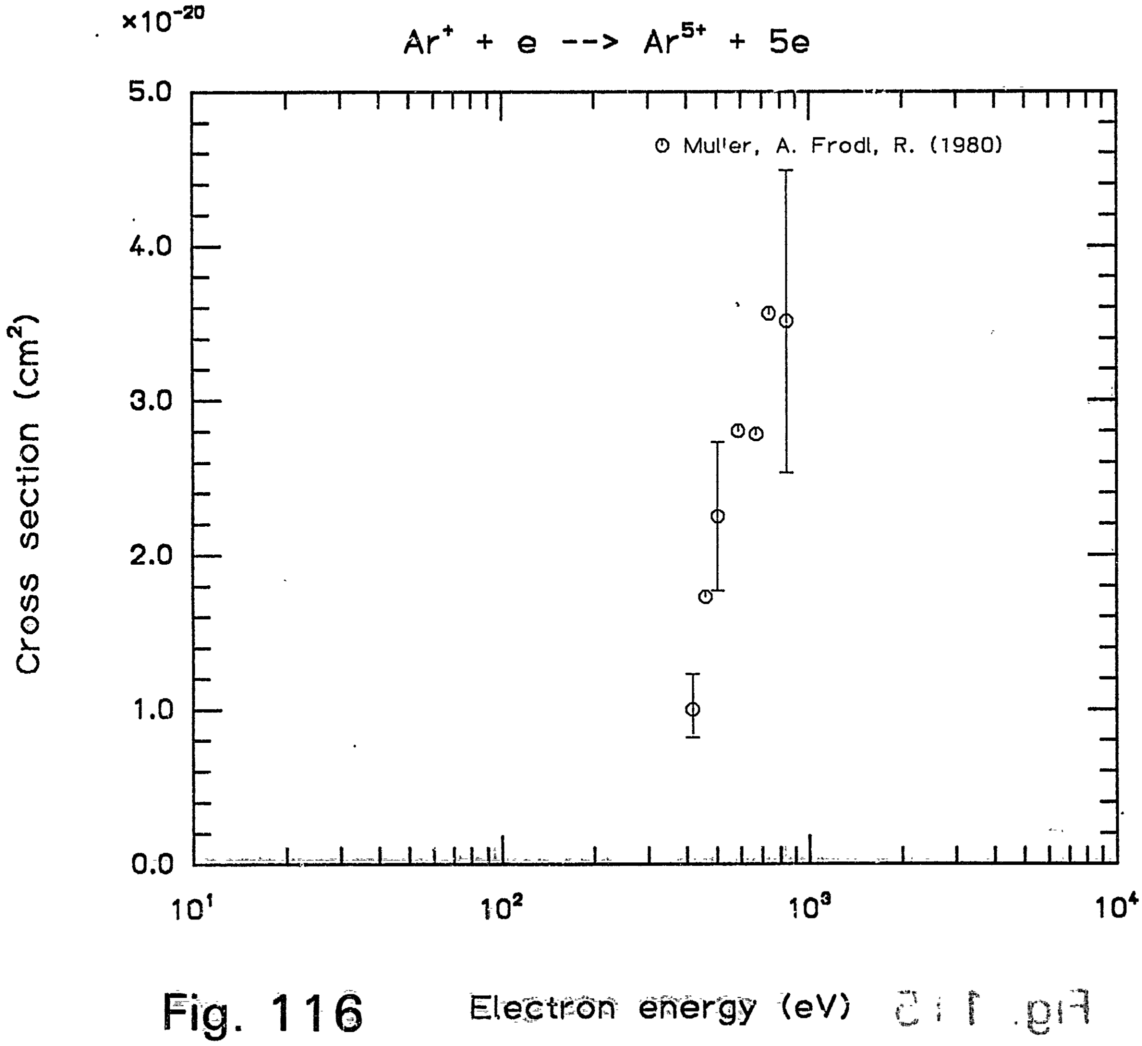
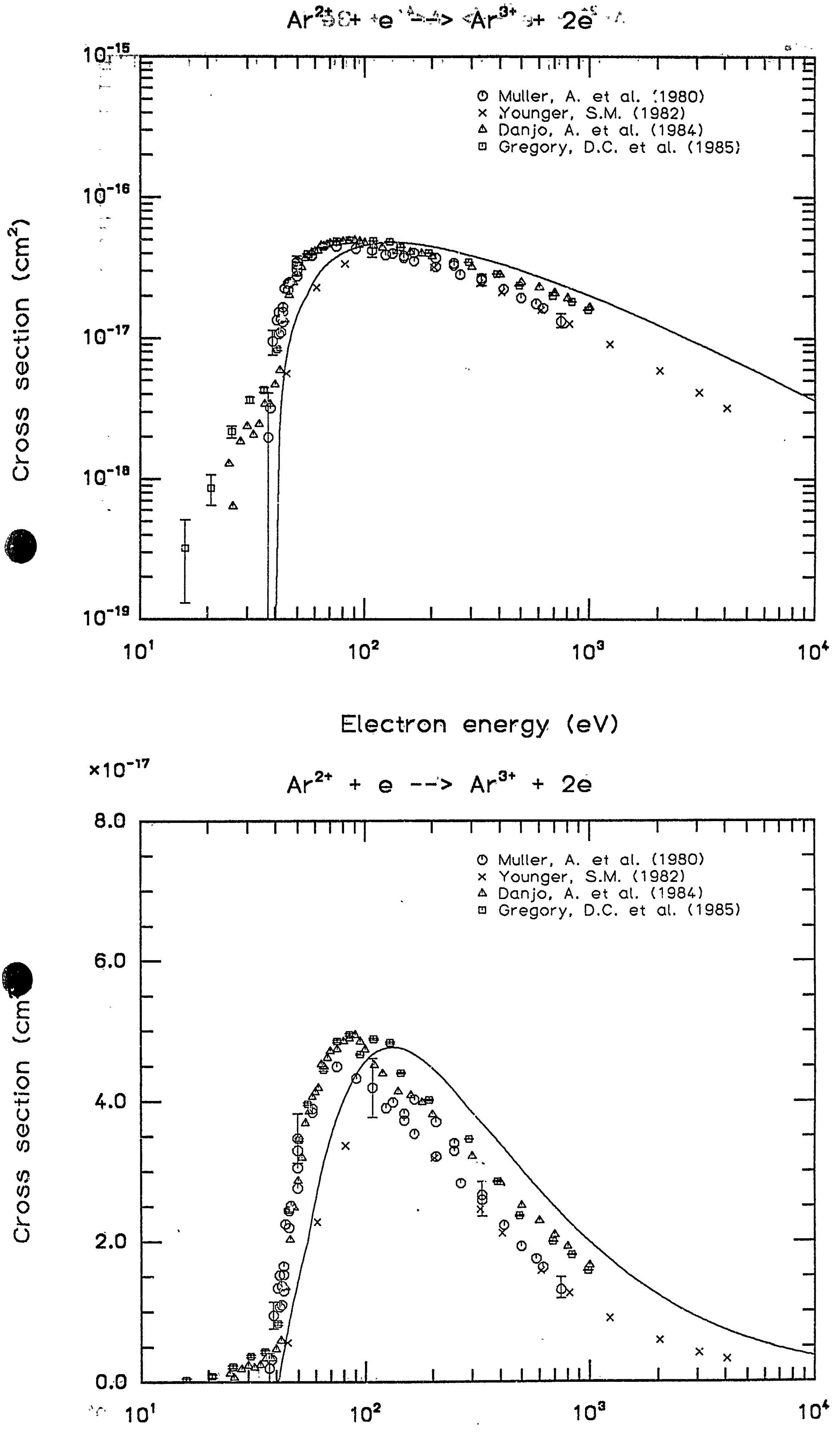
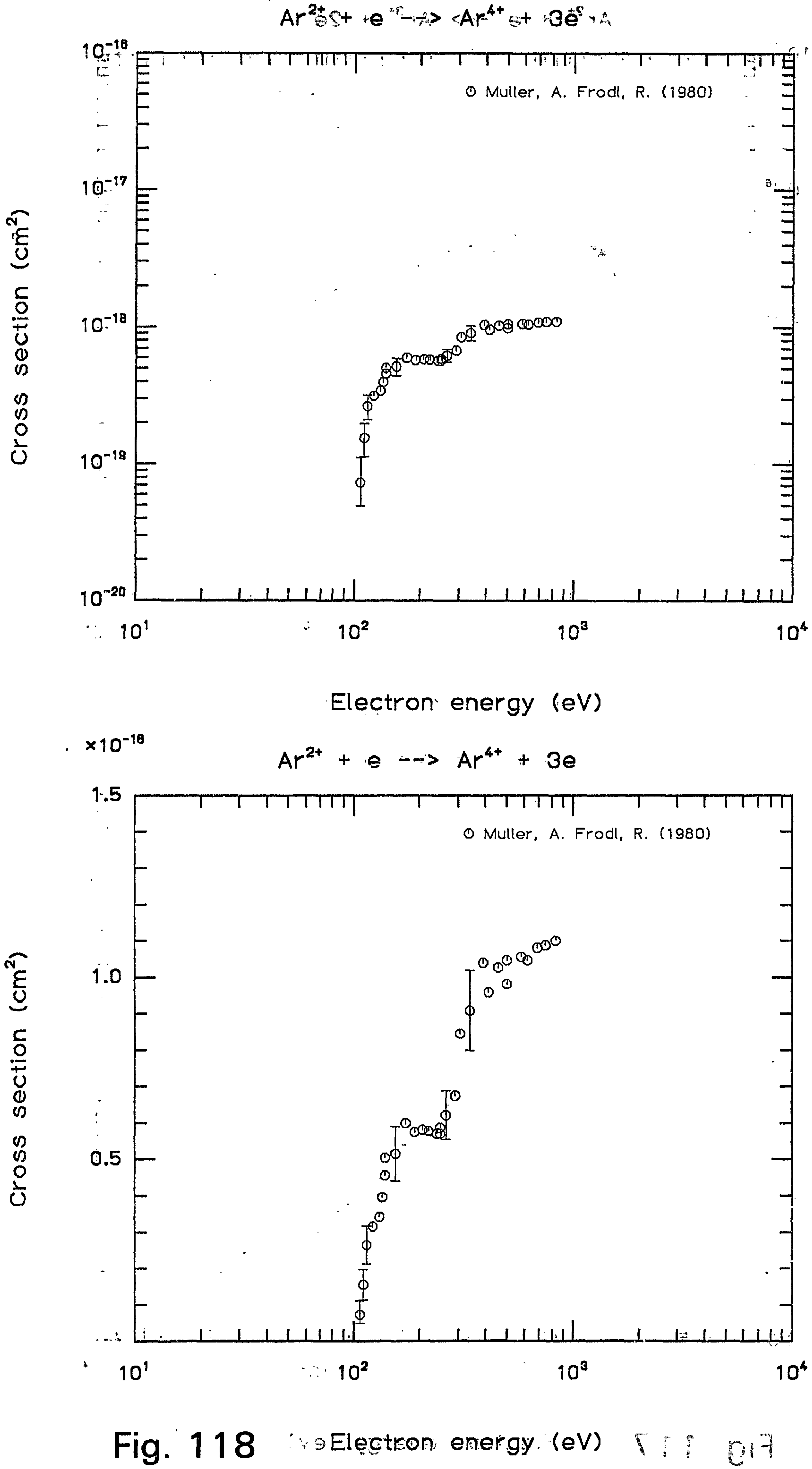

×10-20
Ar+ + e --> Ar5+ + 5e
Muller, A. Frodl, R. (1980)
Cross section (cm2)
5.0
4.0
3.0
2.0
1.0
0.0
101
102
103
104
Electron energy (eV)

Fig. 116



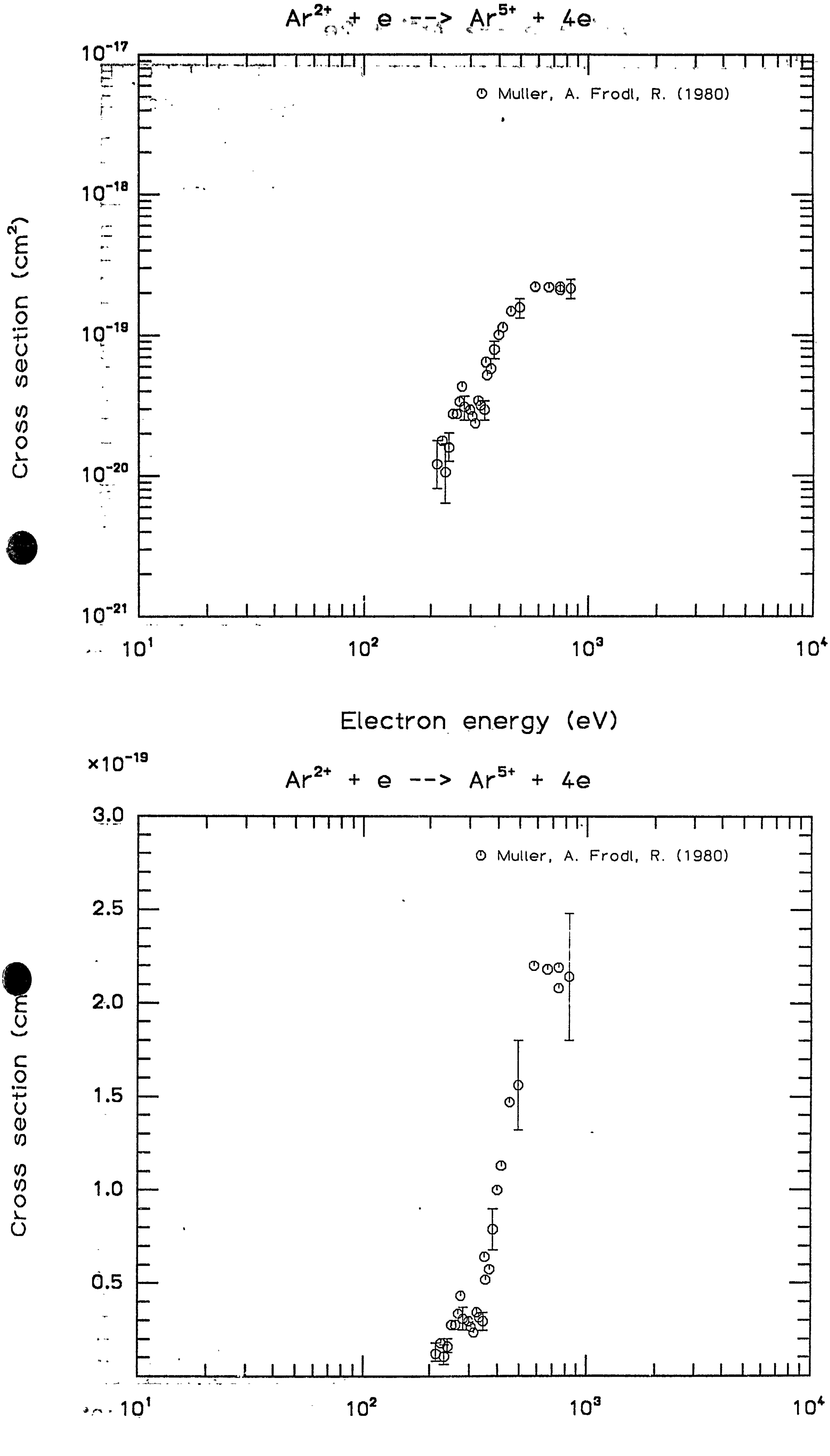
Ar2+ + e --> Ar3+ + 2e
Muller, A. et al. (1980)
Younger, S.M. (1982)
Danjo, A. et al. (1984)
Gregory, D.C. et al. (1985)
Cross section (cm2)
10-15
10-16
10-17
10-18
10-19
10 1
10 2
10 3
10 4
Electron energy (eV)
x10-17
Ar2+ + e --> Ar3+ + 2e
Muller, A. et al. (1980)
Younger, S.M. (1982)
Danjo, A. et al. (1984)
Gregory, D.C. et al. (1985)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
10 1
10 2
10 3
10 4
Electron energy (eV)

Fig. 117



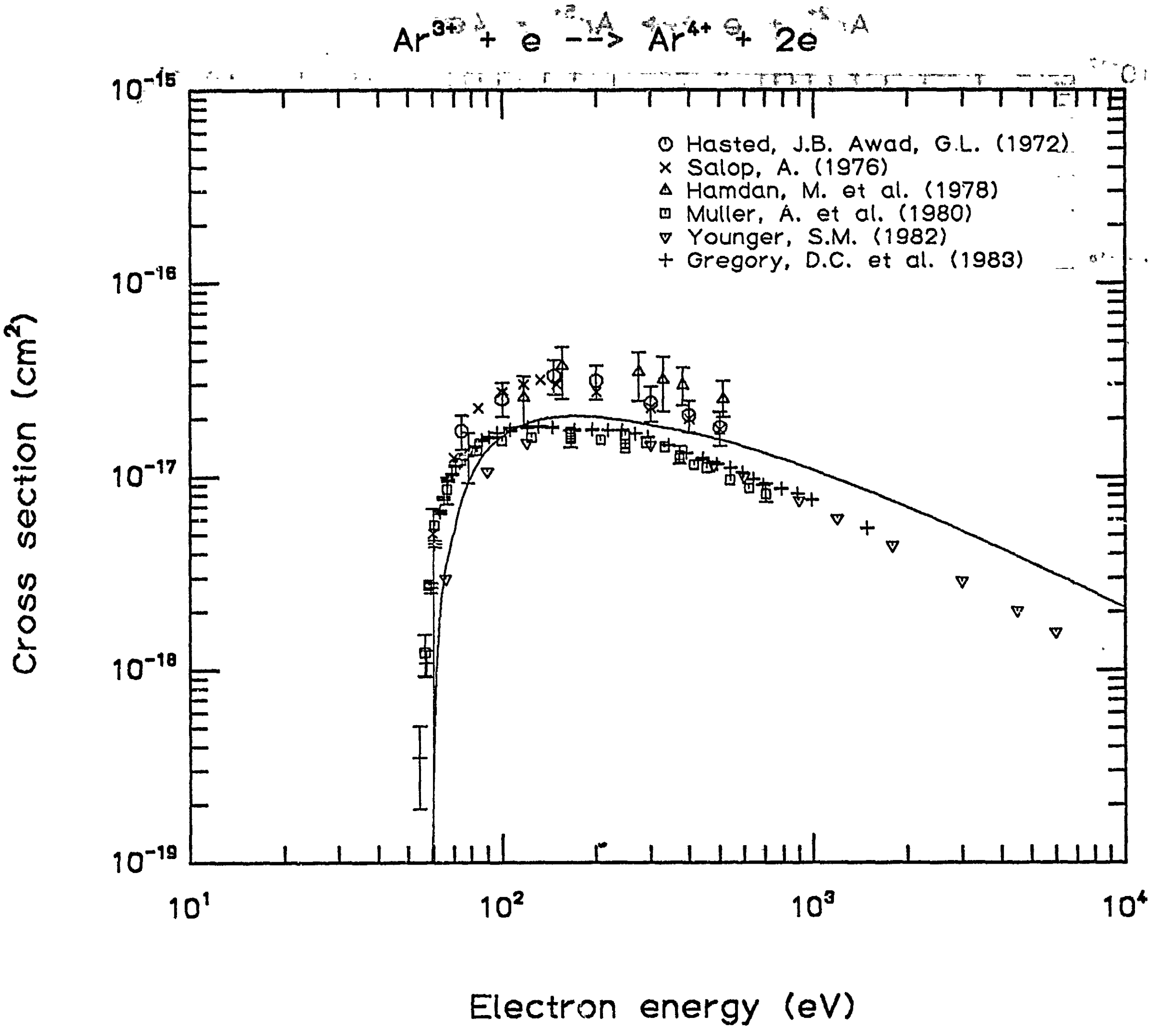
Ar2+ + e --> Ar4+ + 3e
Muller, A. Frodl, R. (1980)
Cross section (cm2)
10-16
10-17
10-18
10-19
10-20
10^1
10^2
10^3
10^4
Electron energy (eV)
×10-16
Ar2+ + e --> Ar4+ + 3e
Muller, A. Frodl, R. (1980)
Cross section (cm2)
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 118

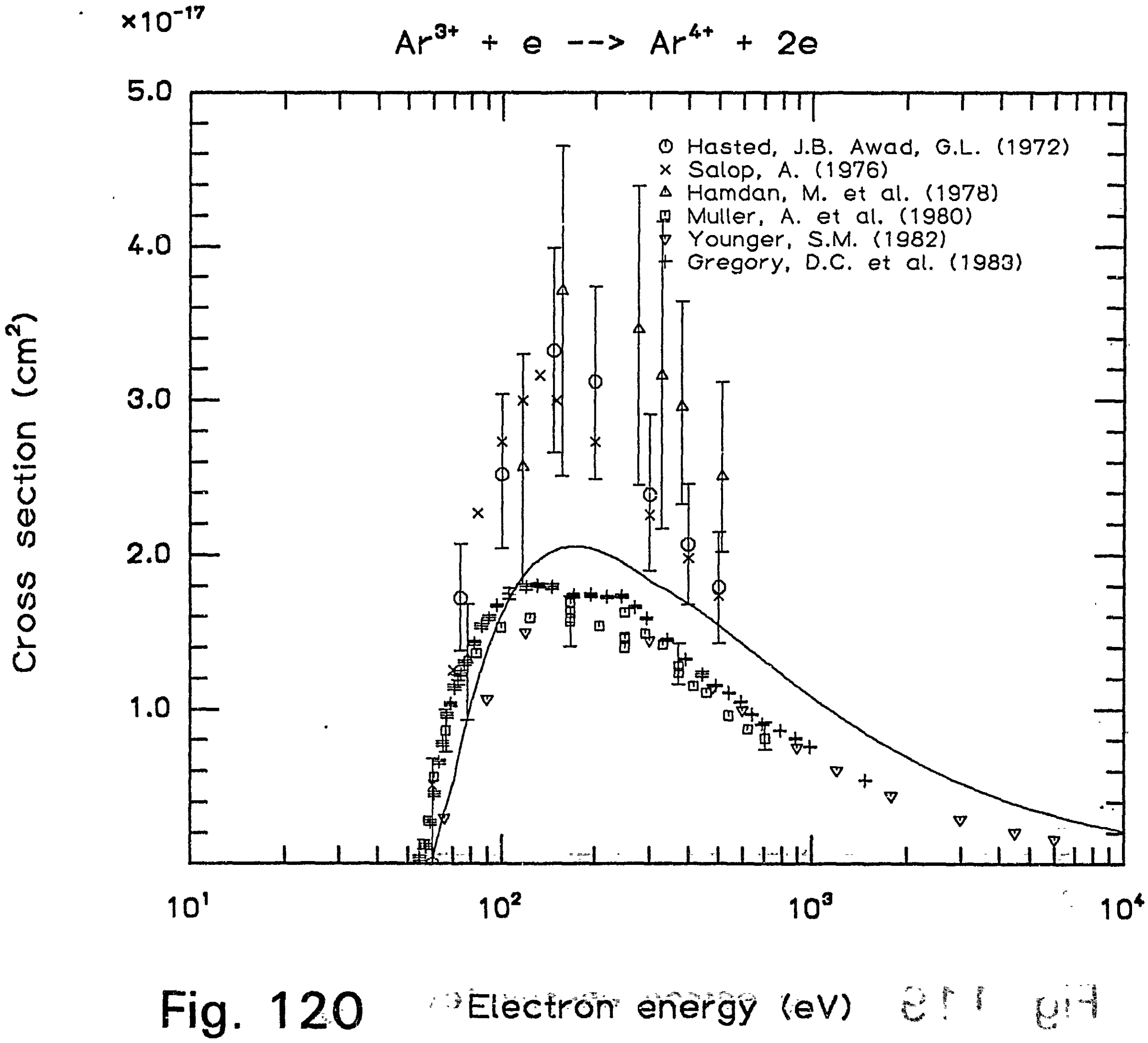


Ar2+ + e --> Ar5+ + 4e
Muller, A. Frodl, R. (1980)
Cross section (cm2)
10-17
10-18
10-19
10-20
10-21
10¹
10²
10³
10⁴
Electron energy (eV)
×10-19
Ar2+ + e --> Ar5+ + 4e
Muller, A. Frodl, R. (1980)
3.0
2.5
2.0
1.5
1.0
0.5
Cross section (cm
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 119

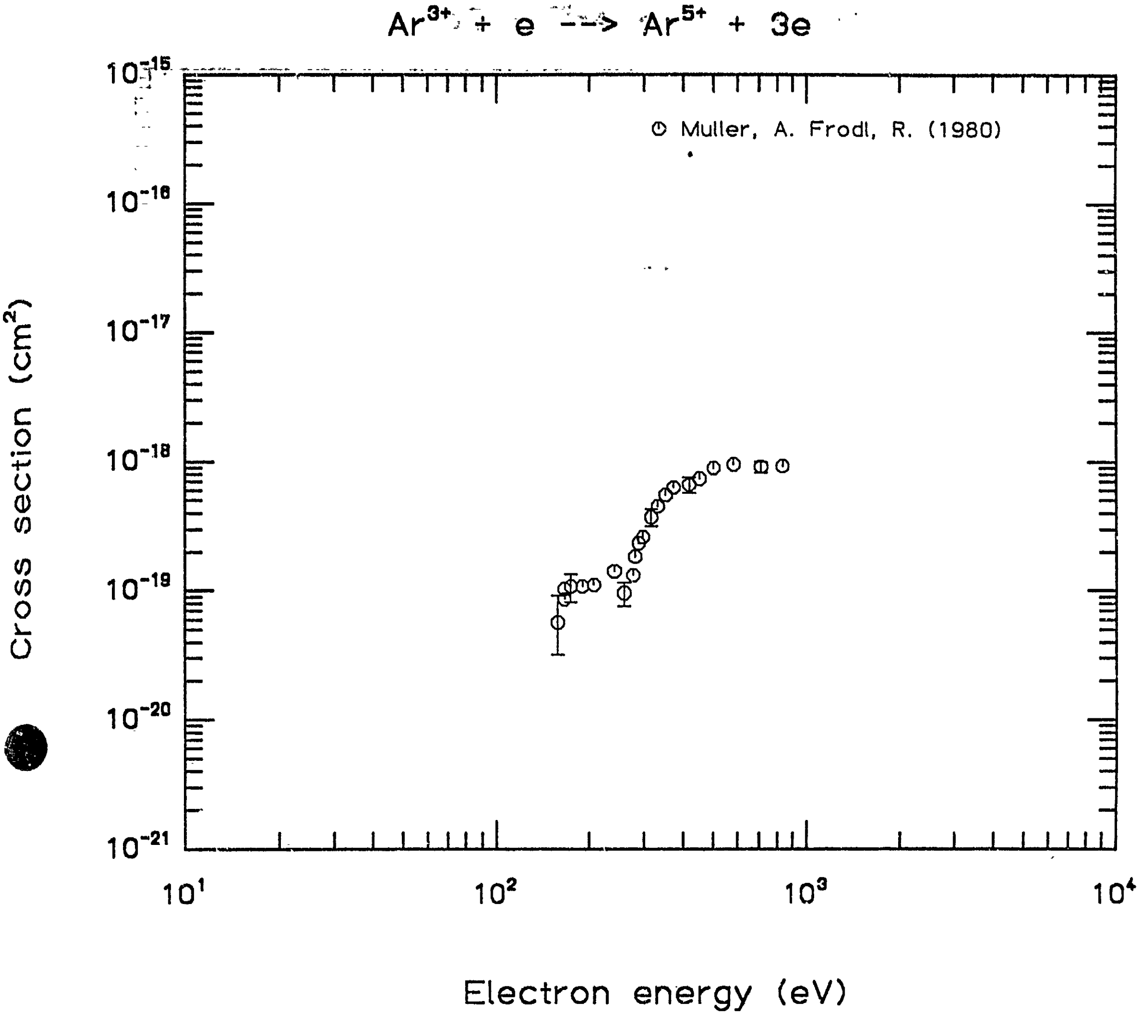


Ar3+ + e --> Ar4+ + 2e
Hasted, J.B. Awad, G.L. (1972)
Salop, A. (1976)
Hamdan, M. et al. (1978)
Muller, A. et al. (1980)
Younger, S.M. (1982)
Gregory, D.C. et al. (1983)
Cross section (cm2)
Electron energy (eV)

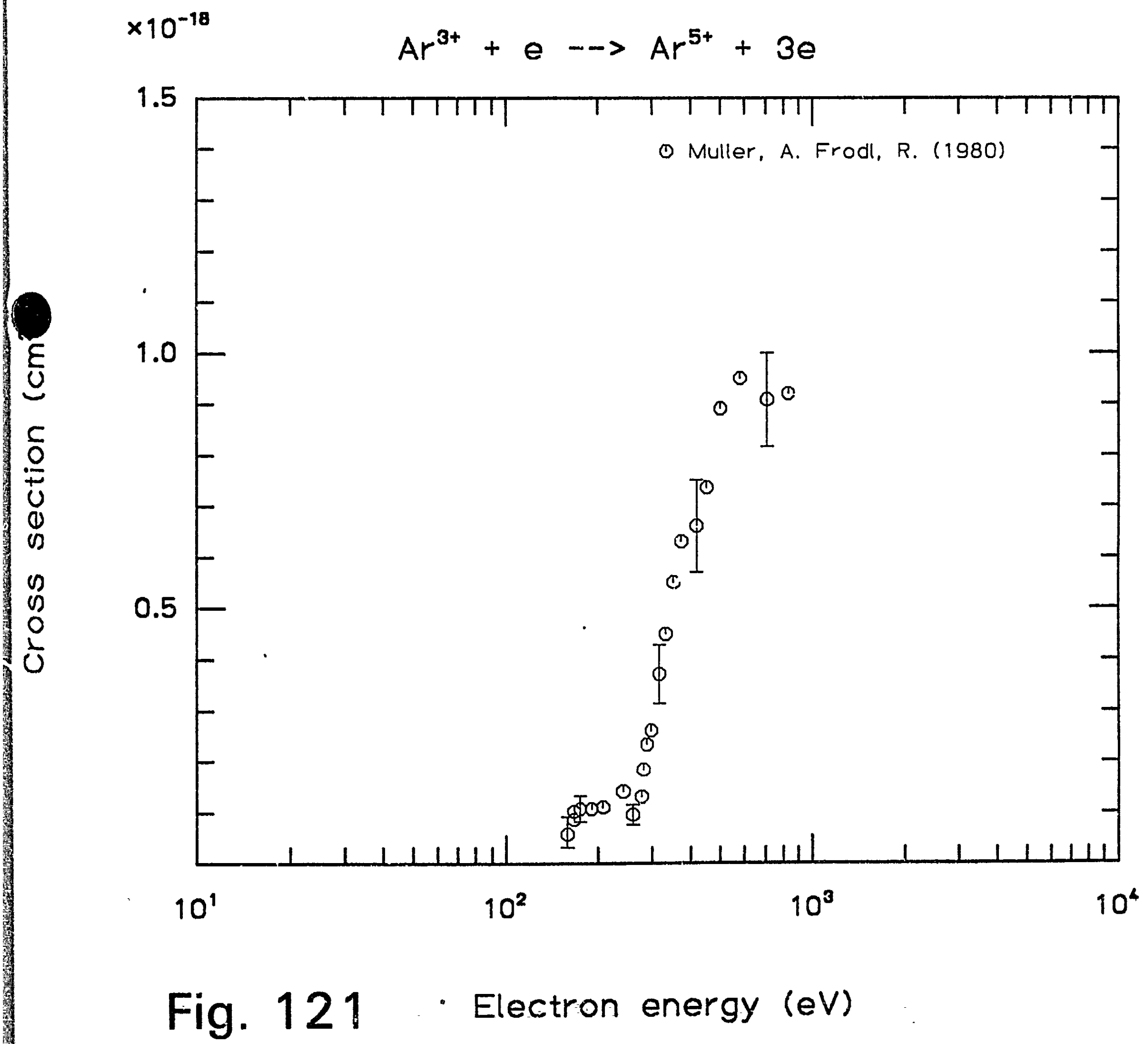


×10-17
Ar3+ + e --> Ar4+ + 2e
Hasted, J.B. Awad, G.L. (1972)
Salop, A. (1976)
Hamdan, M. et al. (1978)
Muller, A. et al. (1980)
Younger, S.M. (1982)
Gregory, D.C. et al. (1983)
Cross section (cm2)
Electron energy (eV)

Fig. 120

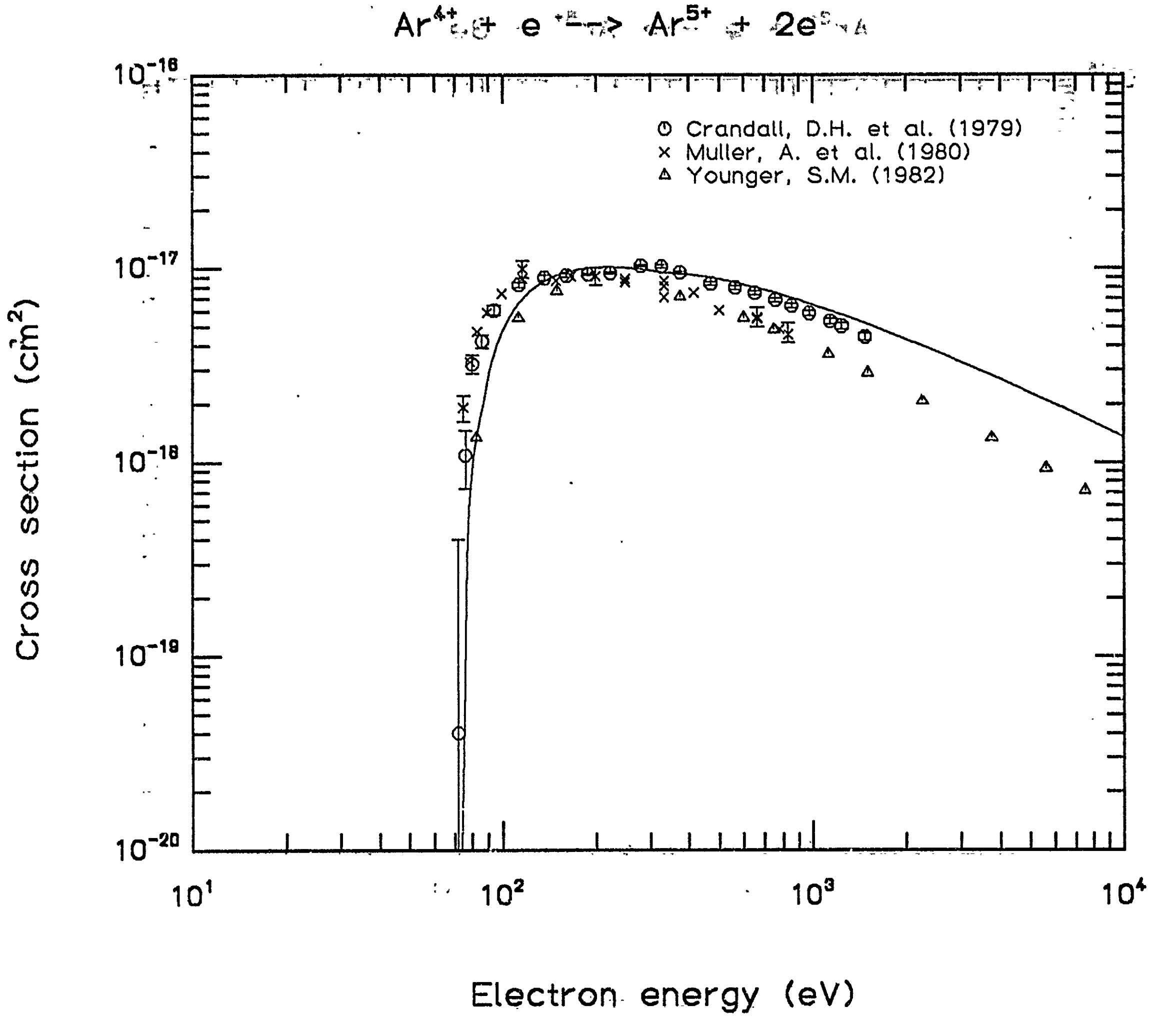


Ar3+ + e --> Ar5+ + 3e
Muller, A. Frodl, R. (1980)
Cross section (cm2)
10-15
10-16
10-17
10-18
10-19
10-20
10-21
101
102
103
104
Electron energy (eV)

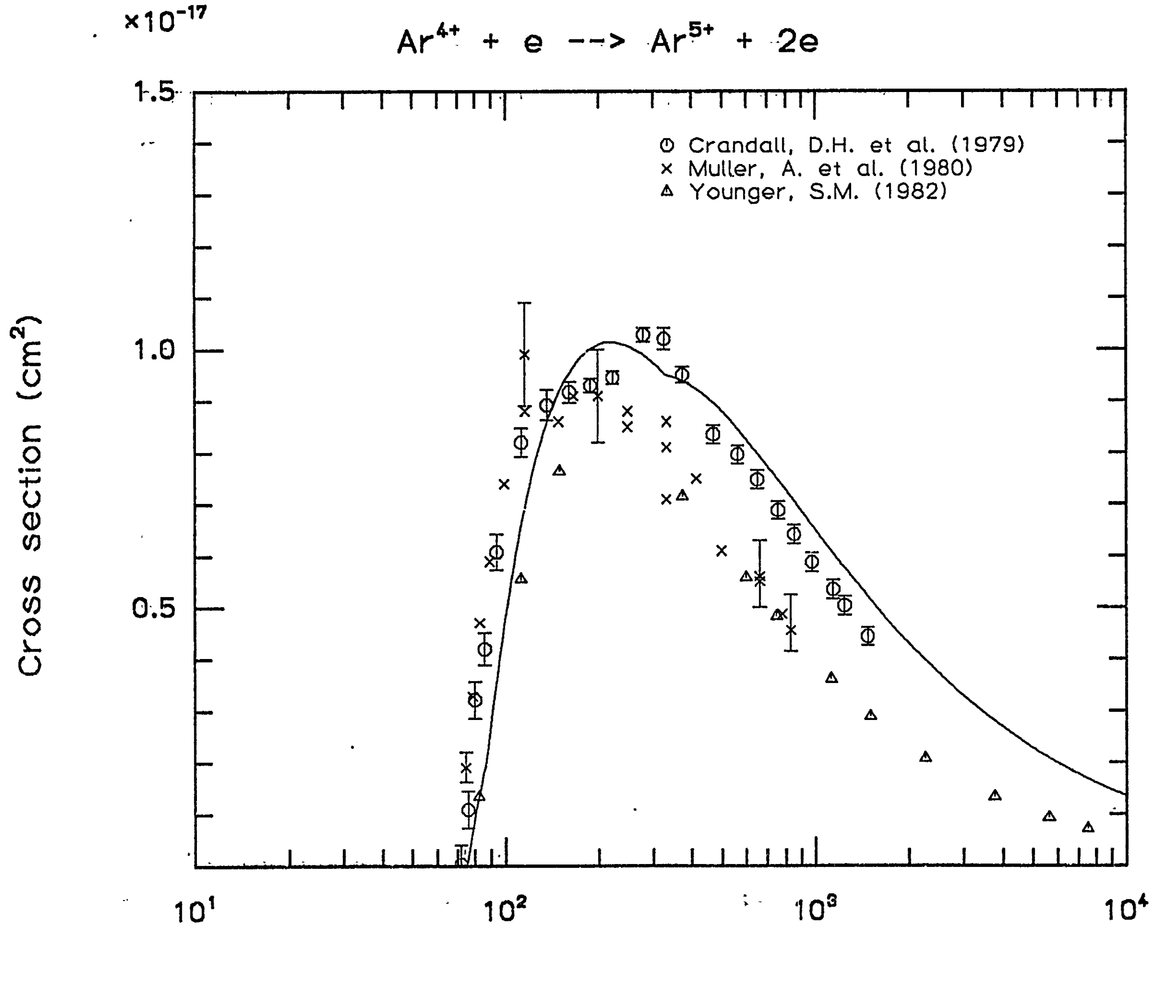


×10-18
Ar3+ + e --> Ar5+ + 3e
Muller, A. Frodl, R. (1980)
Cross section (cm2)
1.5
1.0
0.5
101
102
103
104
Electron energy (eV)

Fig. 121

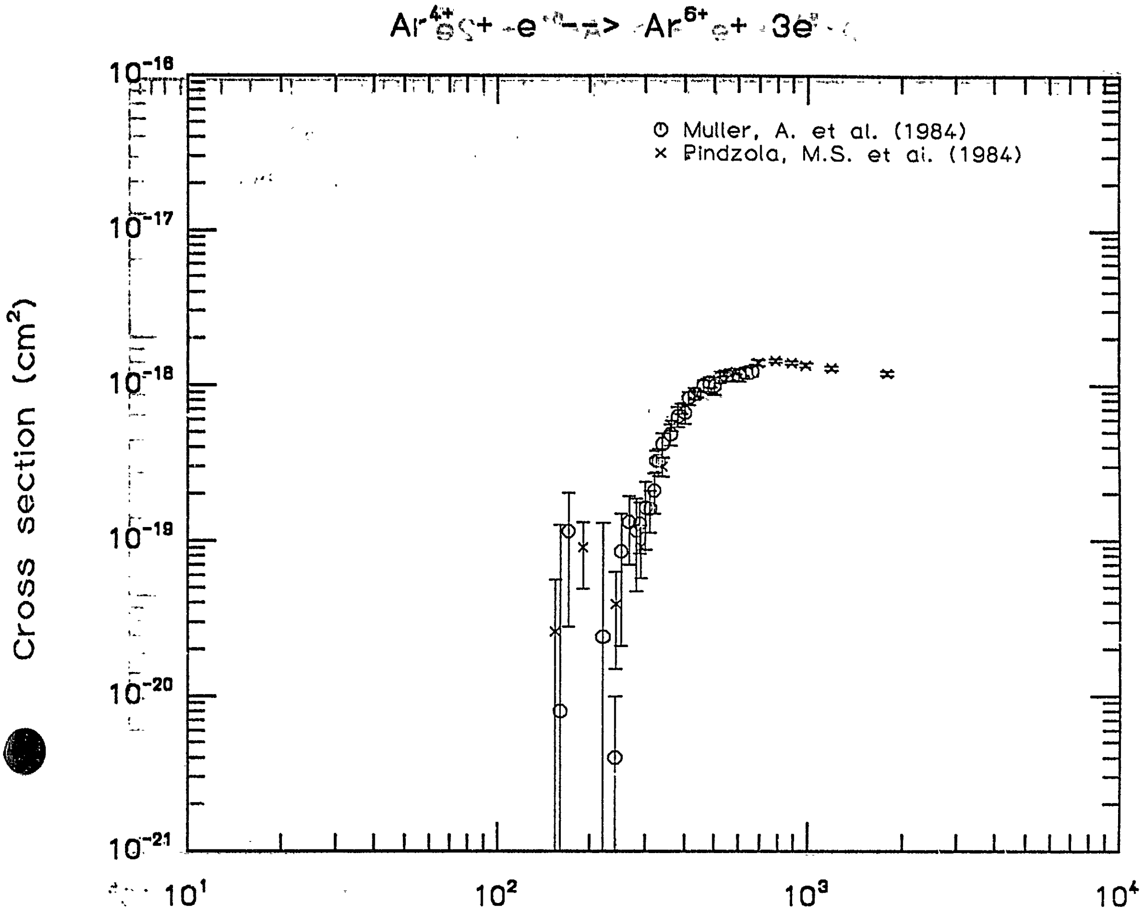


Ar^{4+} + e --> Ar^{5+} + 2e
Crandall, D.H. et al. (1979)
Muller, A. et al. (1980)
Younger, S.M. (1982)
Cross section (cm^2)
Electron energy (eV)



×10^{-17}
Ar^{4+} + e --> Ar^{5+} + 2e
Crandall, D.H. et al. (1979)
Muller, A. et al. (1980)
Younger, S.M. (1982)
Cross section (cm^2)
Electron energy (eV)

Fig. 122



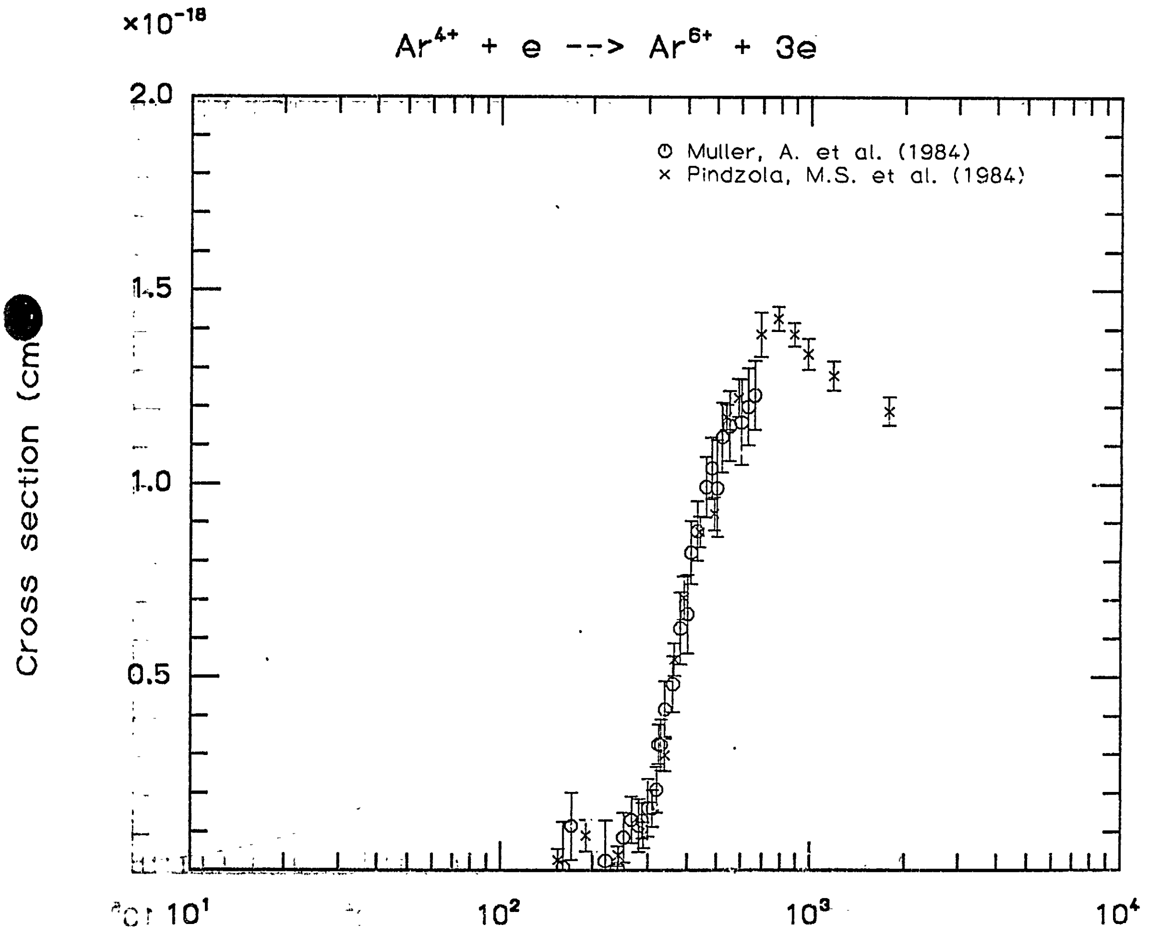
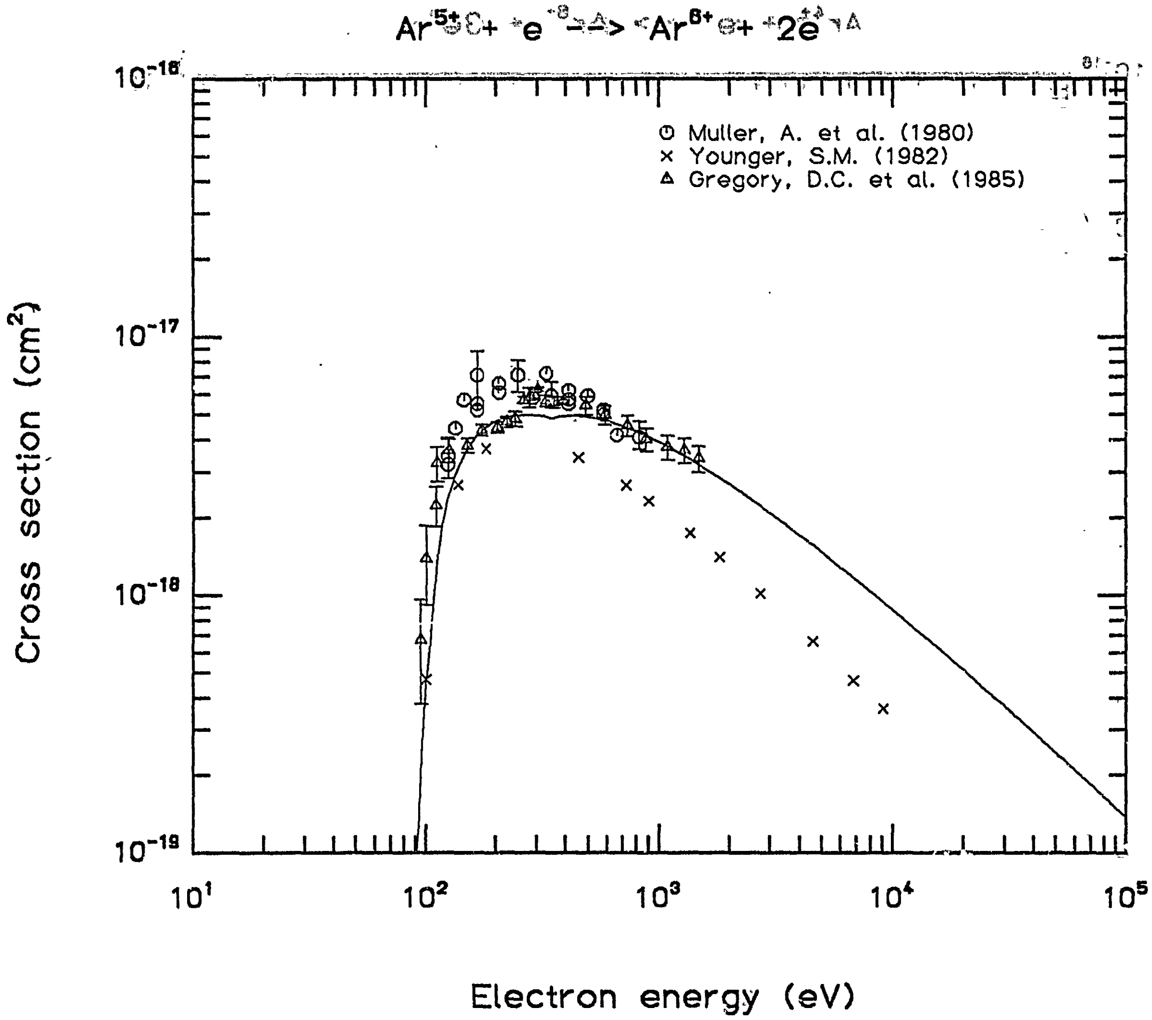
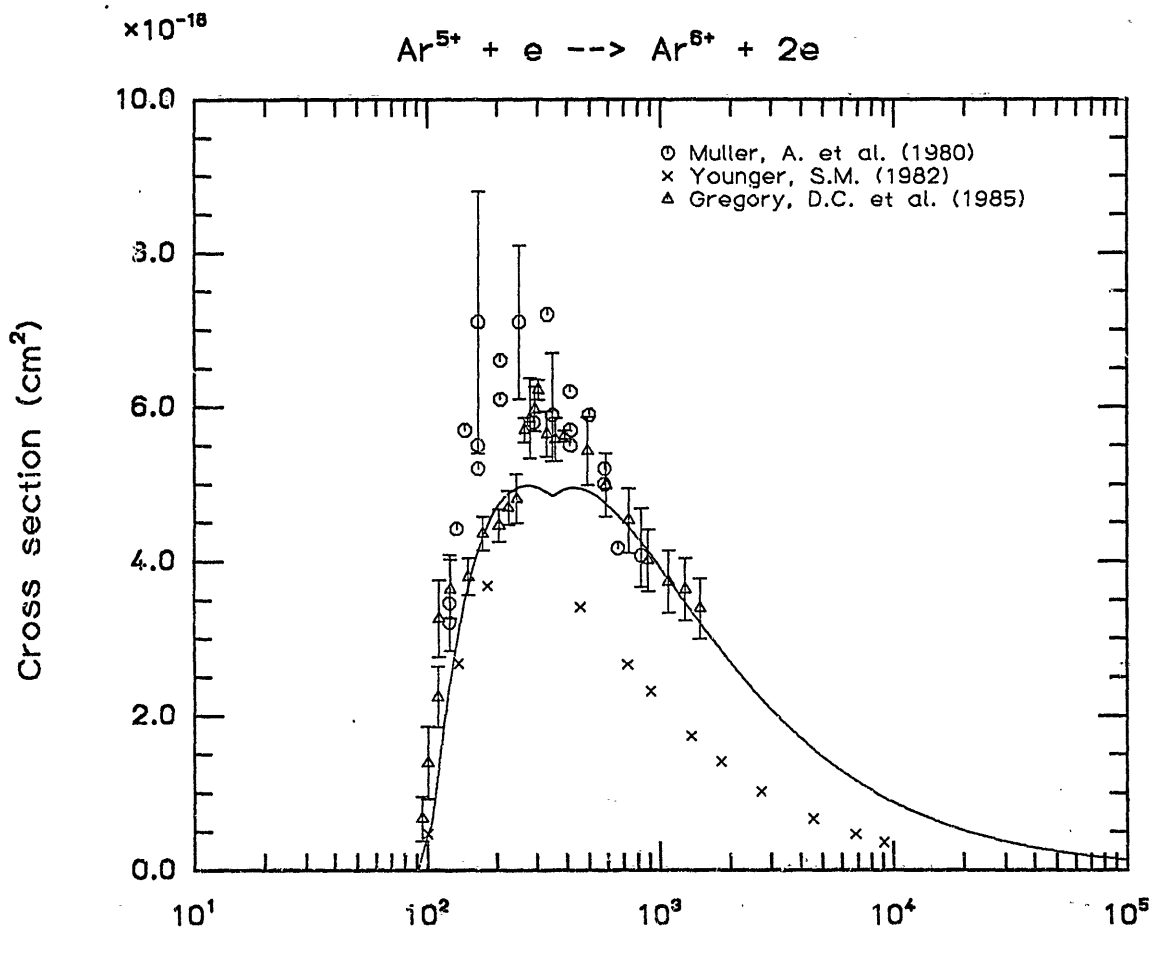


Fig. 123 Electron energy (eV)

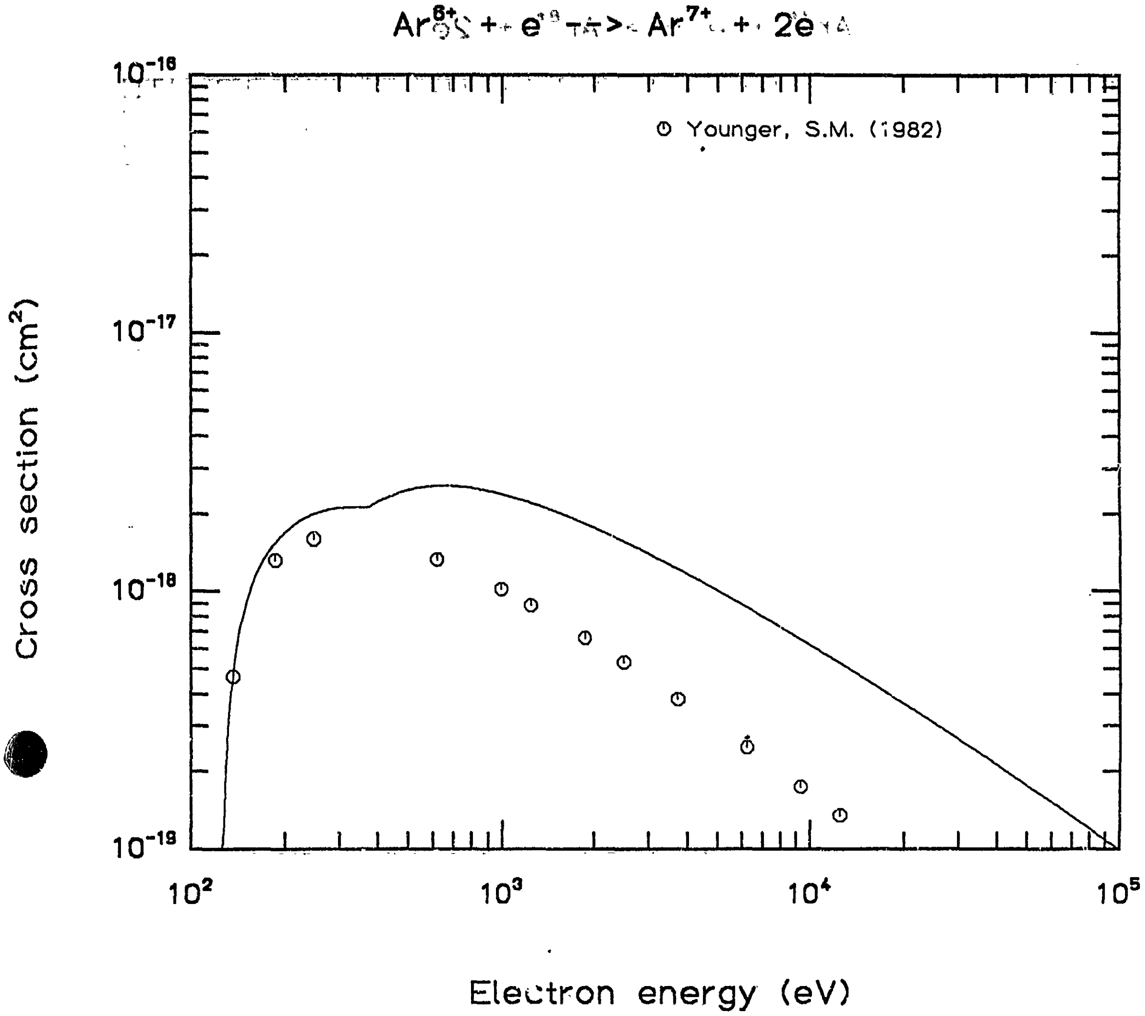


Ar5+ + e --> Ar6+ + 2e
10-16
10-17
10-18
10-19
Cross section (cm2)
Muller, A. et al. (1980)
Younger, S.M. (1982)
Gregory, D.C. et al. (1985)
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)



×10-18
Ar5+ + e --> Ar6+ + 2e
10.0
8.0
6.0
4.0
2.0
0.0
Cross section (cm2)
Muller, A. et al. (1980)
Younger, S.M. (1982)
Gregory, D.C. et al. (1985)
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 124



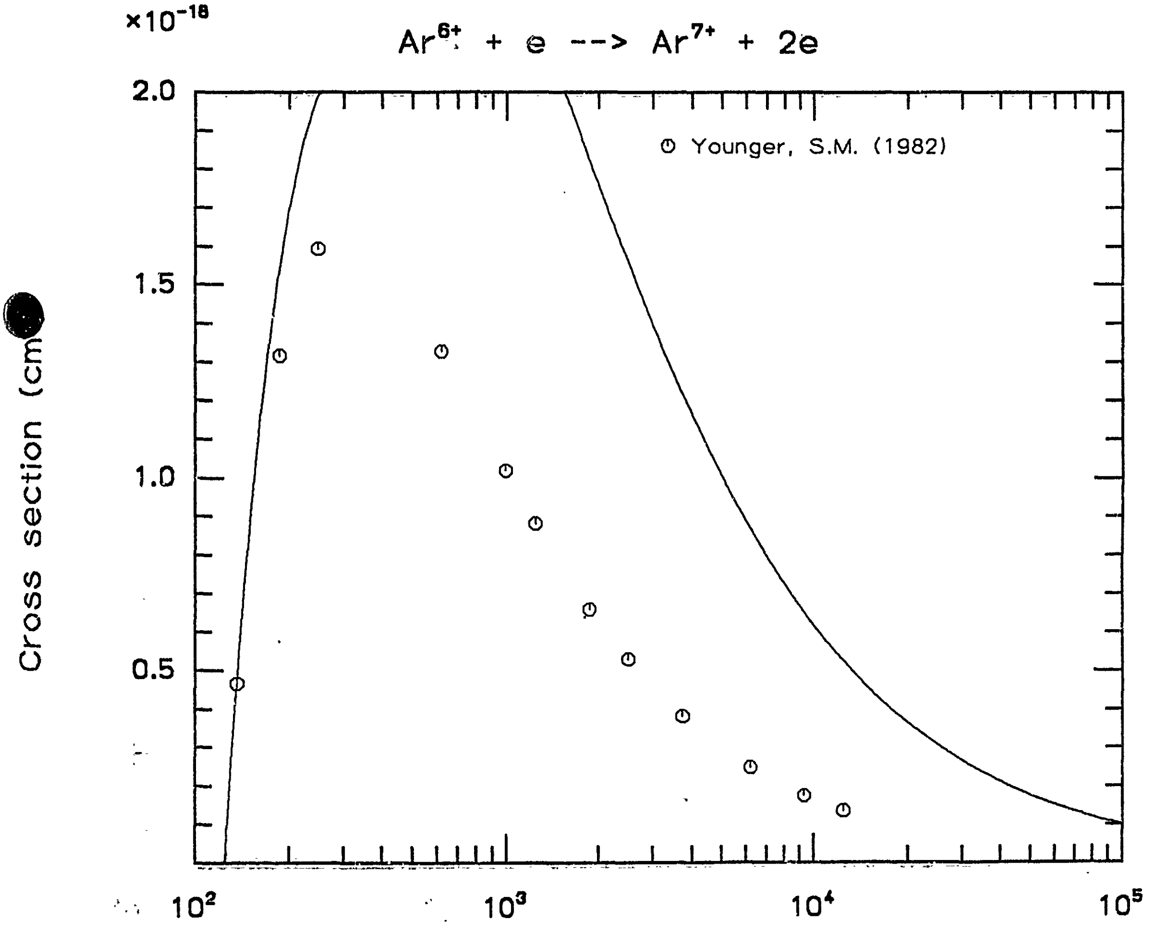
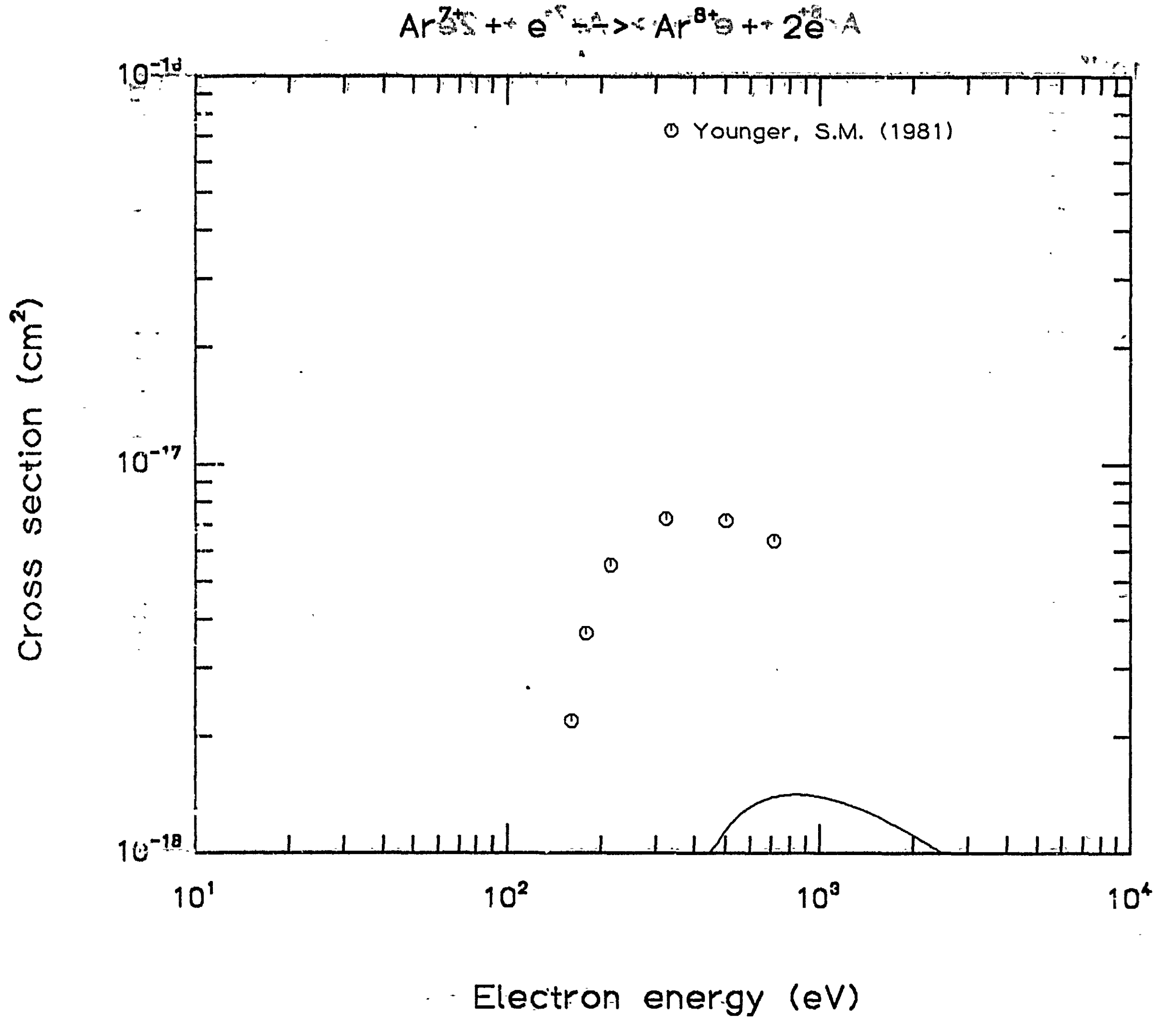


Fig. 125 Electron energy (eV)



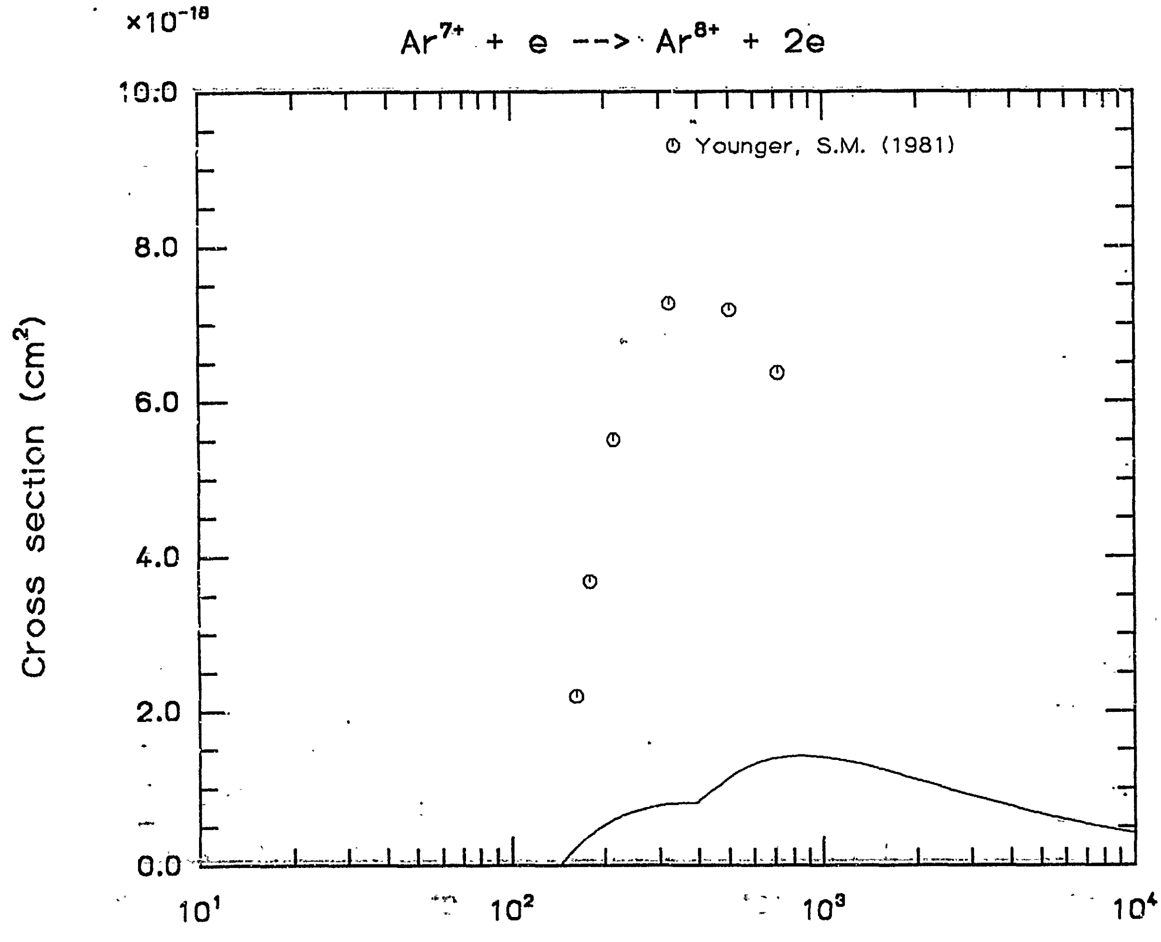


Fig. 126 Electron energy (eV)

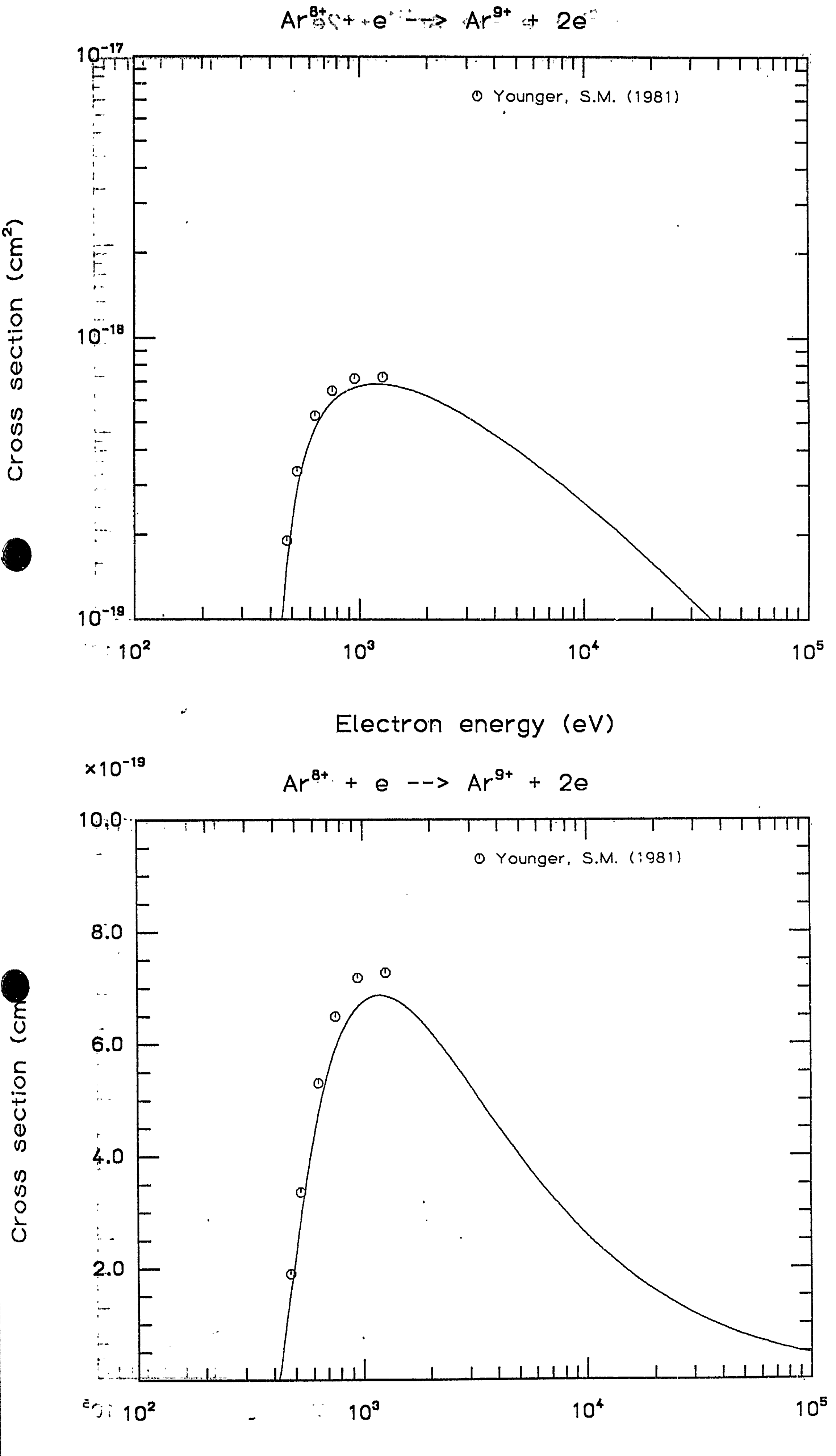
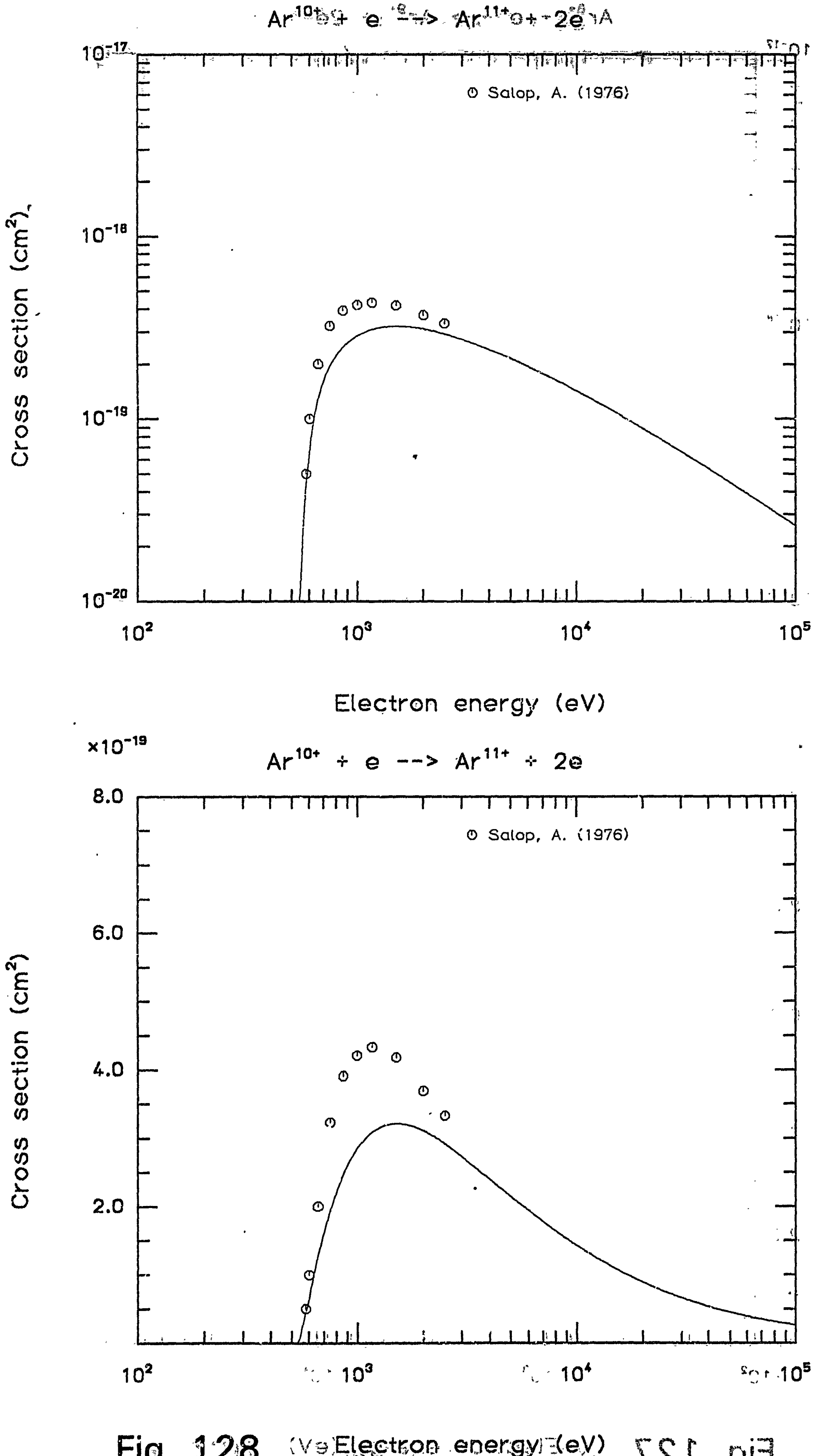
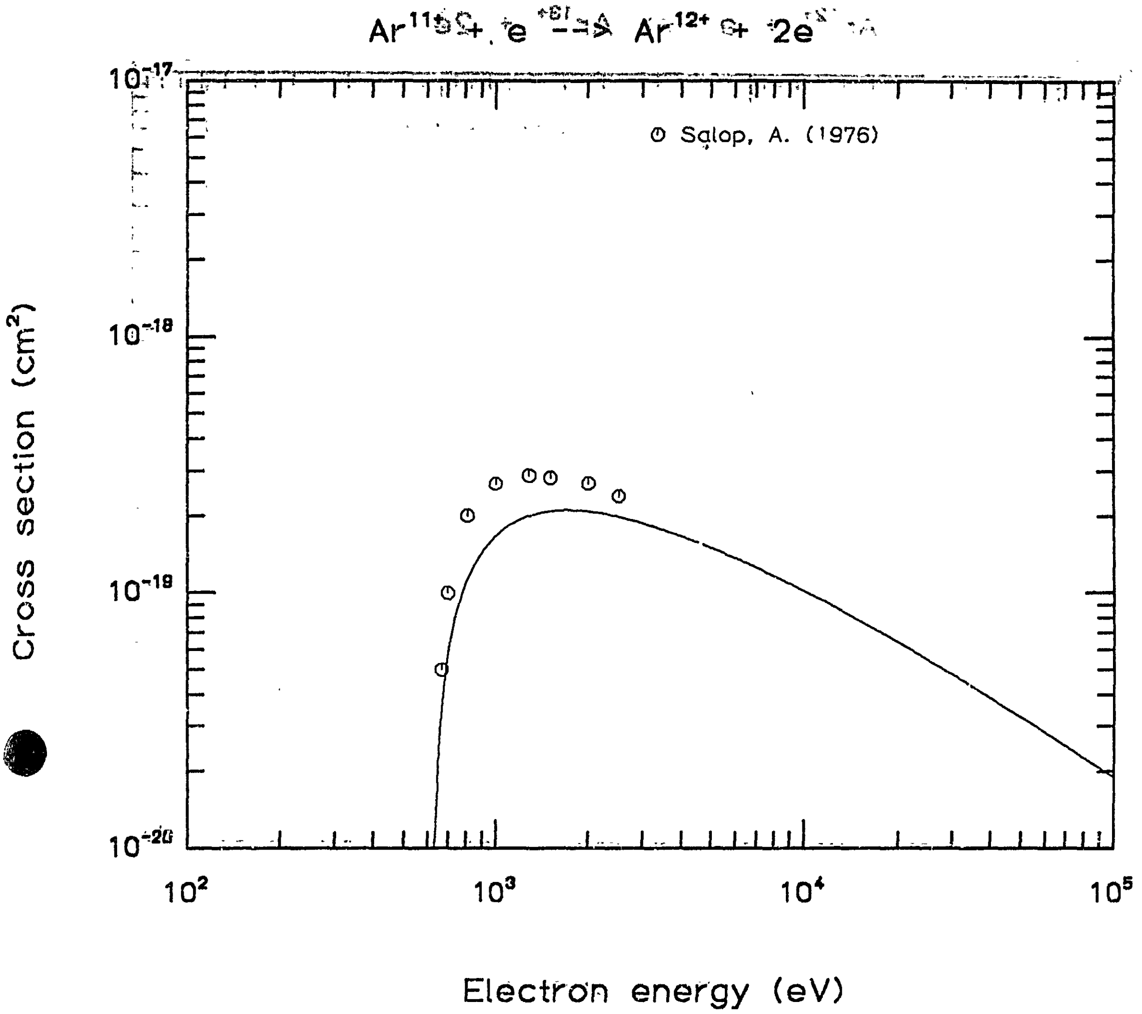


Fig. 127 Electron energy (eV)



Ar10+ + e --> Ar11+ + 2e
Salop, A. (1976)
Cross section (cm2)
10-17
10-18
10-19
10-20
10^2
10^3
10^4
10^5
Electron energy (eV)
x10-19
Ar10+ + e --> Ar11+ + 2e
Salop, A. (1976)
Cross section (cm2)
8.0
6.0
4.0
2.0
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 128


Ar^{11+} + e --> Ar^{12+} + 2e
Salop, A. (1976)
Cross section (cm^2)
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^2
10^3
10^4
10^5
Electron energy (eV)

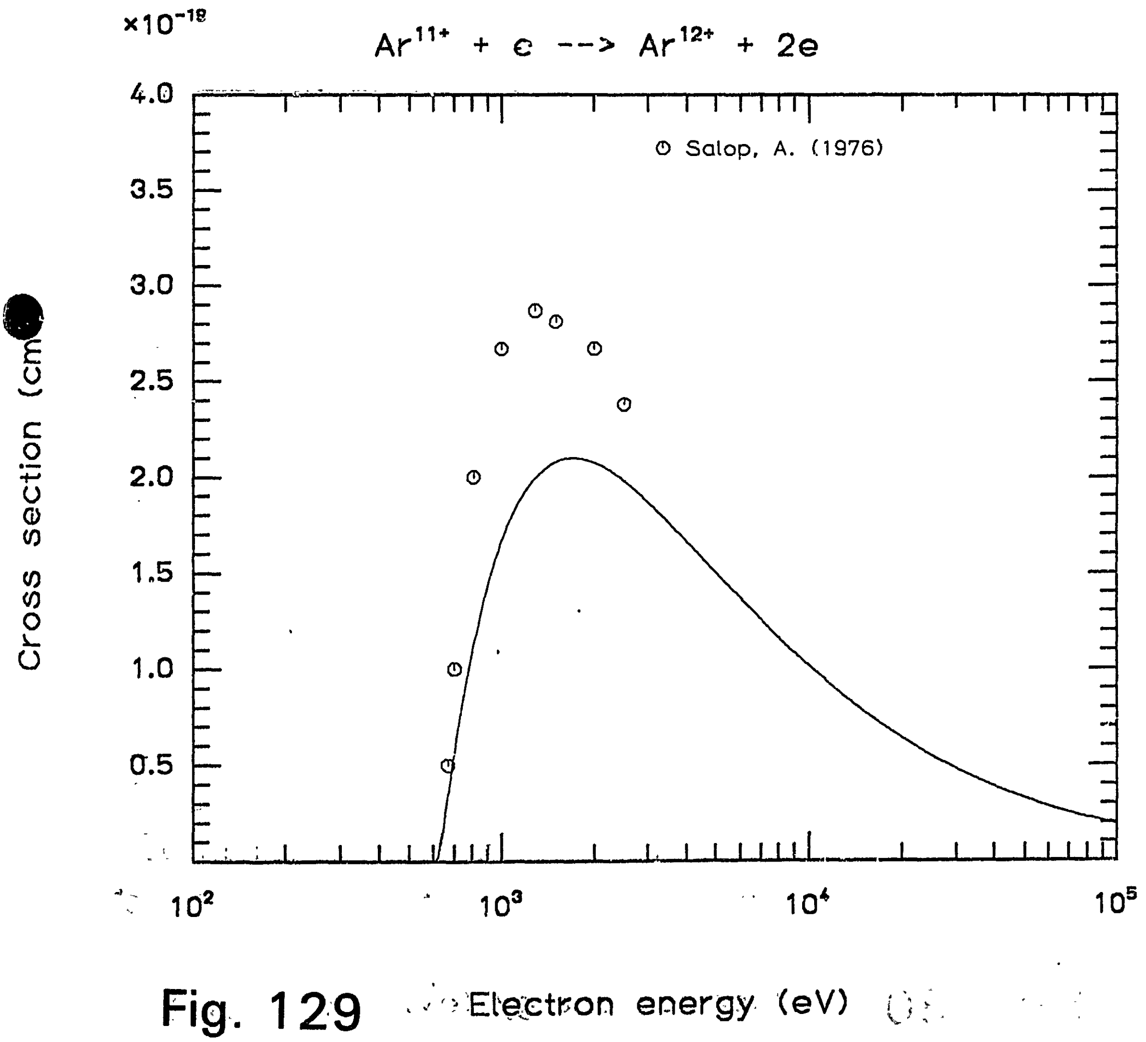
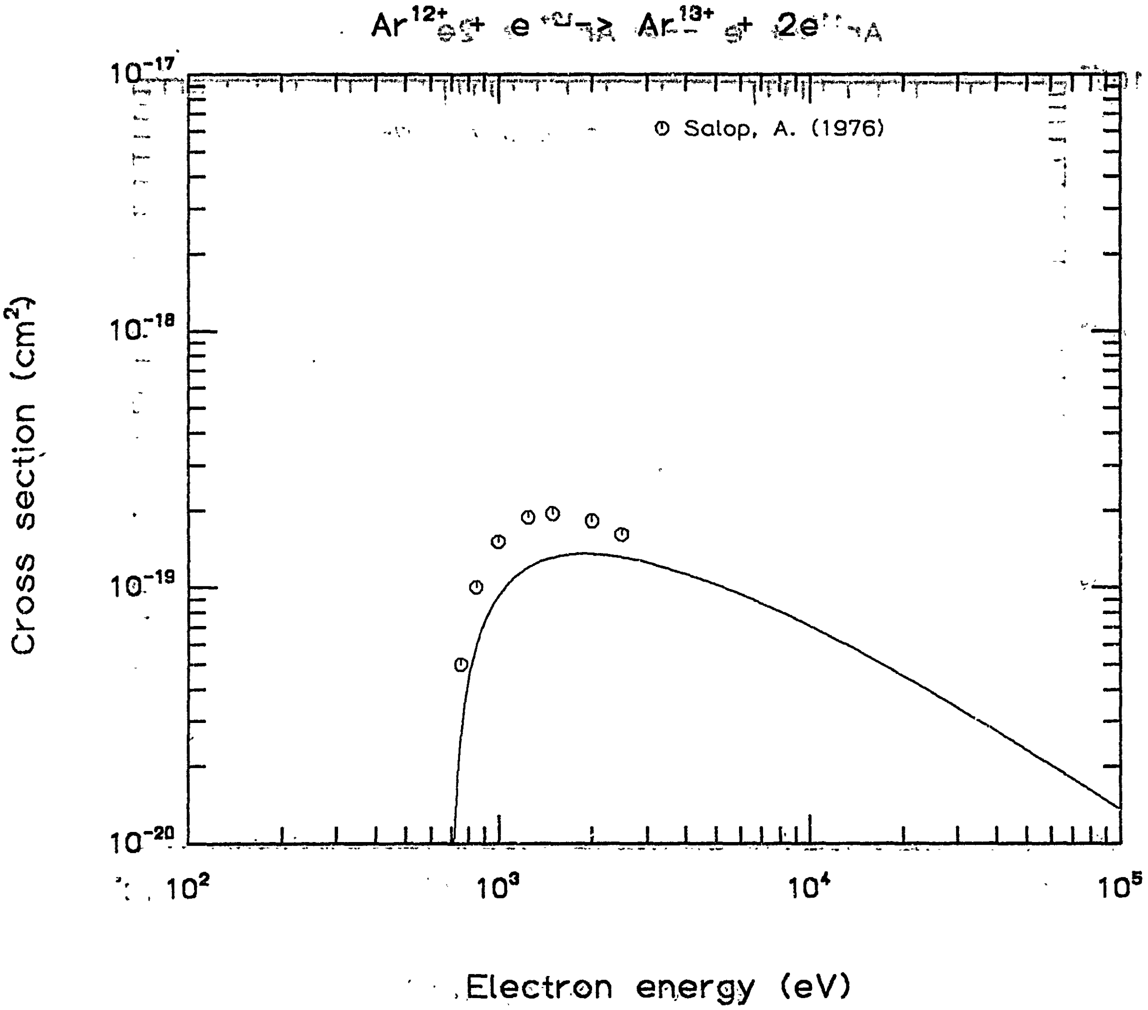

×10^{-19}
Ar^{11+} + e --> Ar^{12+} + 2e
Salop, A. (1976)
Cross section (cm^2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 129


Ar^12+ + e --> Ar^13+ + 2e
Salop, A. (1976)
Cross section (cm^2)
10^-17
10^-18
10^-19
10^-20
10^2
10^3
10^4
10^5
Electron energy (eV)

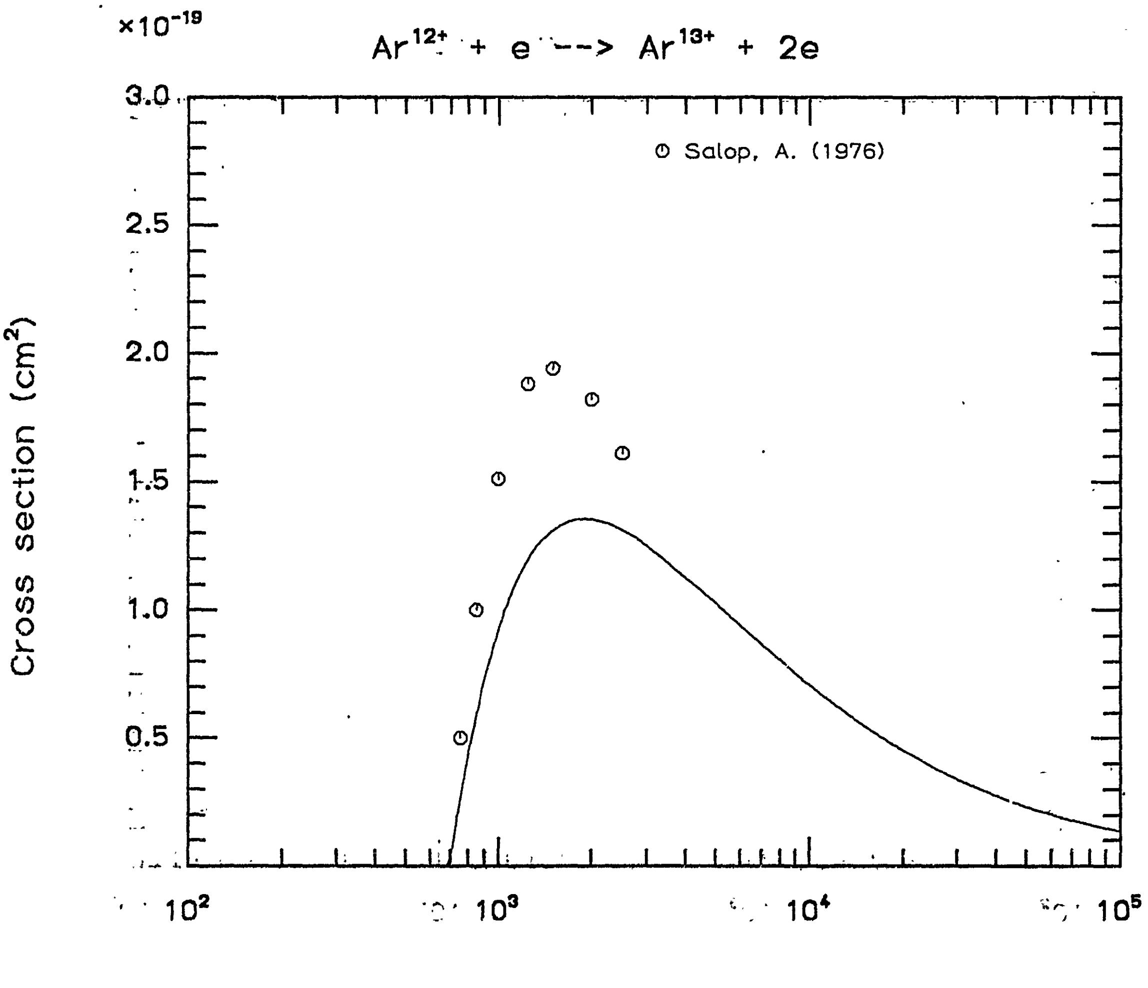
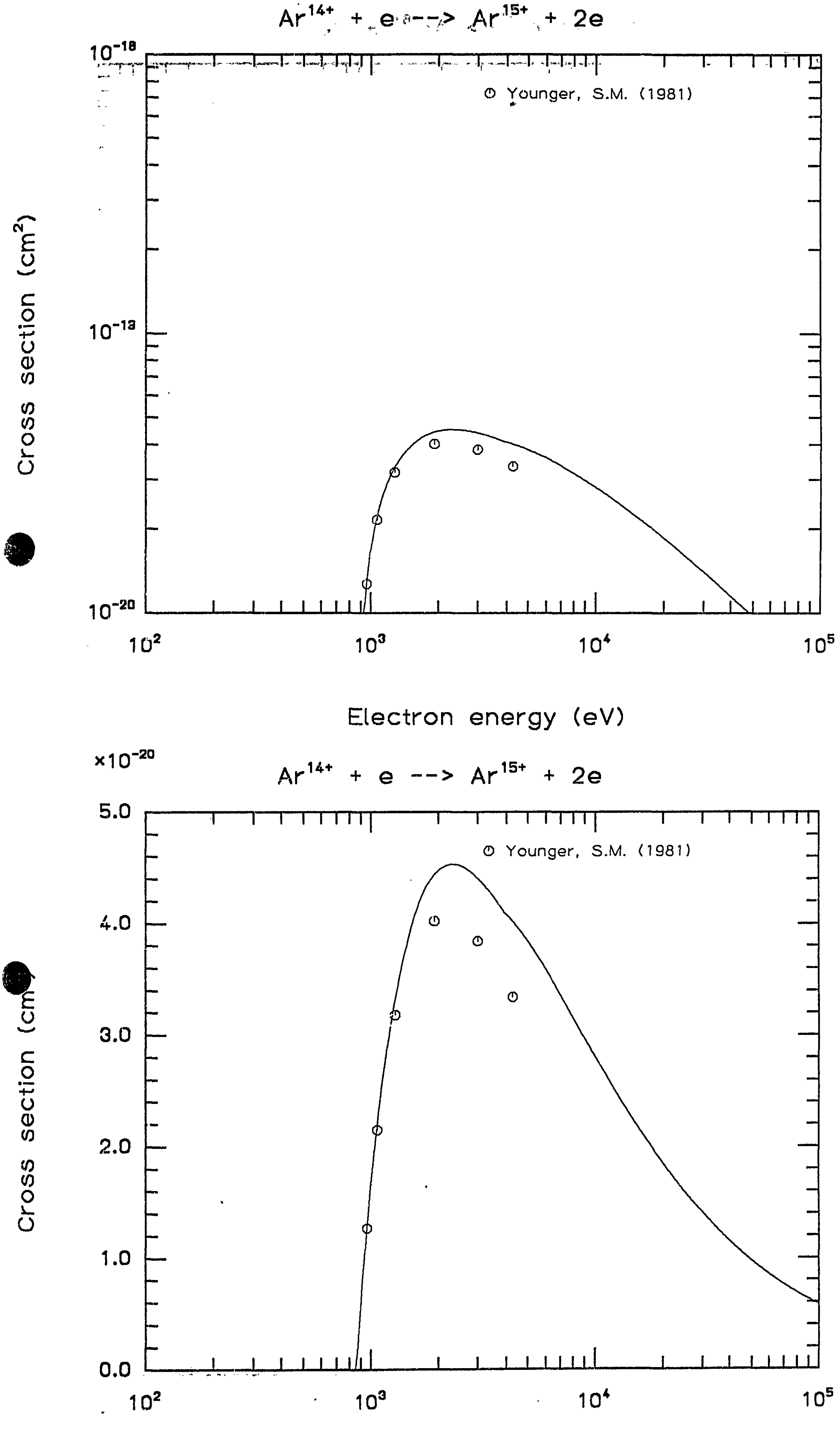
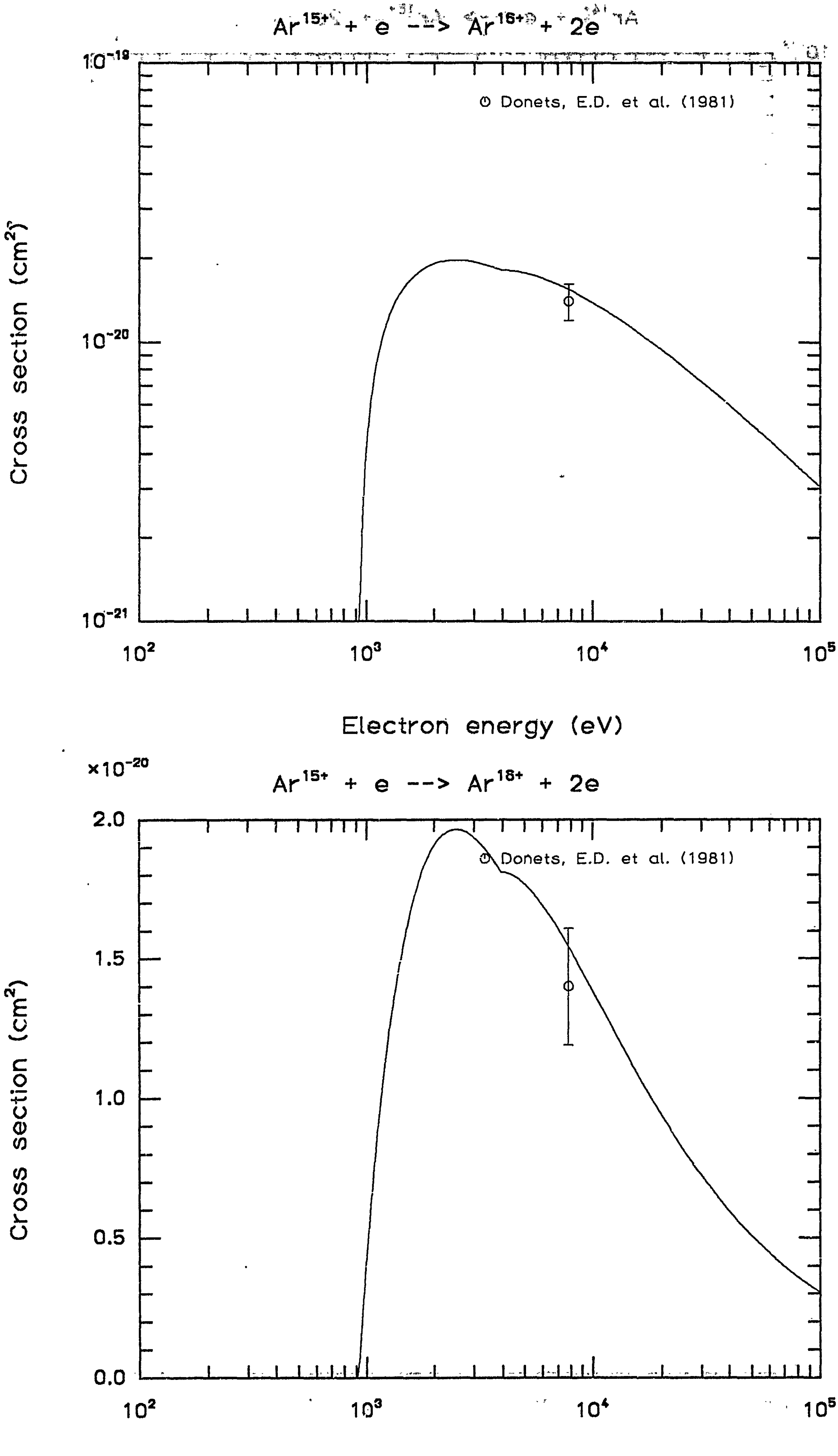

×10^-19
Ar^12+ + e --> Ar^13+ + 2e
Salop, A. (1976)
Cross section (cm^2)
3.0
2.5
2.0
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 130



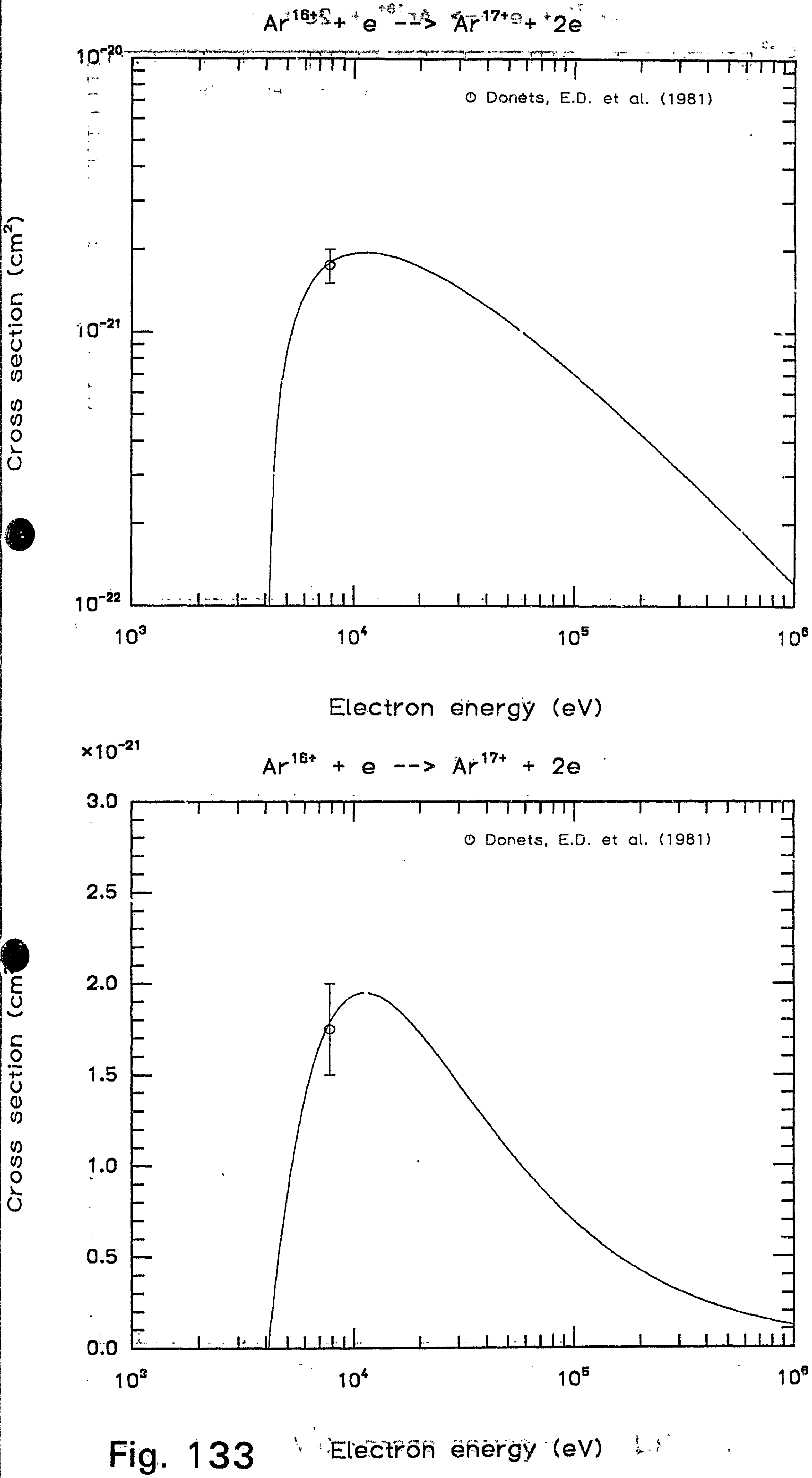
$Ar^{14+} + e \rightarrow Ar^{15+} + 2e$
Younger, S.M. (1981)
Cross section (cm^2)
10^{-18}
10^{-20}
10^2
10^3
10^4
10^5
Electron energy (eV)
$\times 10^{-20}$
$Ar^{14+} + e \rightarrow Ar^{15+} + 2e$
5.0
4.0
3.0
2.0
1.0
0.0
Younger, S.M. (1981)
Cross section (cm^2)
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 131



Ar15+ + e --> Ar16+ + 2e
Donets, E.D. et al. (1981)
Cross section (cm2)
10-19
10-20
10-21
10^2
10^3
10^4
10^5
Electron energy (eV)
x10-20
Ar15+ + e --> Ar16+ + 2e
Donets, E.D. et al. (1981)
Cross section (cm2)
2.0
1.5
1.0
0.5
0.0
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 132



Ar16+ + e --> Ar17+ + 2e
Donets, E.D. et al. (1981)
Cross section (cm2)
10-20
10-21
10-22
103
104
105
106
Electron energy (eV)
×10-21
Ar16+ + e --> Ar17+ + 2e
Donets, E.D. et al. (1981)
Cross section (cm2)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
103
104
105
106
Electron energy (eV)

Fig. 133

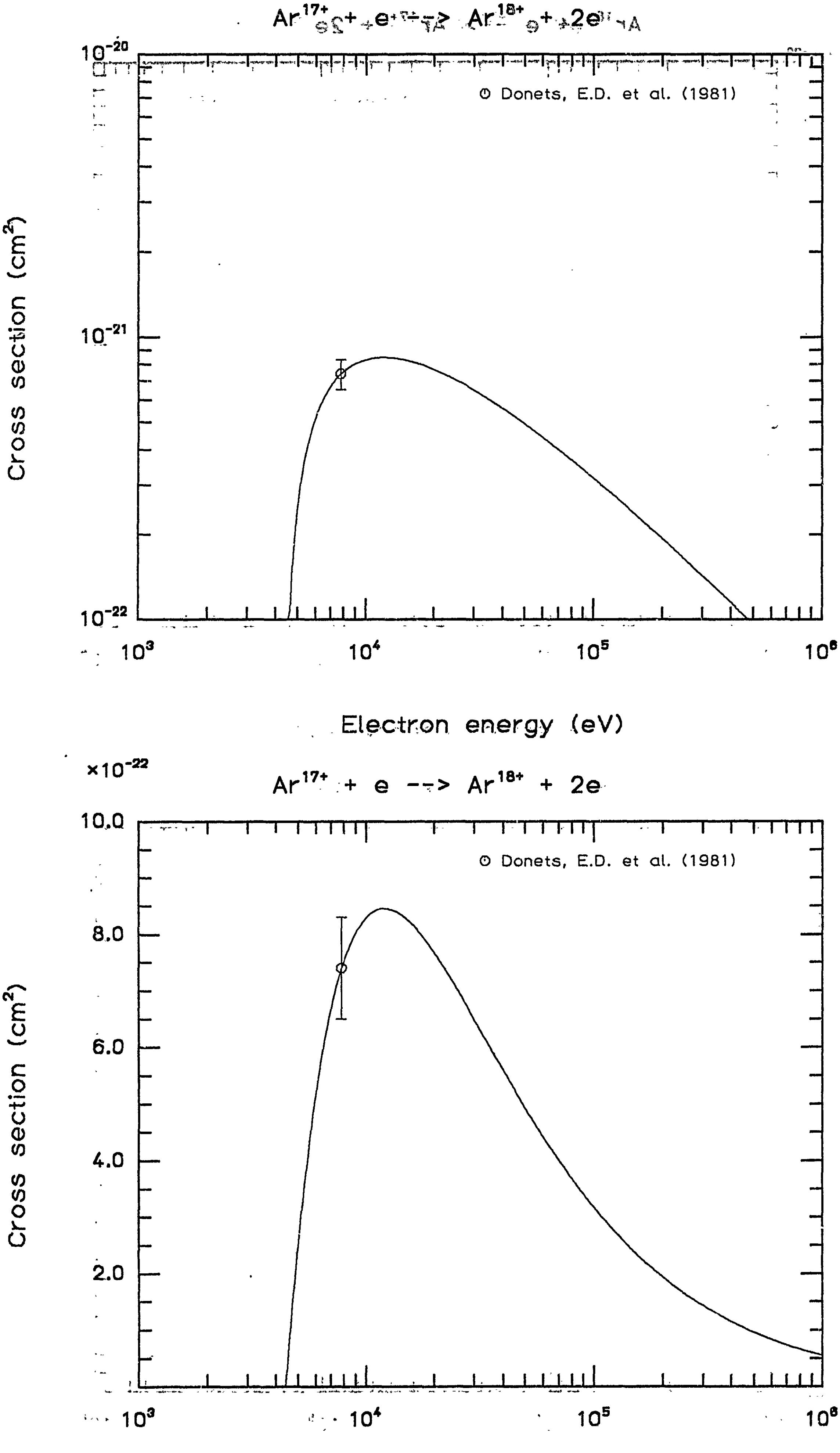
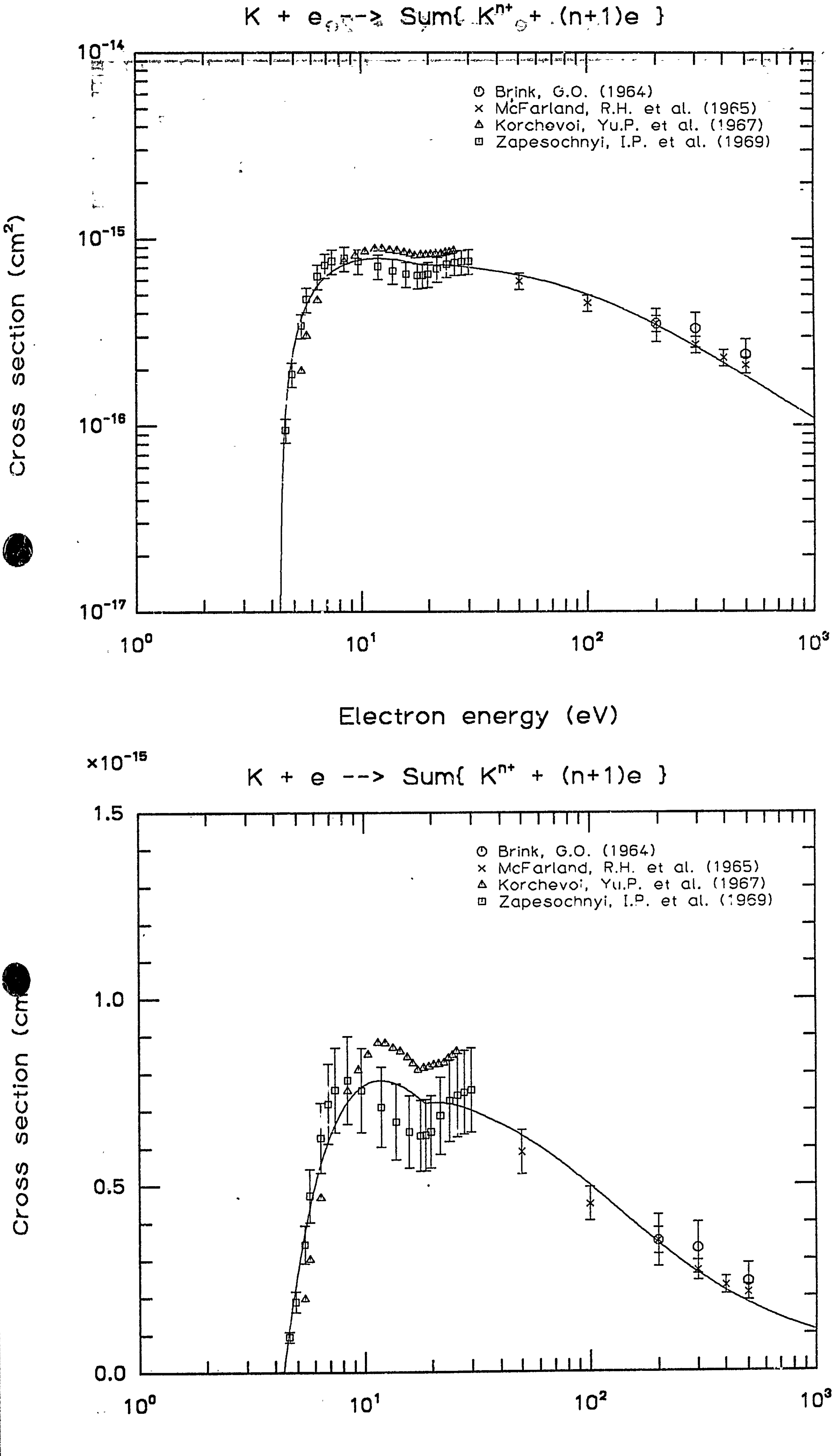

Ar17+ + e --> Ar18+ + 2e
10-20
10-21
10-22
Cross section (cm2)
© Donets, E.D. et al. (1981)
10^3
10^4
10^5
10^6
Electron energy (eV)
×10-22
Ar17+ + e --> Ar18+ + 2e
10.0
8.0
6.0
4.0
2.0
Cross section (cm2)
© Donets, E.D. et al. (1981)
10^3
10^4
10^5
10^6
Electron energy (eV)

Fig. 134



K + e --> Sum{ K^n+ + (n+1)e }
Brink, G.O. (1964)
McFarland, R.H. et al. (1965)
Korchevoi, Yu.P. et al. (1967)
Zapesochnyi, I.P. et al. (1969)
Cross section (cm²)
Electron energy (eV)
×10⁻¹⁵
K + e --> Sum{ K^n+ + (n+1)e }
Brink, G.O. (1964)
McFarland, R.H. et al. (1965)
Korchevoi, Yu.P. et al. (1967)
Zapesochnyi, I.P. et al. (1969)
Cross section (cm
Electron energy (eV)

Fig. 135

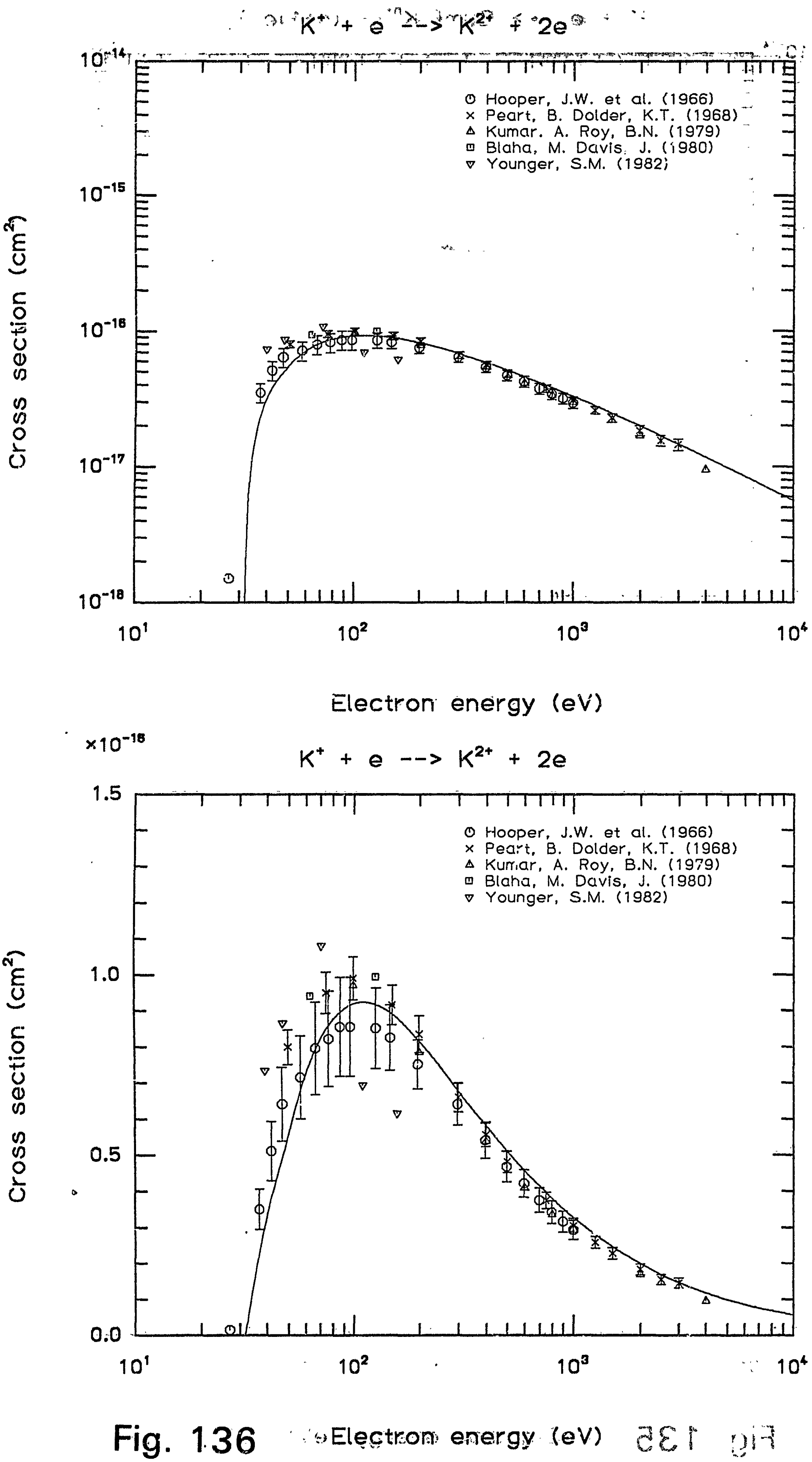
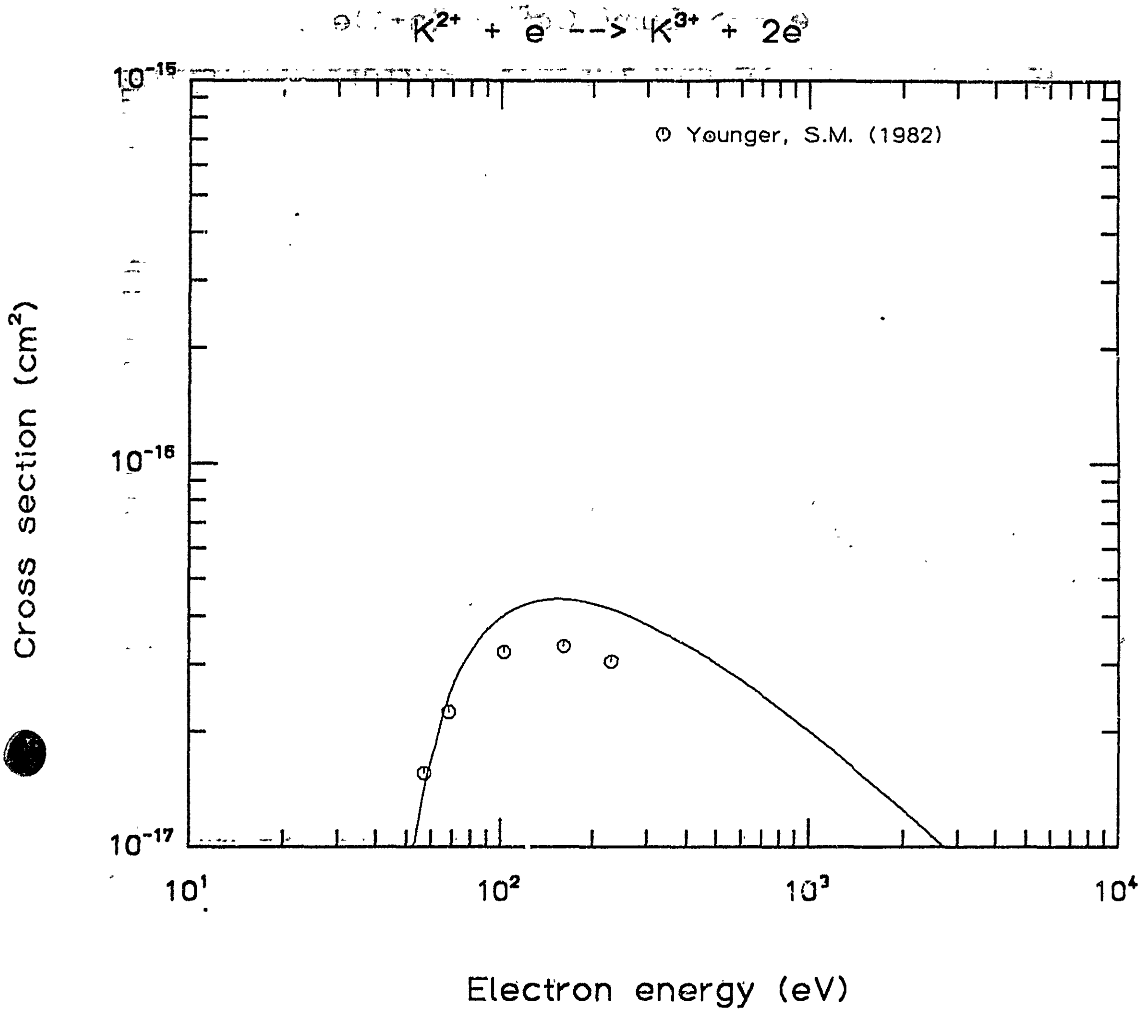
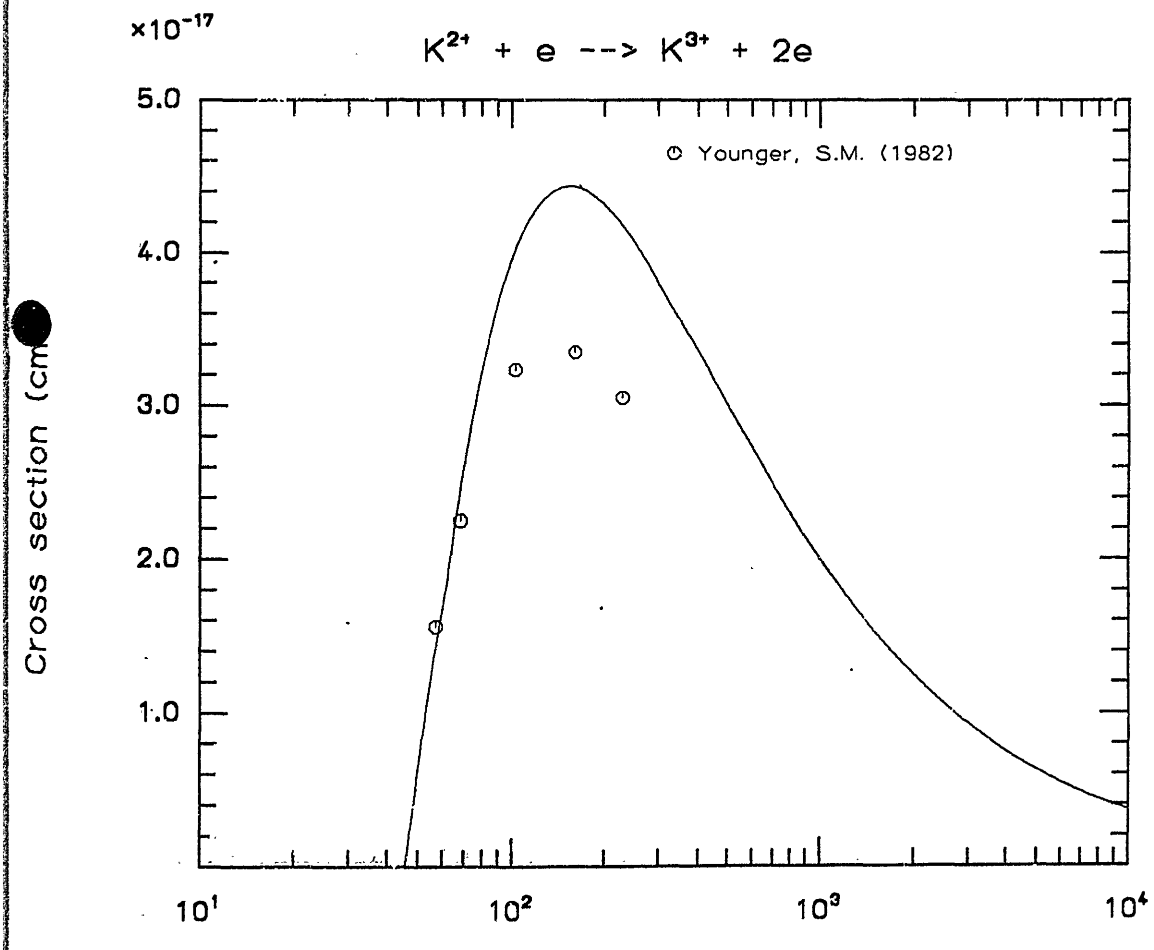

$K^+ + e \rightarrow K^{2+} + 2e$
Hooper, J.W. et al. (1966)
Peart, B. Dolder, K.T. (1968)
Kumar. A. Roy, B.N. (1979)
Blaha, M. Davis, J. (1980)
Younger, S.M. (1982)
Cross section (cm²)
Electron energy (eV)
×10⁻¹⁶
$K^+ + e \rightarrow K^{2+} + 2e$
Hooper, J.W. et al. (1966)
Peart, B. Dolder, K.T. (1968)
Kumar, A. Roy, B.N. (1979)
Blaha, M. Davis, J. (1980)
Younger, S.M. (1982)
Cross section (cm²)
Electron energy (eV)

Fig. 136

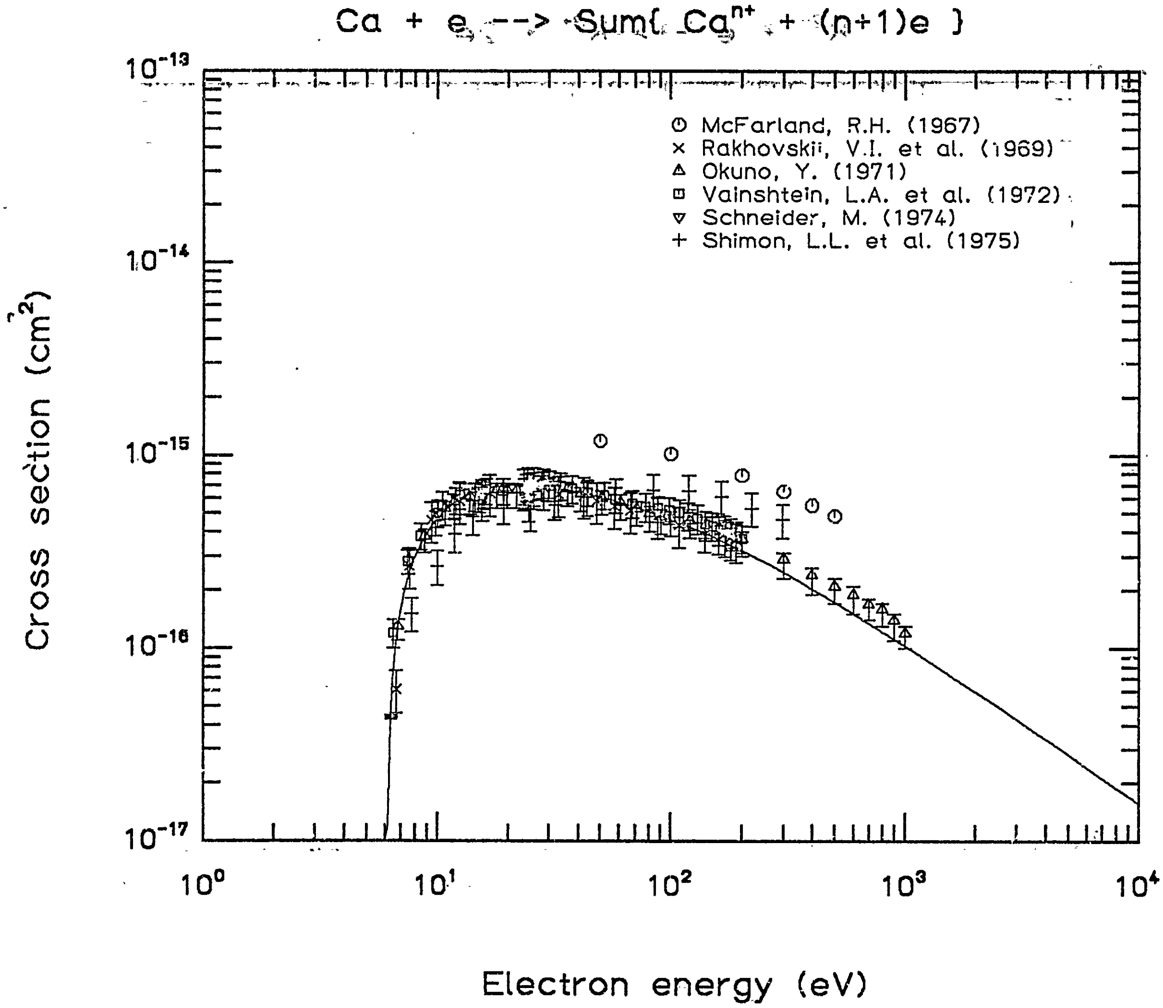


K2+ + e --> K3+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
10-15
10-16
10-17
101
102
103
104
Electron energy (eV)

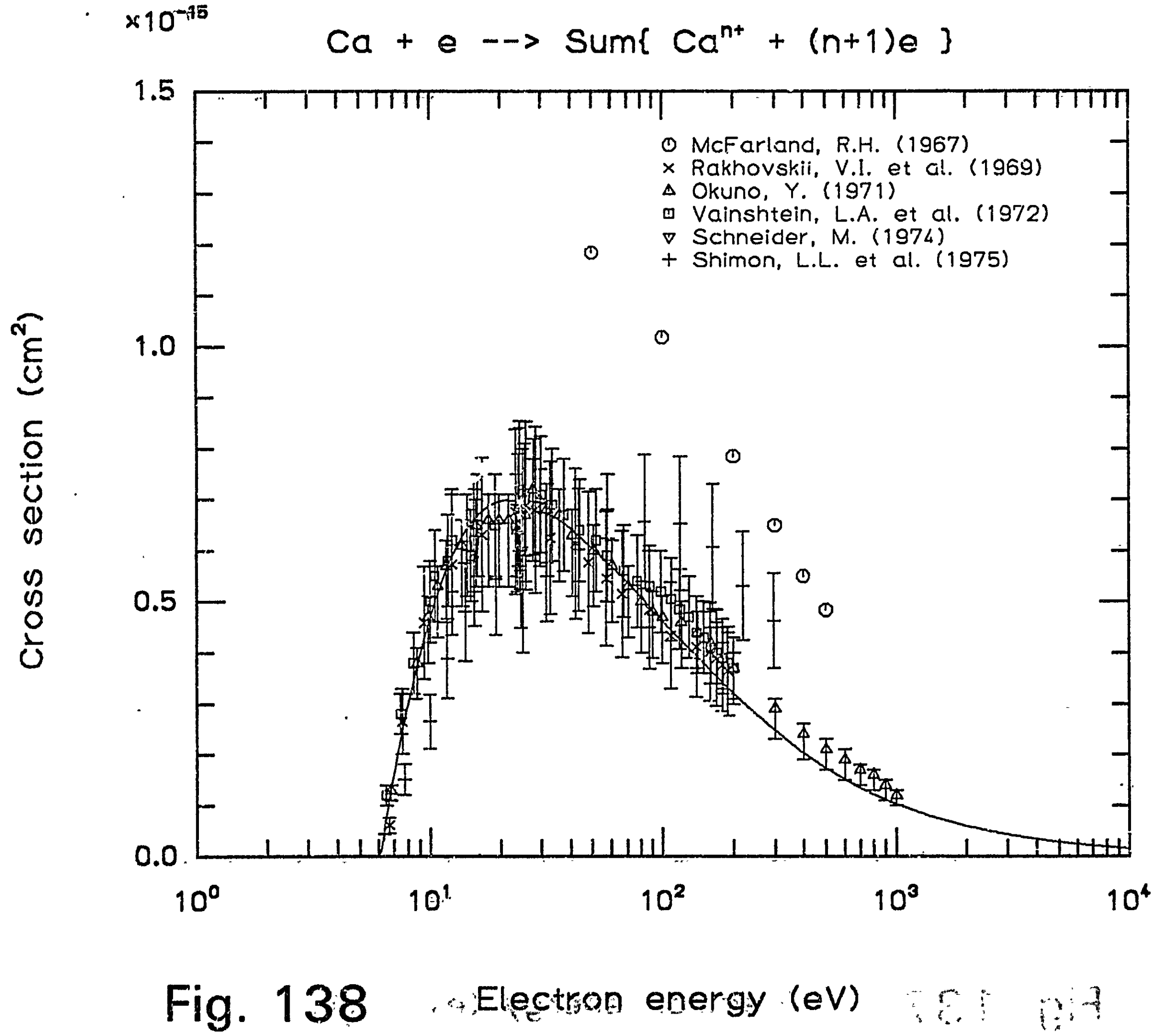


×10-17
K2+ + e --> K3+ + 2e
Younger, S.M. (1982)
Cross section (cm
5.0
4.0
3.0
2.0
1.0
101
102
103
104
Electron energy (eV)

Fig. 137

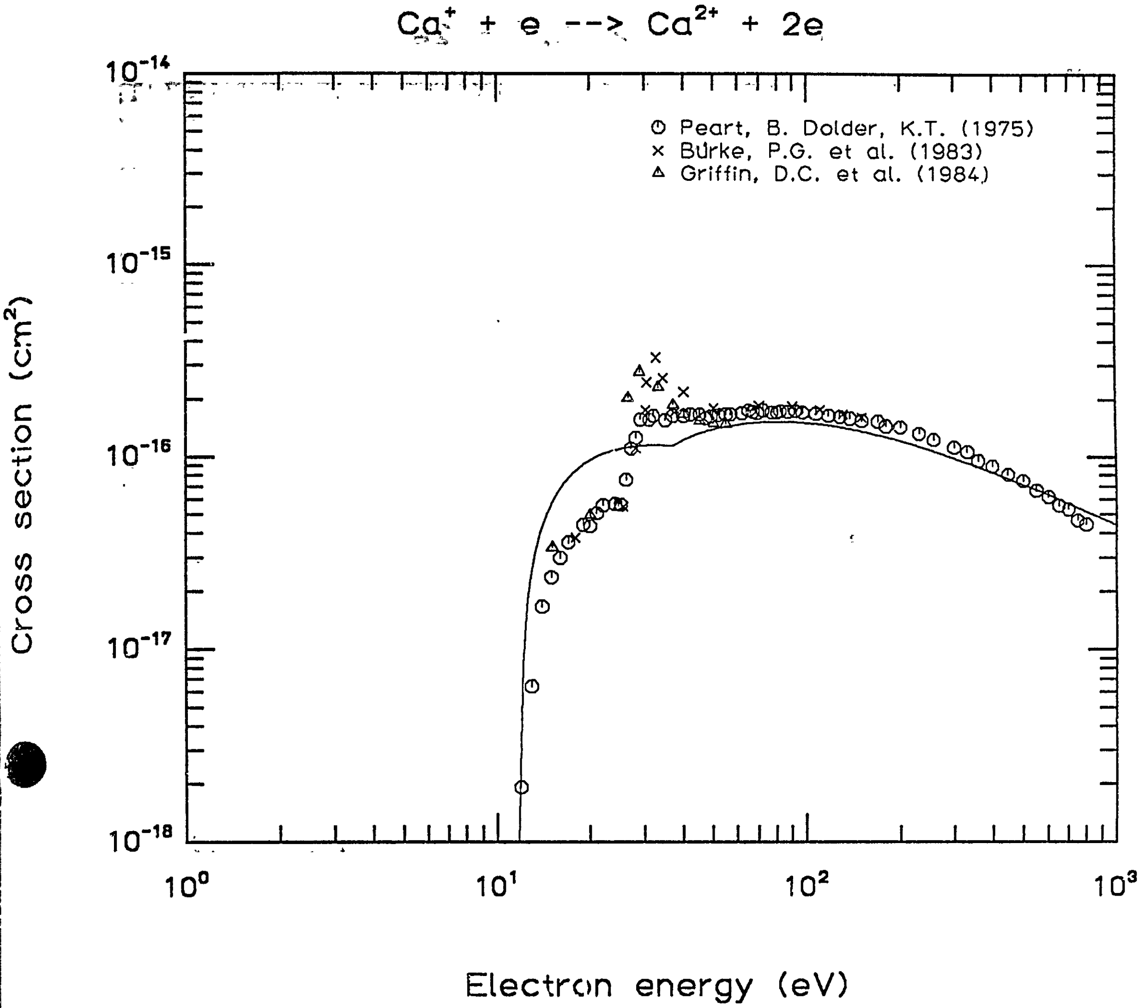


Ca + e --> Sum{ Ca^{n+} + (n+1)e }
McFarland, R.H. (1967)
Rakhovskii, V.I. et al. (1969)
Okuno, Y. (1971)
Vainshtein, L.A. et al. (1972)
Schneider, M. (1974)
Shimon, L.L. et al. (1975)
Cross section (cm^2)
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^0
10^1
10^2
10^3
10^4
Electron energy (eV)



$\times 10^{-15}$
Ca + e --> Sum{ Ca^{n+} + (n+1)e }
McFarland, R.H. (1967)
Rakhovskii, V.I. et al. (1969)
Okuno, Y. (1971)
Vainshtein, L.A. et al. (1972)
Schneider, M. (1974)
Shimon, L.L. et al. (1975)
Cross section (cm^2)
1.5
1.0
0.5
0.0
10^0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 138


Ca⁺ + e --> Ca²⁺ + 2e
Peart, B. Dolder, K.T. (1975)
Burke, P.G. et al. (1983)
Griffin, D.C. et al. (1984)
Cross section (cm²)
Electron energy (eV)
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10⁰
10¹
10²
10³

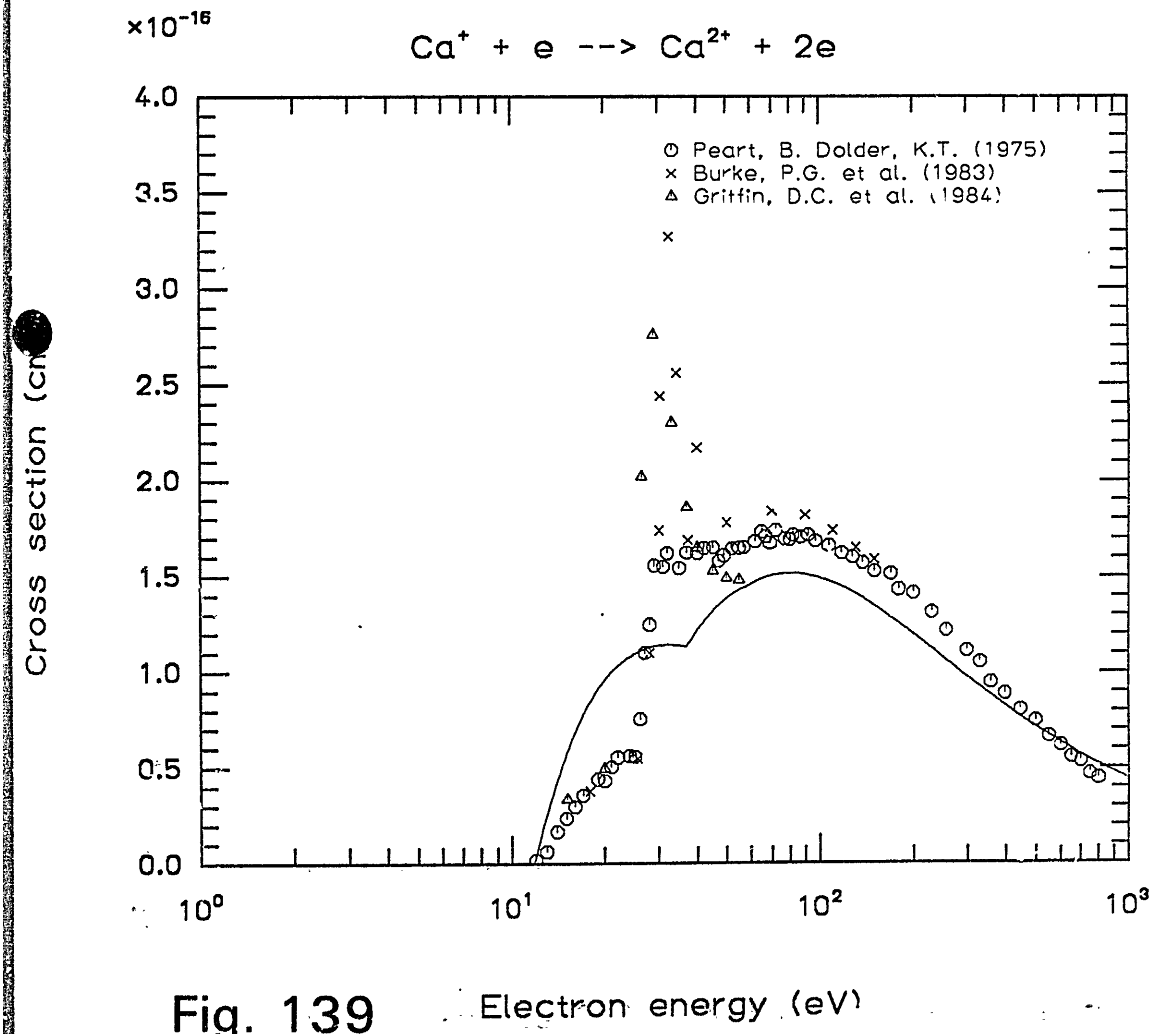
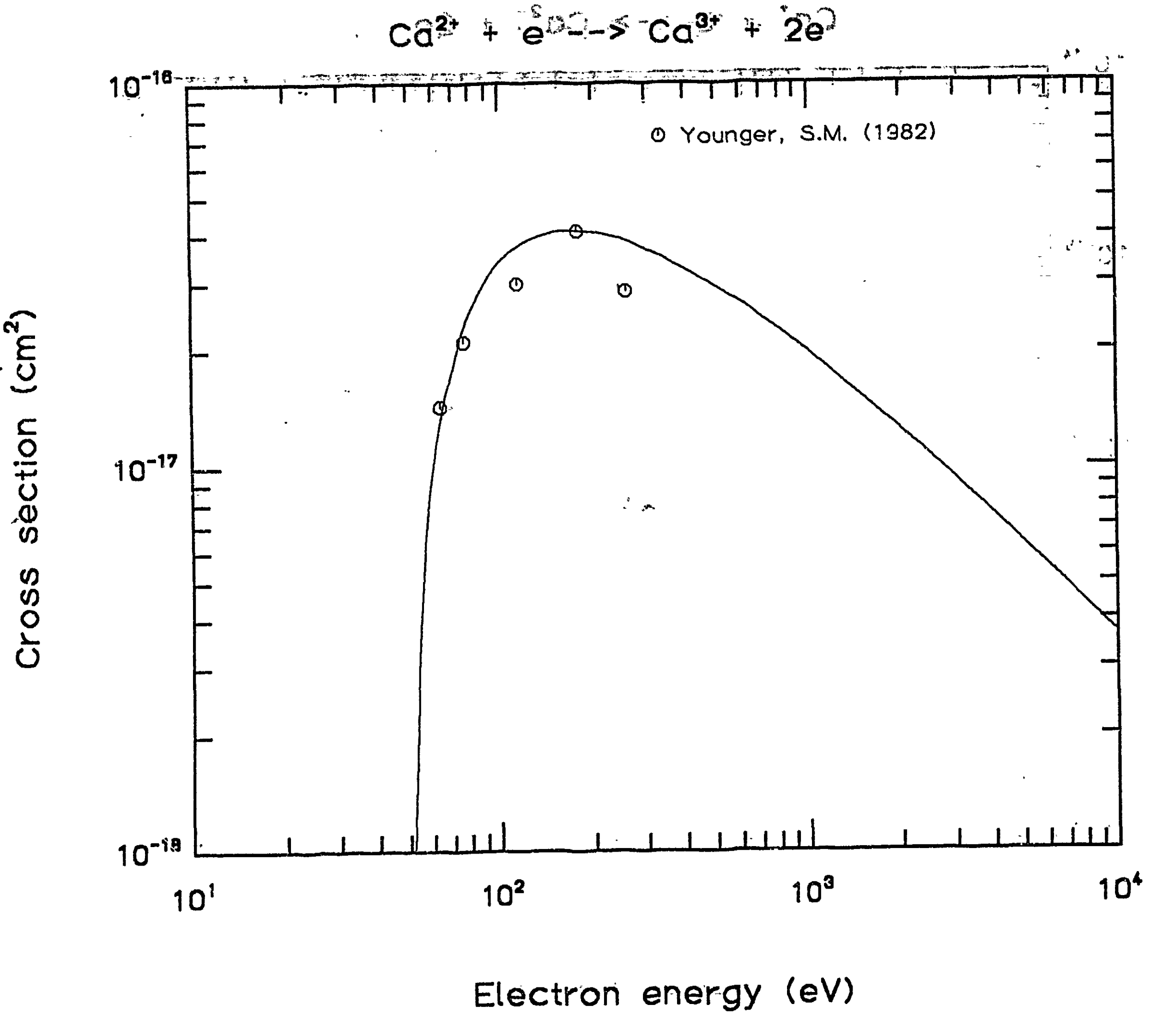
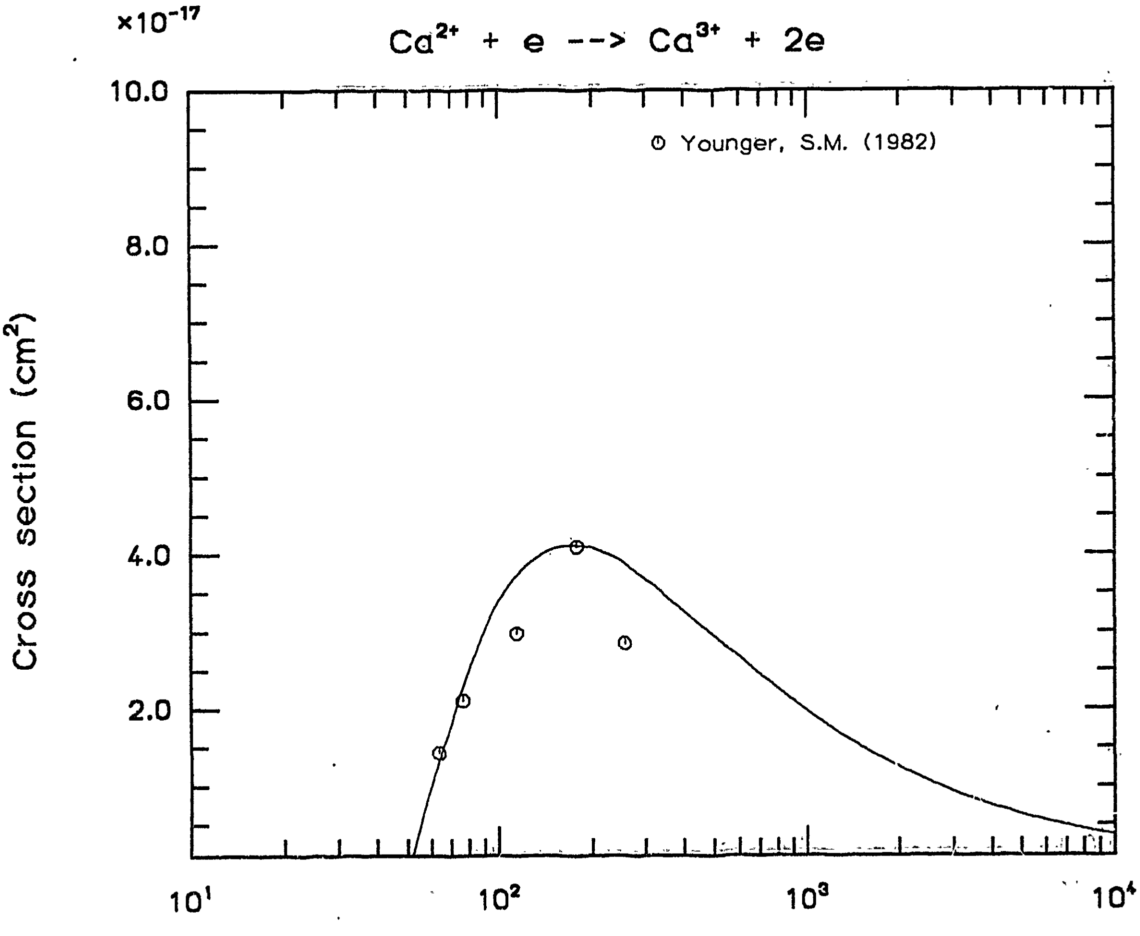

×10⁻¹⁶
Ca⁺ + e --> Ca²⁺ + 2e
Peart, B. Dolder, K.T. (1975)
Burke, P.G. et al. (1983)
Griffin, D.C. et al. (1984)
Cross section (cm²)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10⁰
10¹
10²
10³
Electron energy (eV)

Fig. 139

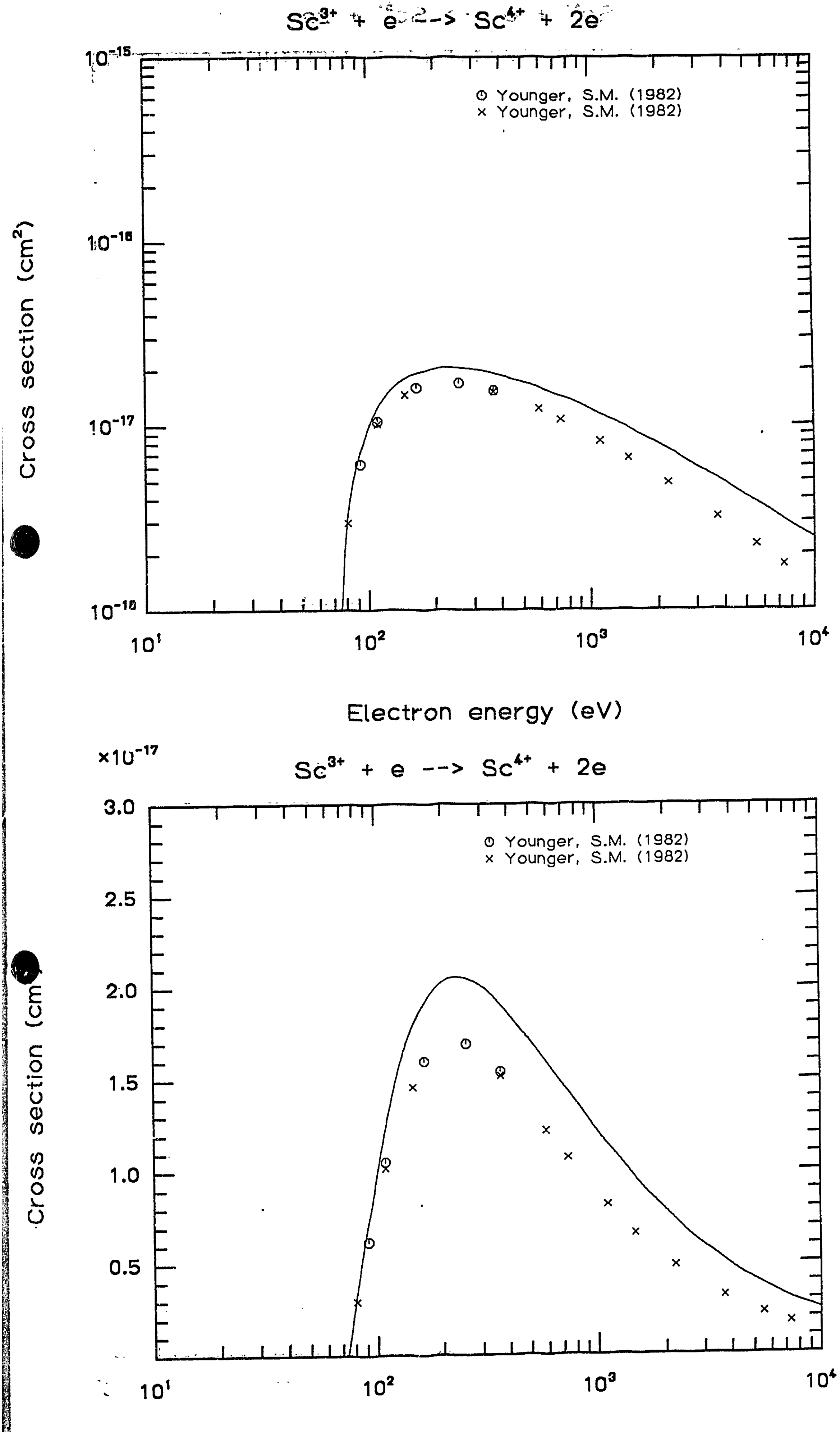


Ca2+ + e --> Ca3+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
10-16
10-17
10-18
101
102
103
104
Electron energy (eV)



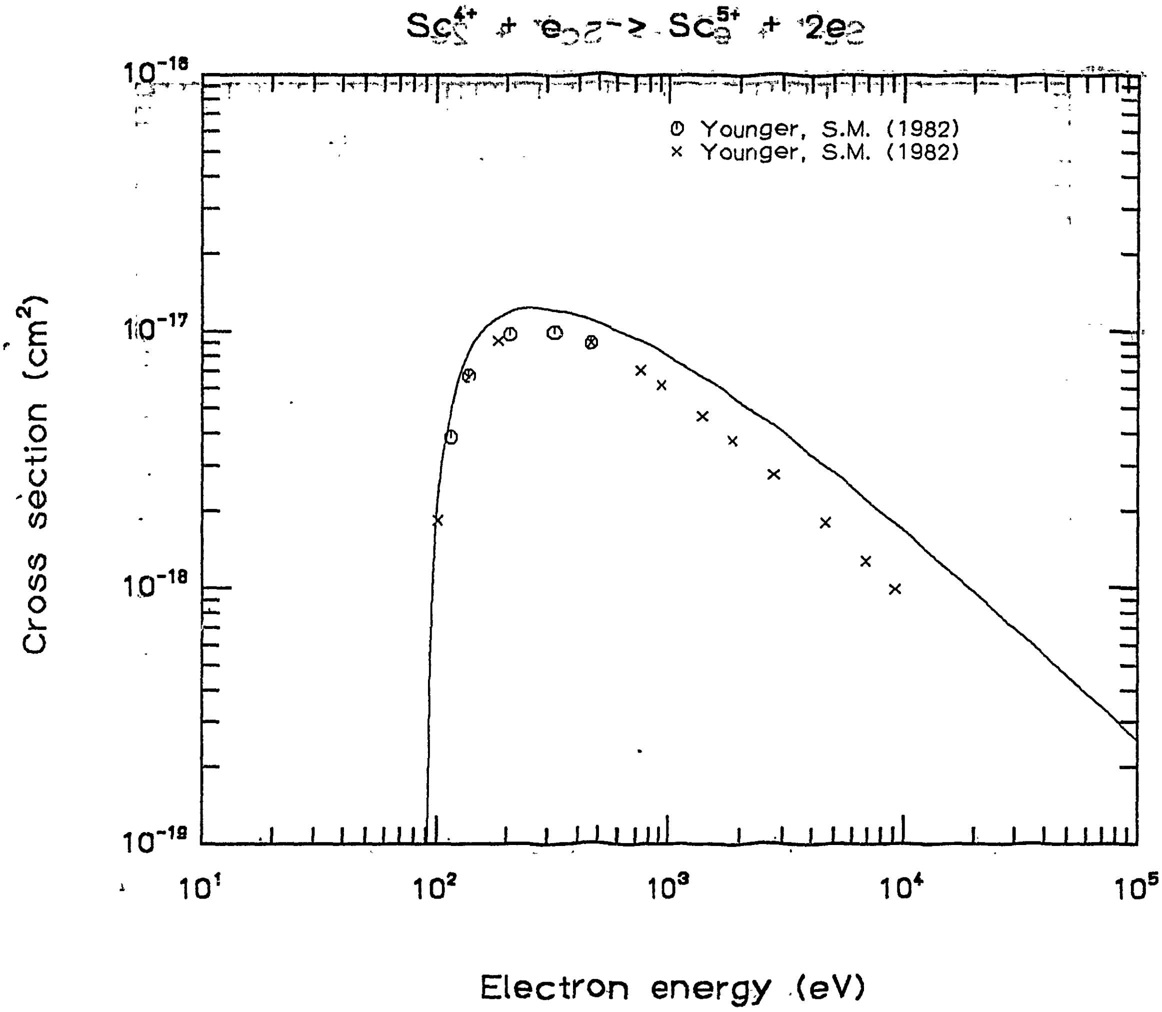
×10-17
Ca2+ + e --> Ca3+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
10.0
8.0
6.0
4.0
2.0
101
102
103
104
Electron energy (eV)

Fig. 140

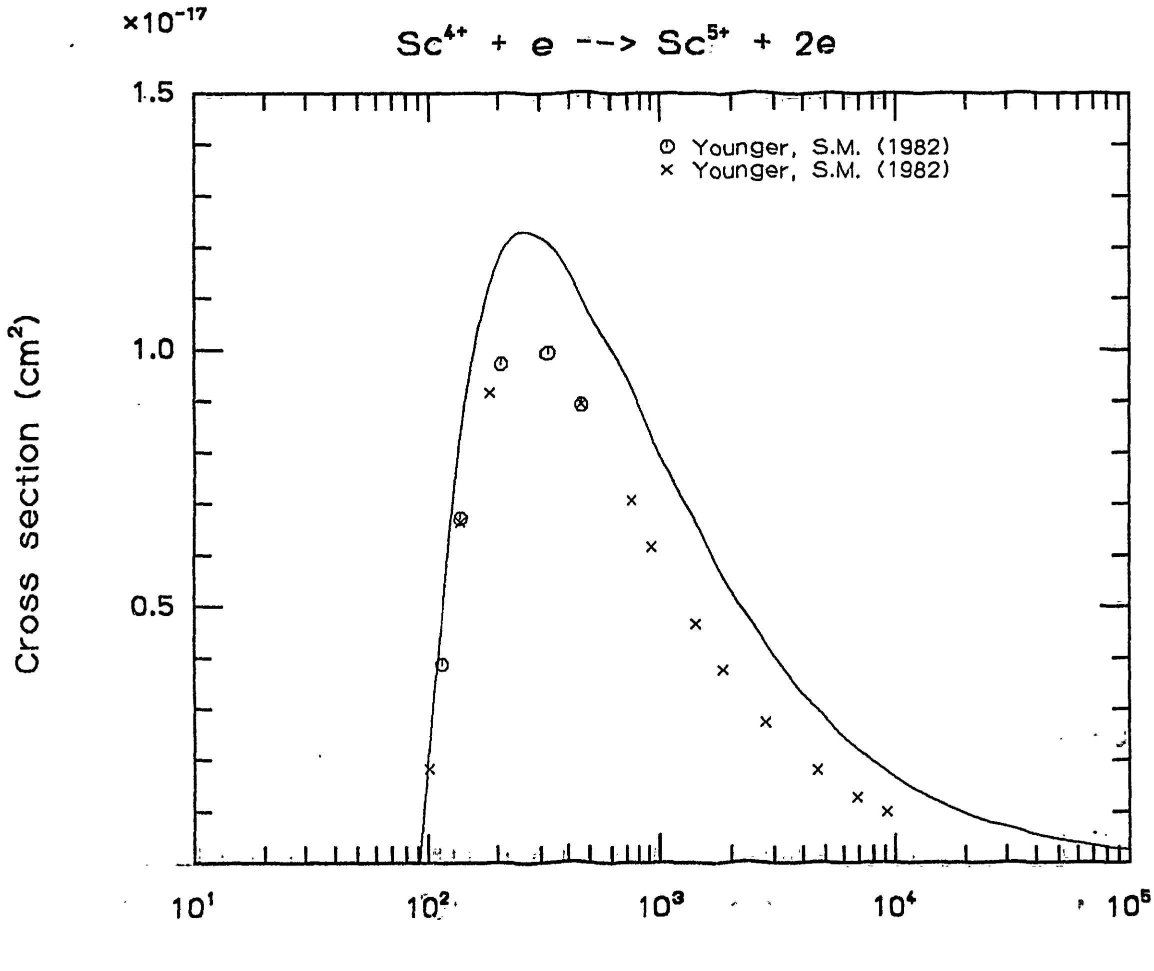


Sc^{3+} + e --> Sc^{4+} + 2e
10^{-15}
10^{-16}
10^{-17}
10^{-18}
Cross section (cm^2)
ⴲ Younger, S.M. (1982)
× Younger, S.M. (1982)
10^1
10^2
10^3
10^4
Electron energy (eV)
$\times 10^{-17}$
Sc^{3+} + e --> Sc^{4+} + 2e
3.0
2.5
2.0
1.5
1.0
0.5
Cross section (cm^2)
ⴲ Younger, S.M. (1982)
× Younger, S.M. (1982)
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 141



$Sc^{4+} + e \rightarrow Sc^{5+} + 2e$
⊙ Younger, S.M. (1982)
× Younger, S.M. (1982)
Cross section (cm²)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
Electron energy (eV)



×10⁻¹⁷
$Sc^{4+} + e \rightarrow Sc^{5+} + 2e$
⊙ Younger, S.M. (1982)
× Younger, S.M. (1982)
Cross section (cm²)
1.5
1.0
0.5
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
Electron energy (eV)

Fig. 142

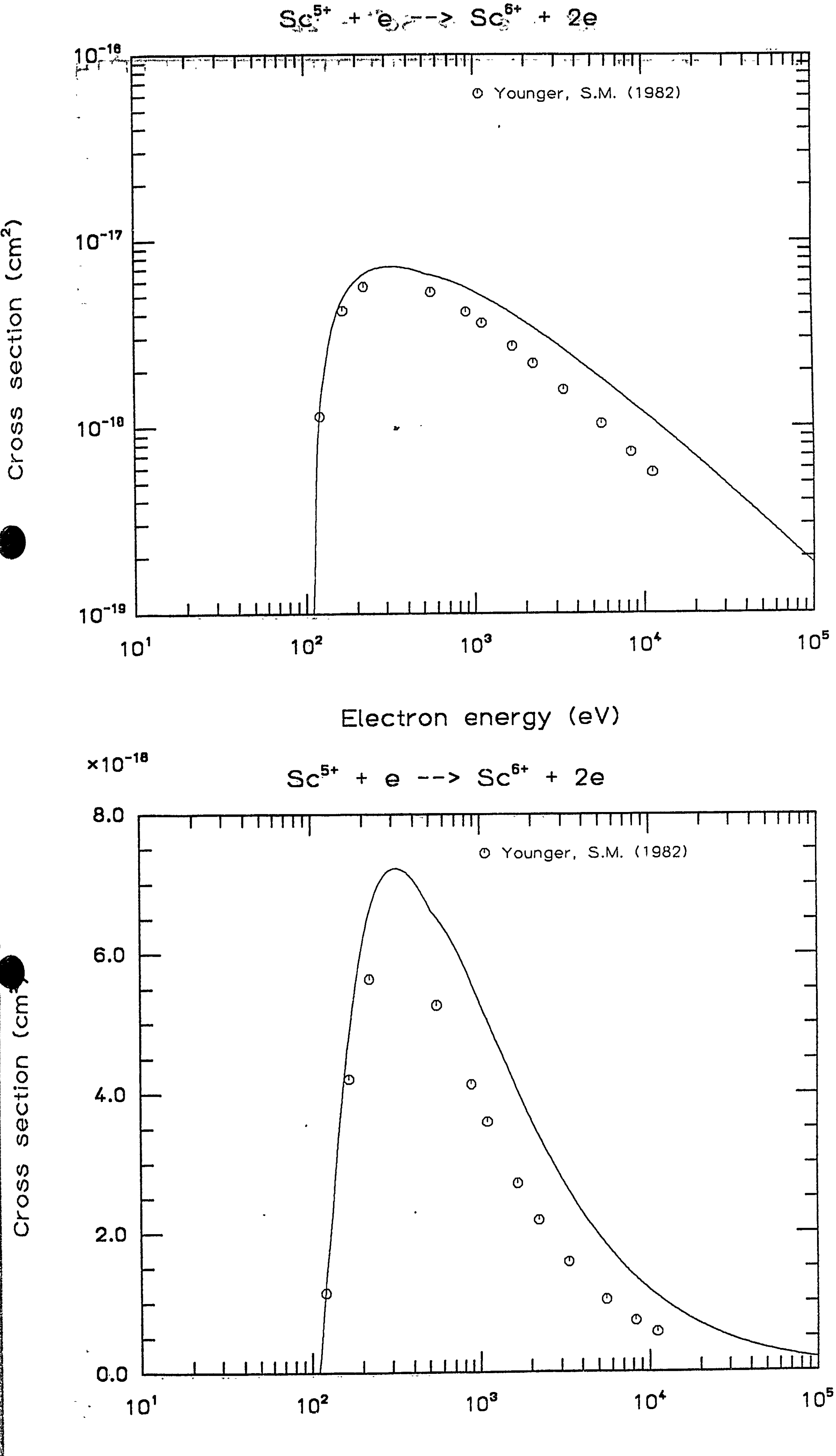
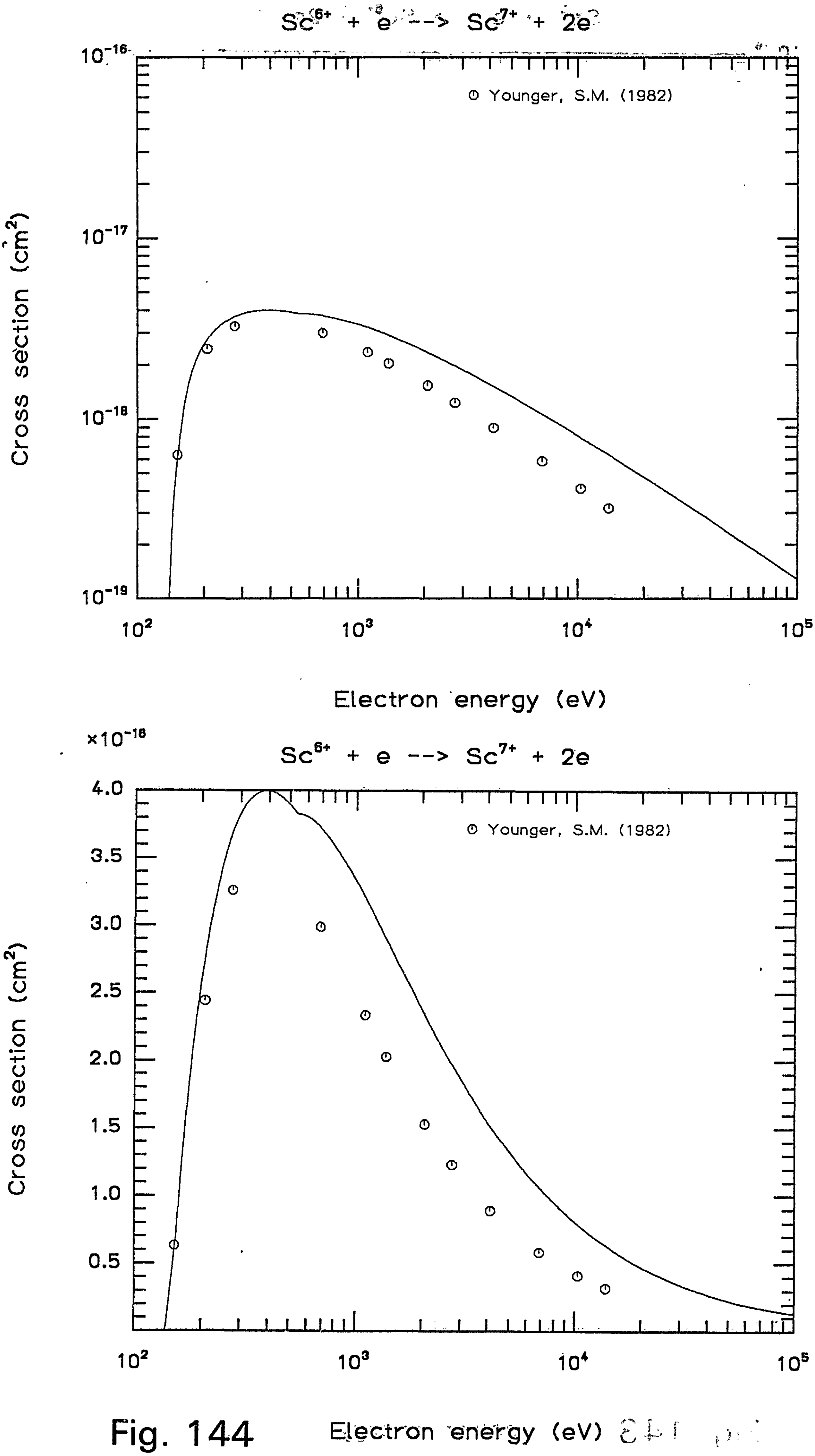
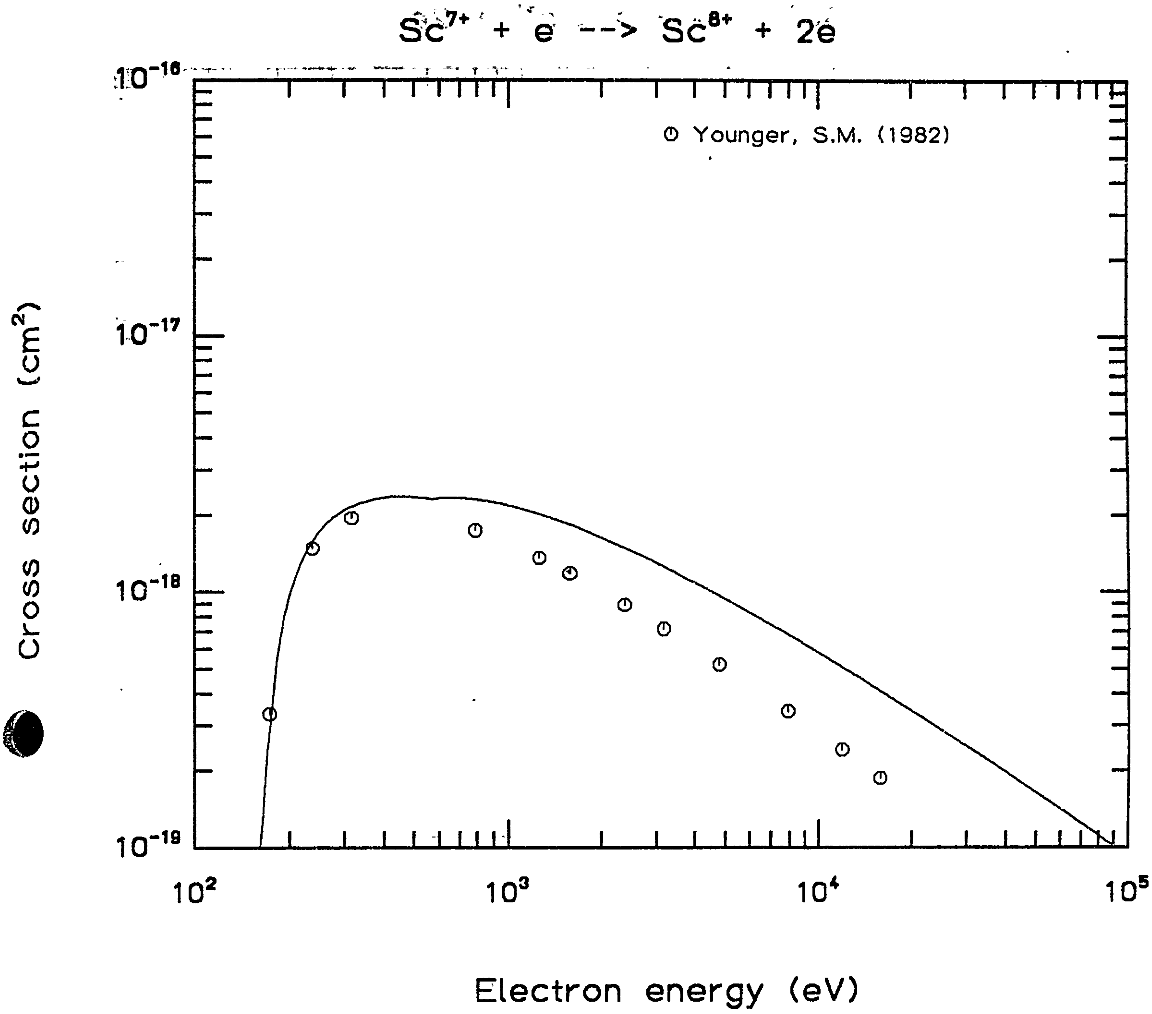


Fig. 143 Electron energy (eV)



Sc6+ + e --> Sc7+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
10-16
10-17
10-18
10-19
10^2
10^3
10^4
10^5
Electron energy (eV)
×10-18
Sc6+ + e --> Sc7+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 144


Sc^{7+} + e --> Sc^{8+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^2
10^3
10^4
10^5
Electron energy (eV)

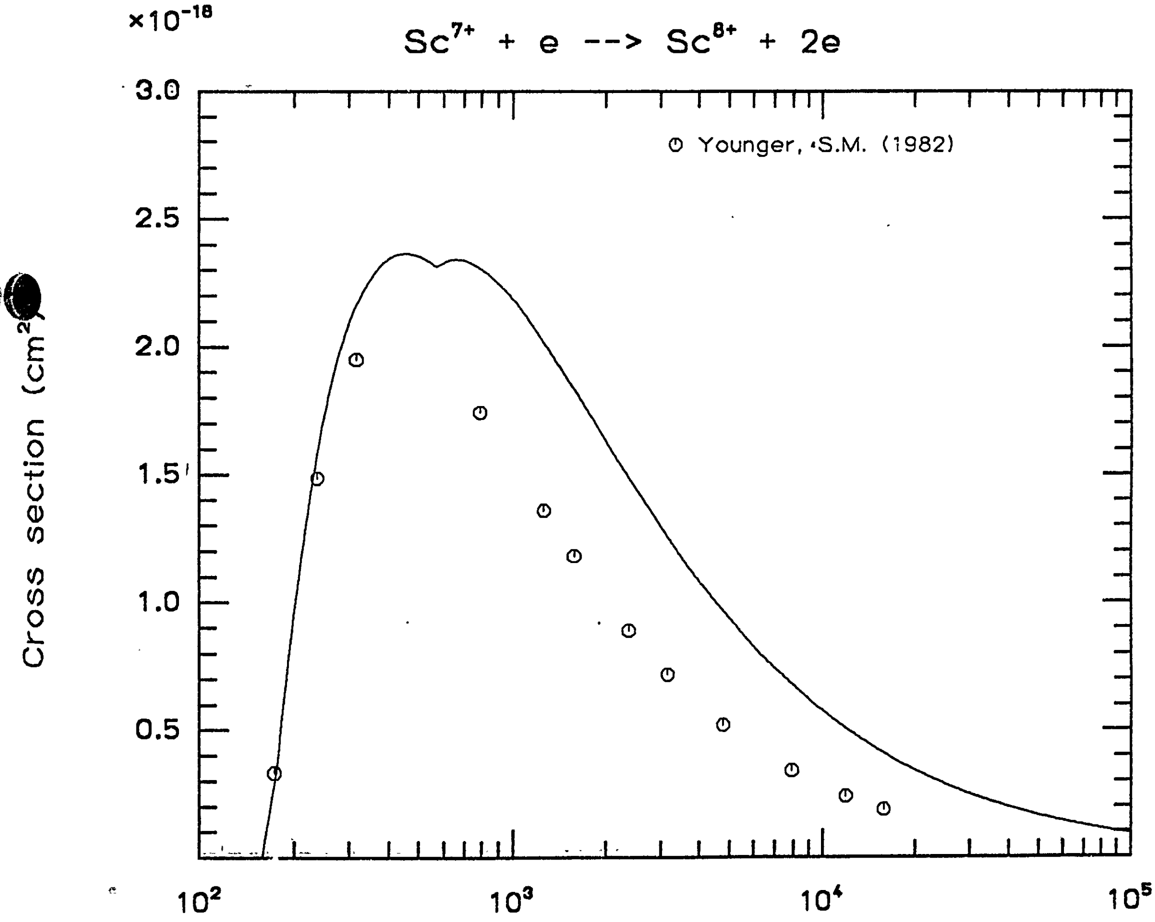
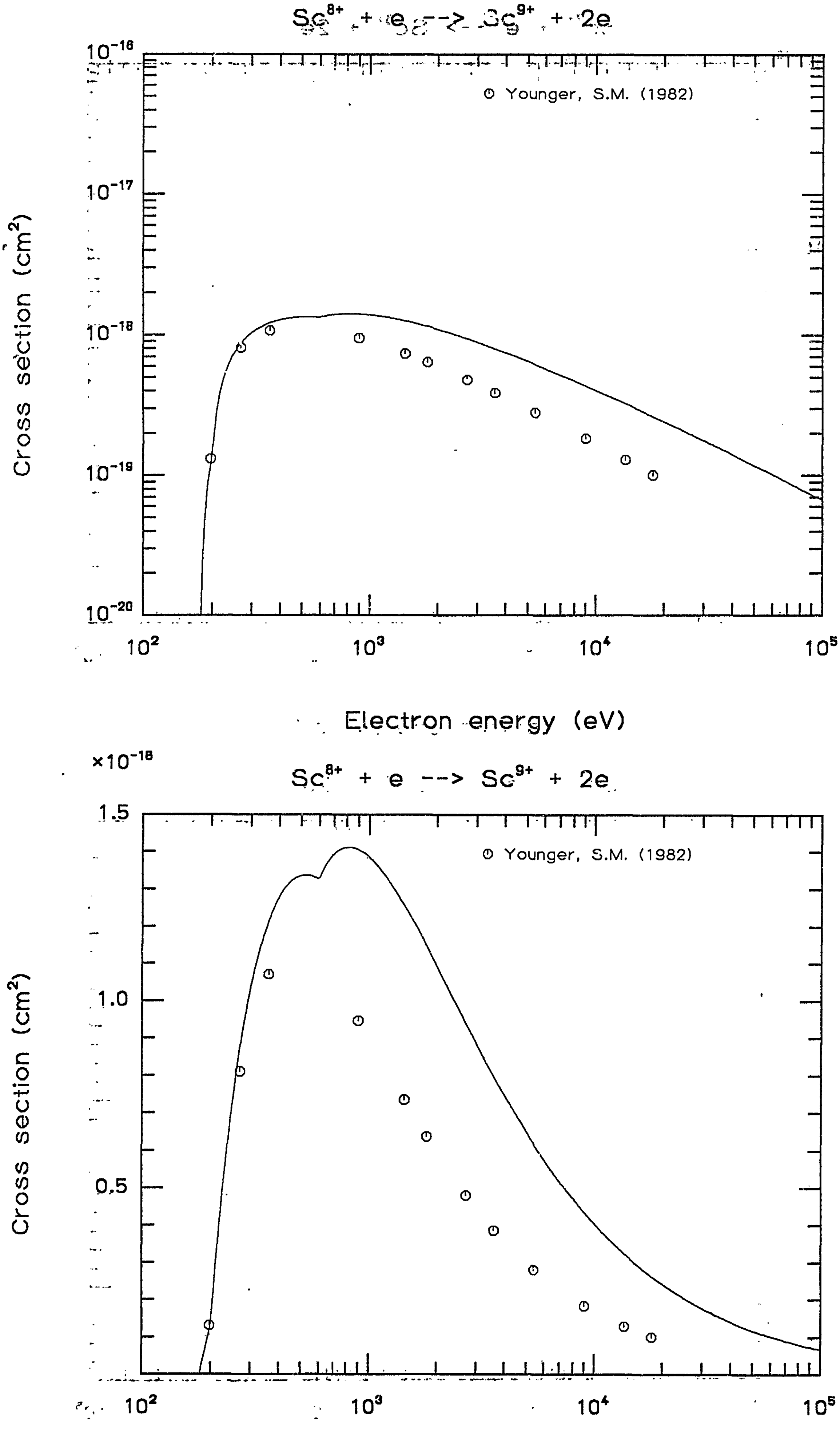
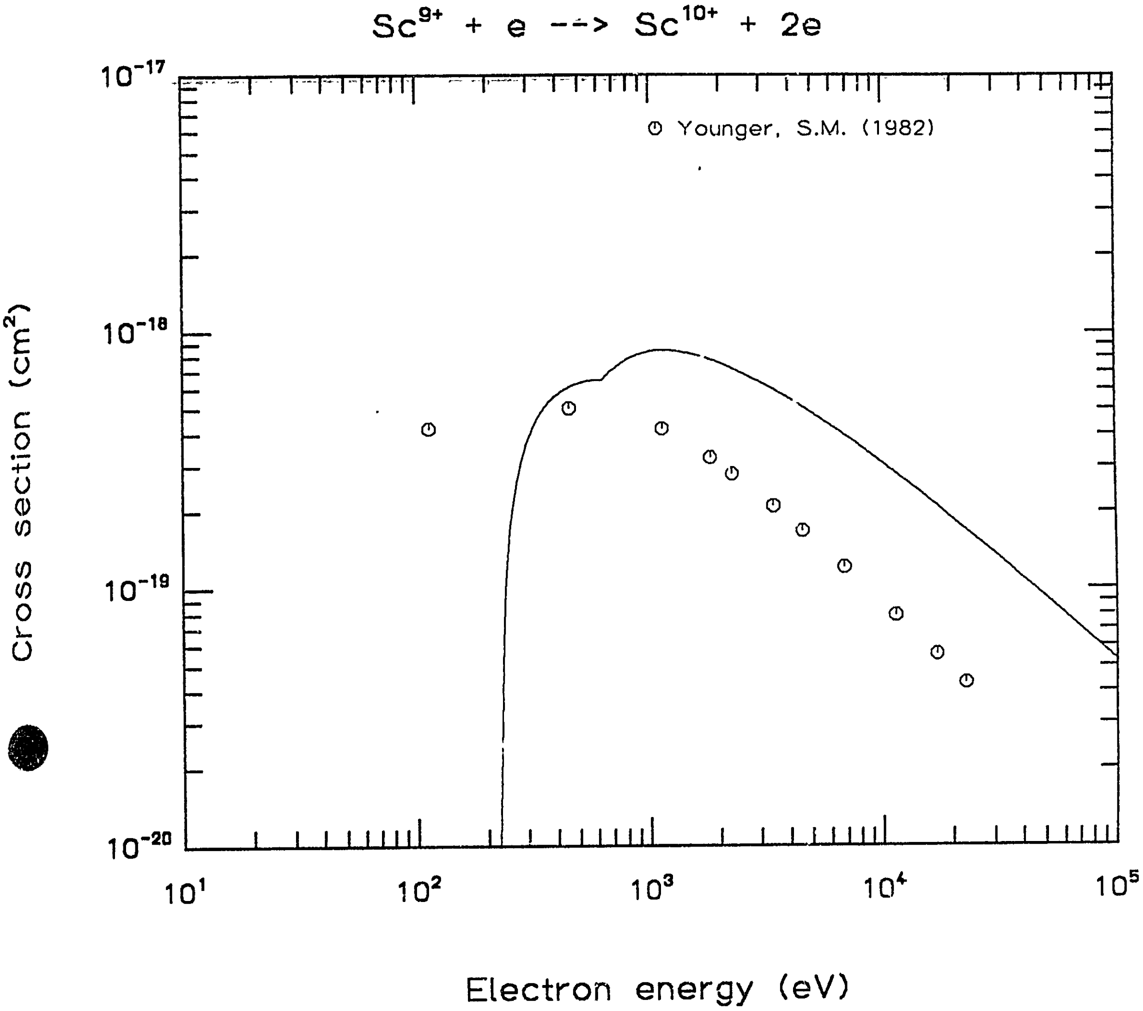

×10^{-18}
Sc^{7+} + e --> Sc^{8+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
3.0
2.5
2.0
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 145



$Sc^{8+} + e \rightarrow Sc^{9+} + 2e$
Younger, S.M. (1982)
Cross section (cm²)
Electron energy (eV)
$\times 10^{-18}$
$Sc^{8+} + e \rightarrow Sc^{9+} + 2e$
Younger, S.M. (1982)
Cross section (cm²)
Electron energy (eV)

Fig. 146



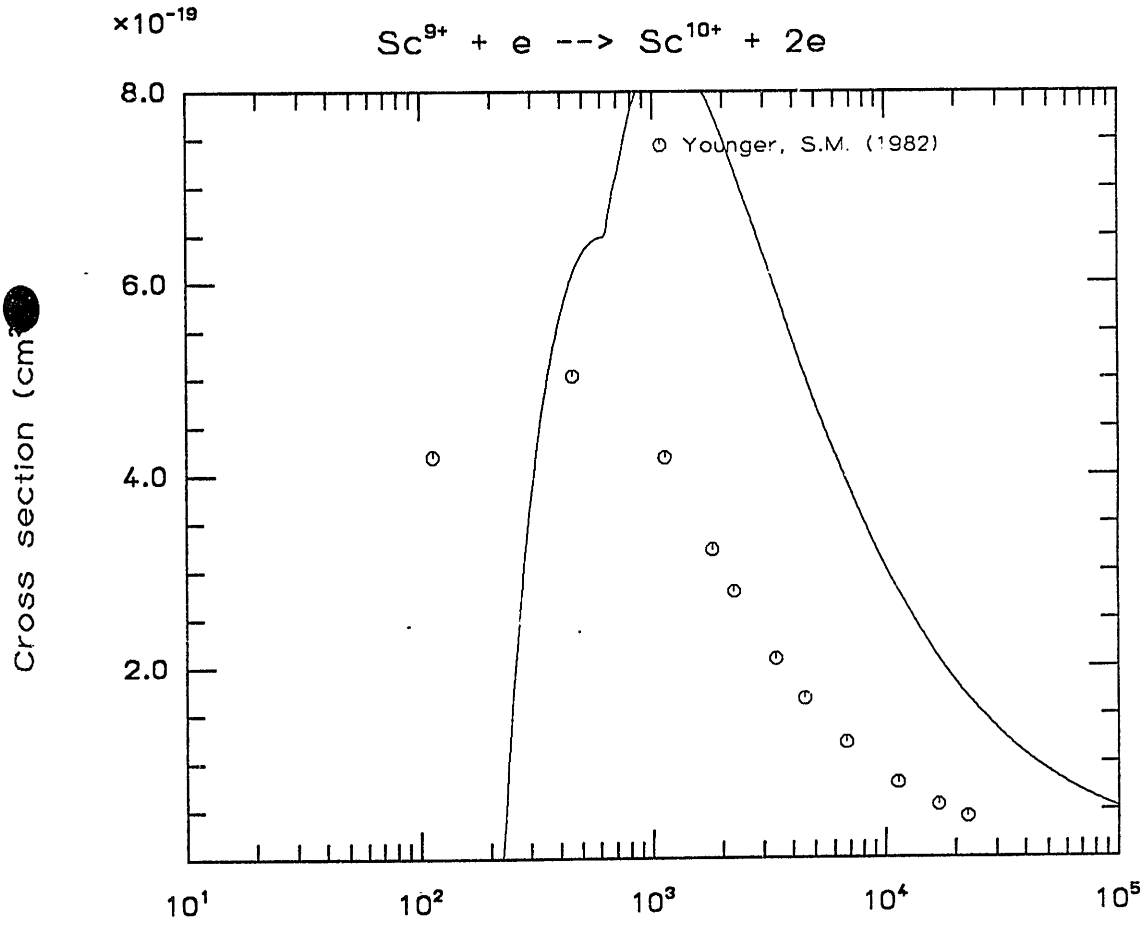
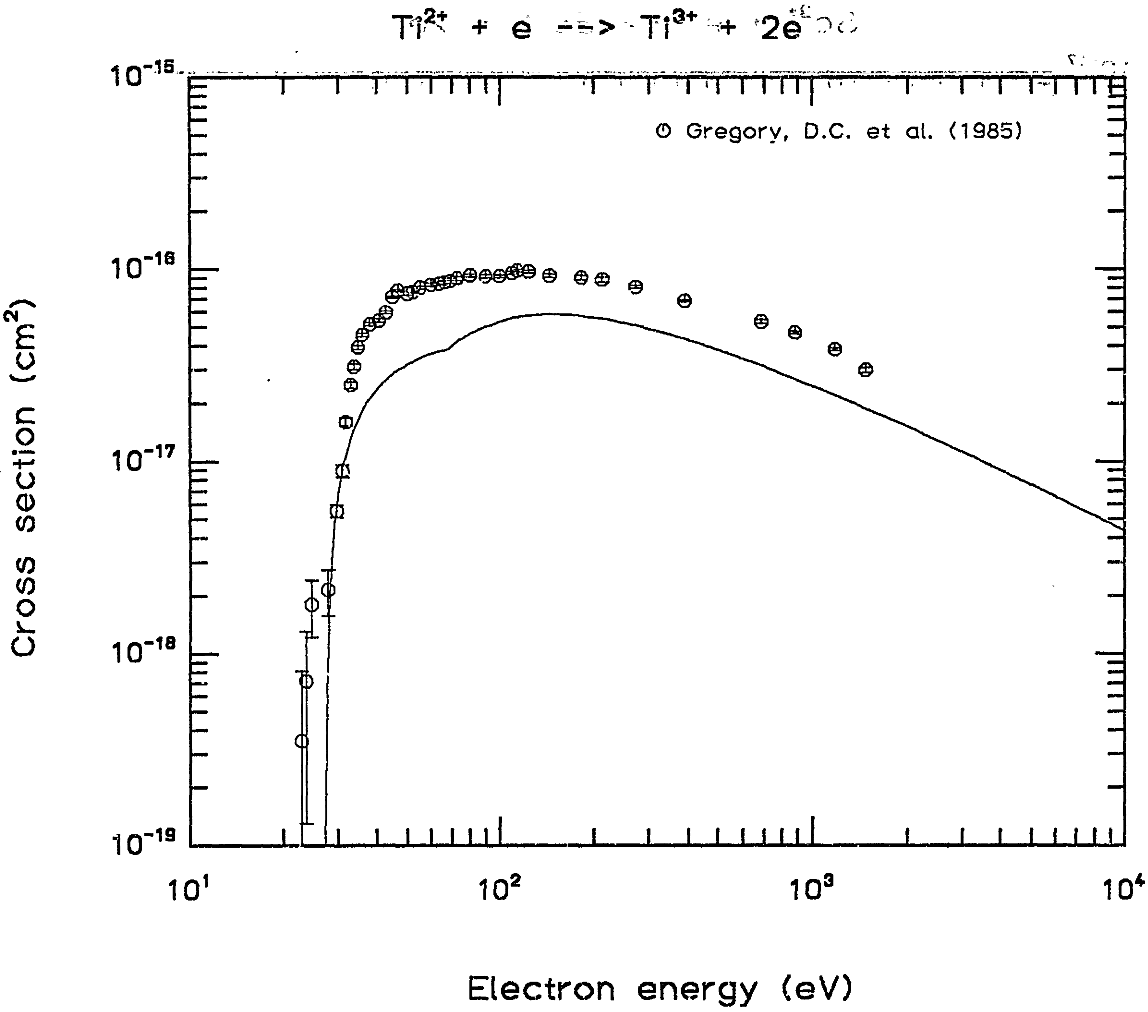
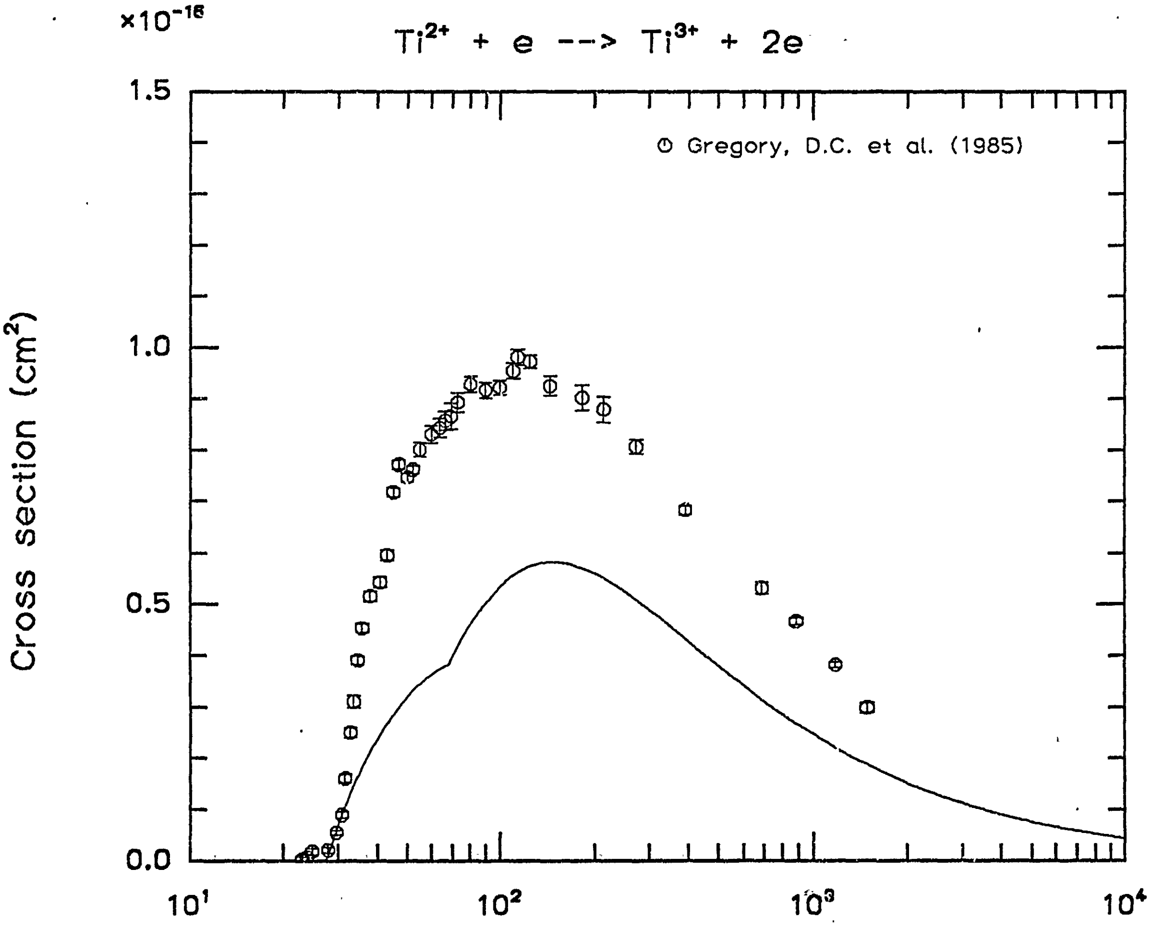


Fig. 147 · Electron energy (eV)

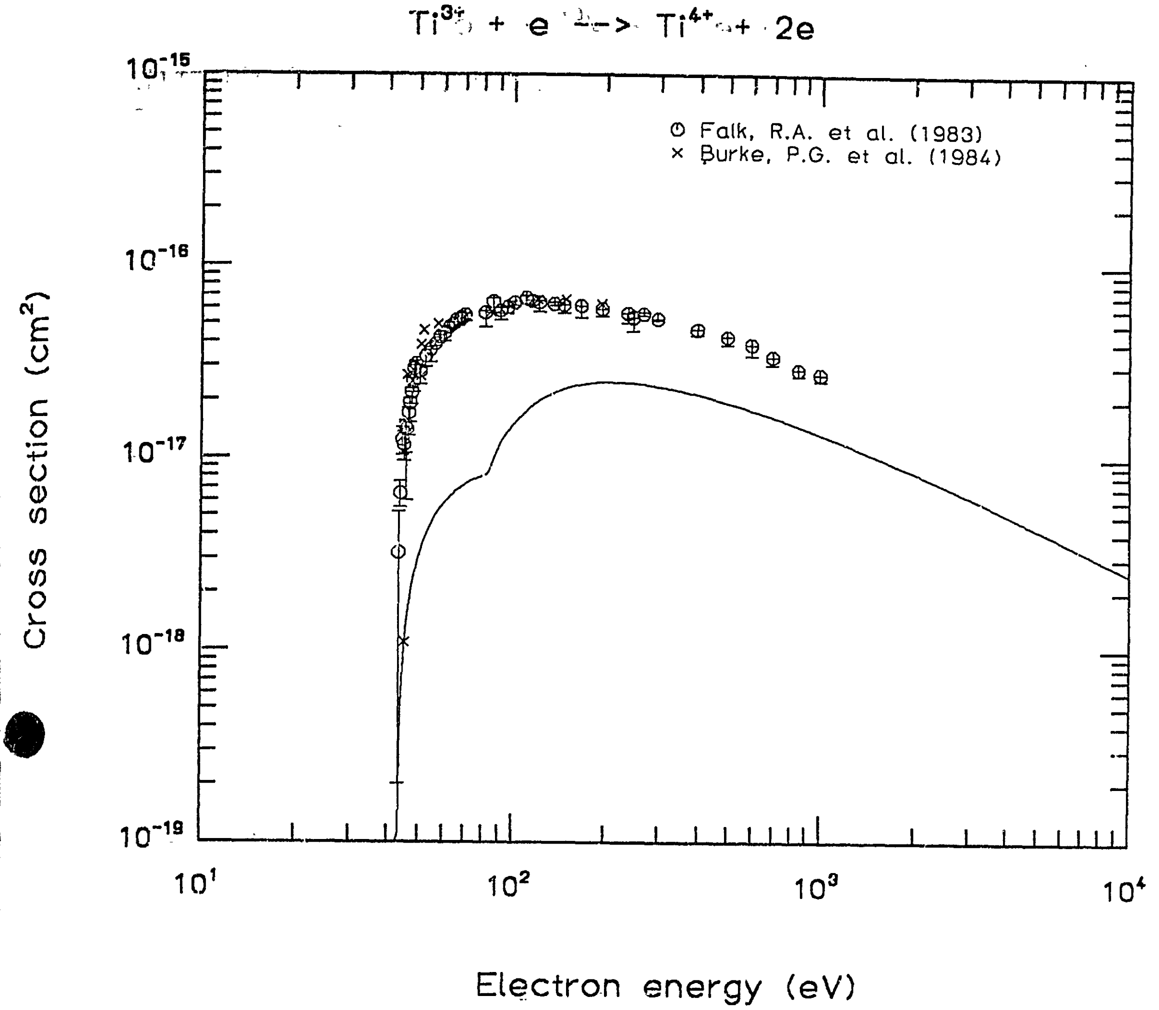


$Ti^{2+} + e \rightarrow Ti^{3+} + 2e$
Gregory, D.C. et al. (1985)
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^1
10^2
10^3
10^4
Electron energy (eV)

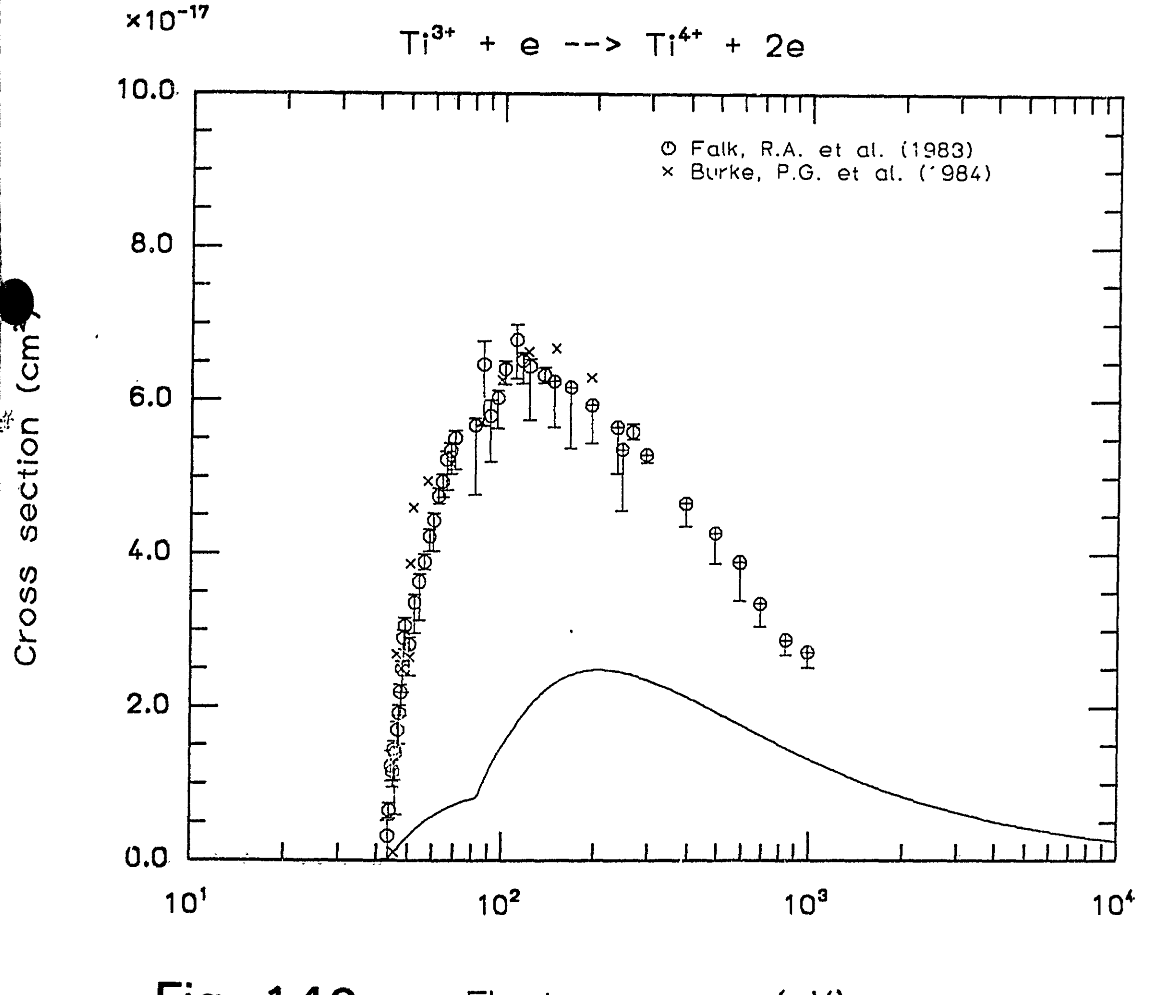


$\times 10^{-16}$
$Ti^{2+} + e \rightarrow Ti^{3+} + 2e$
Gregory, D.C. et al. (1985)
Cross section (cm^2)
1.5
1.0
0.5
0.0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 148

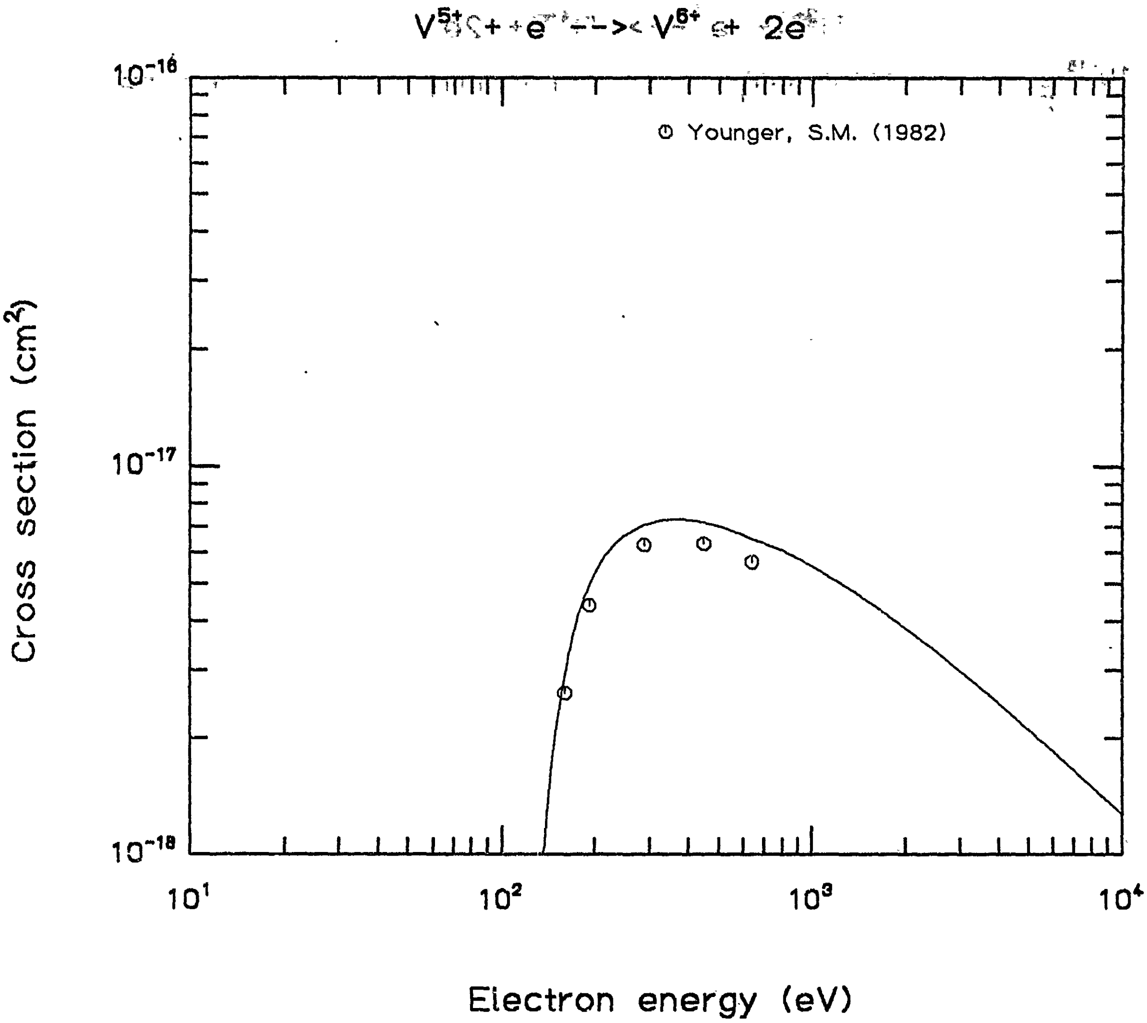


Ti³⁺ + e --> Ti⁴⁺ + 2e
Falk, R.A. et al. (1983)
Burke, P.G. et al. (1984)
Cross section (cm²)
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10⁻¹⁹
10¹
10²
10³
10⁴
Electron energy (eV)



×10⁻¹⁷
Ti³⁺ + e --> Ti⁴⁺ + 2e
Falk, R.A. et al. (1983)
Burke, P.G. et al. (1984)
Cross section (cm²)
10.0
8.0
6.0
4.0
2.0
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 149


V5+ + e --> V6+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
10-16
10-17
10-18
10^1
10^2
10^3
10^4
Electron energy (eV)

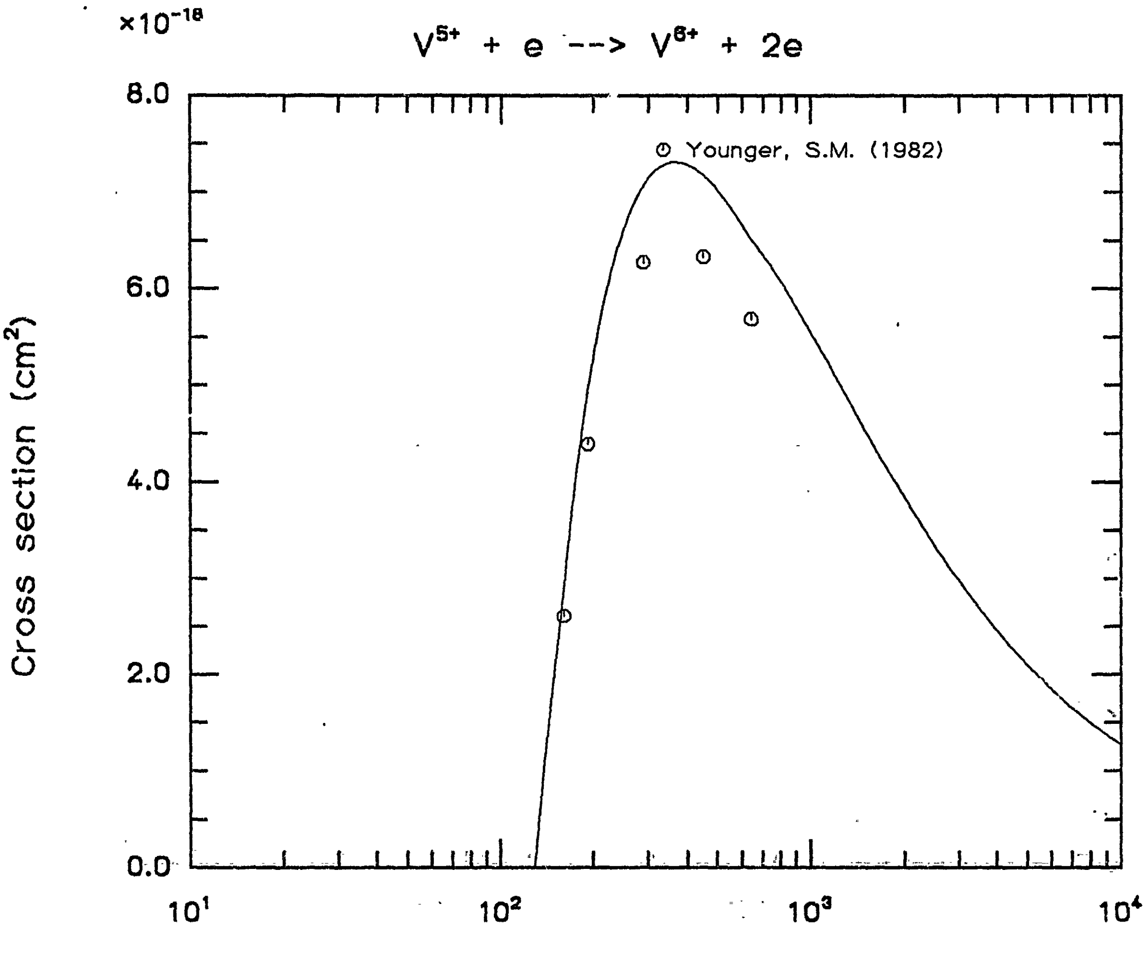

×10-18
V5+ + e --> V6+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 150

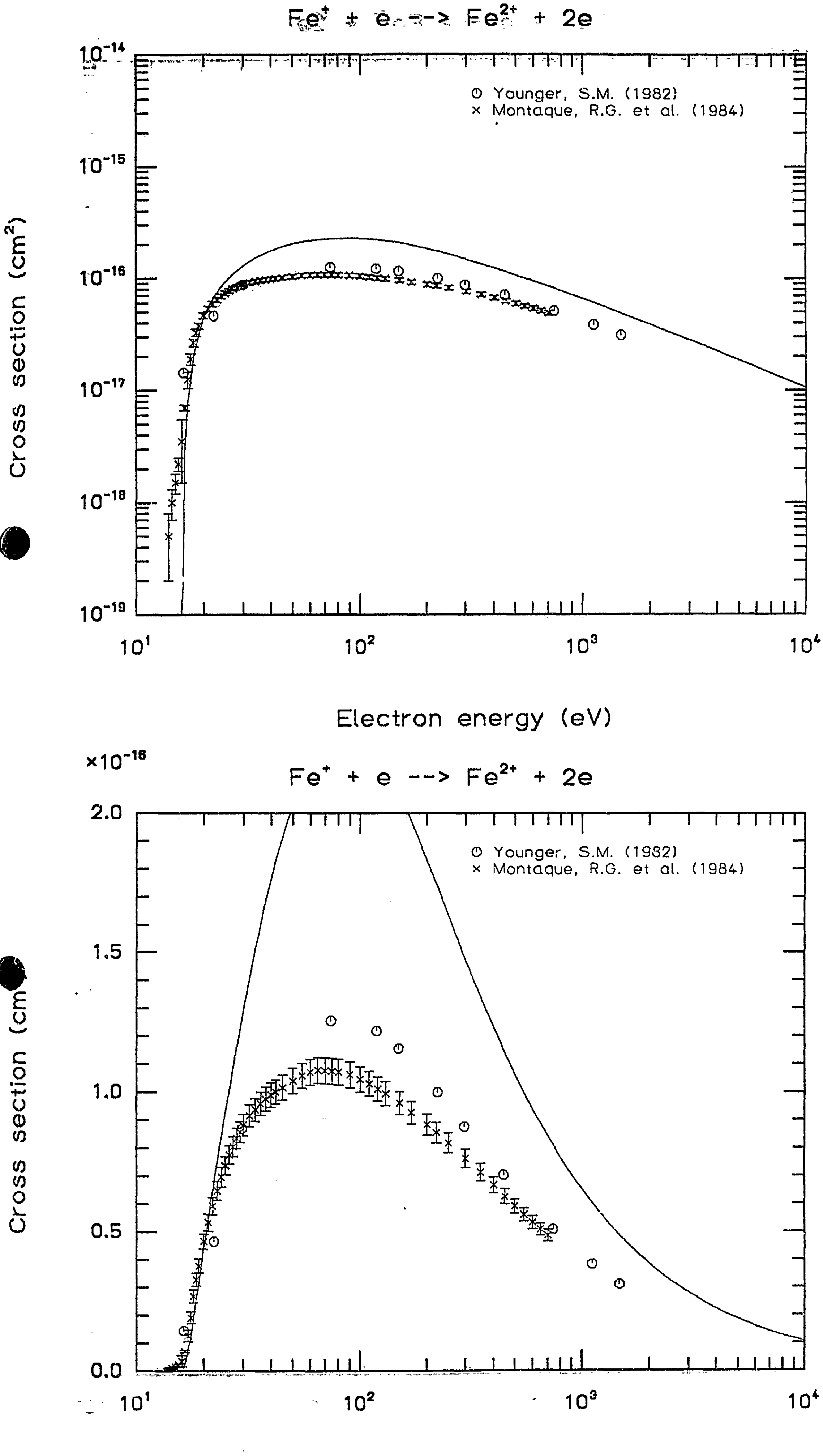
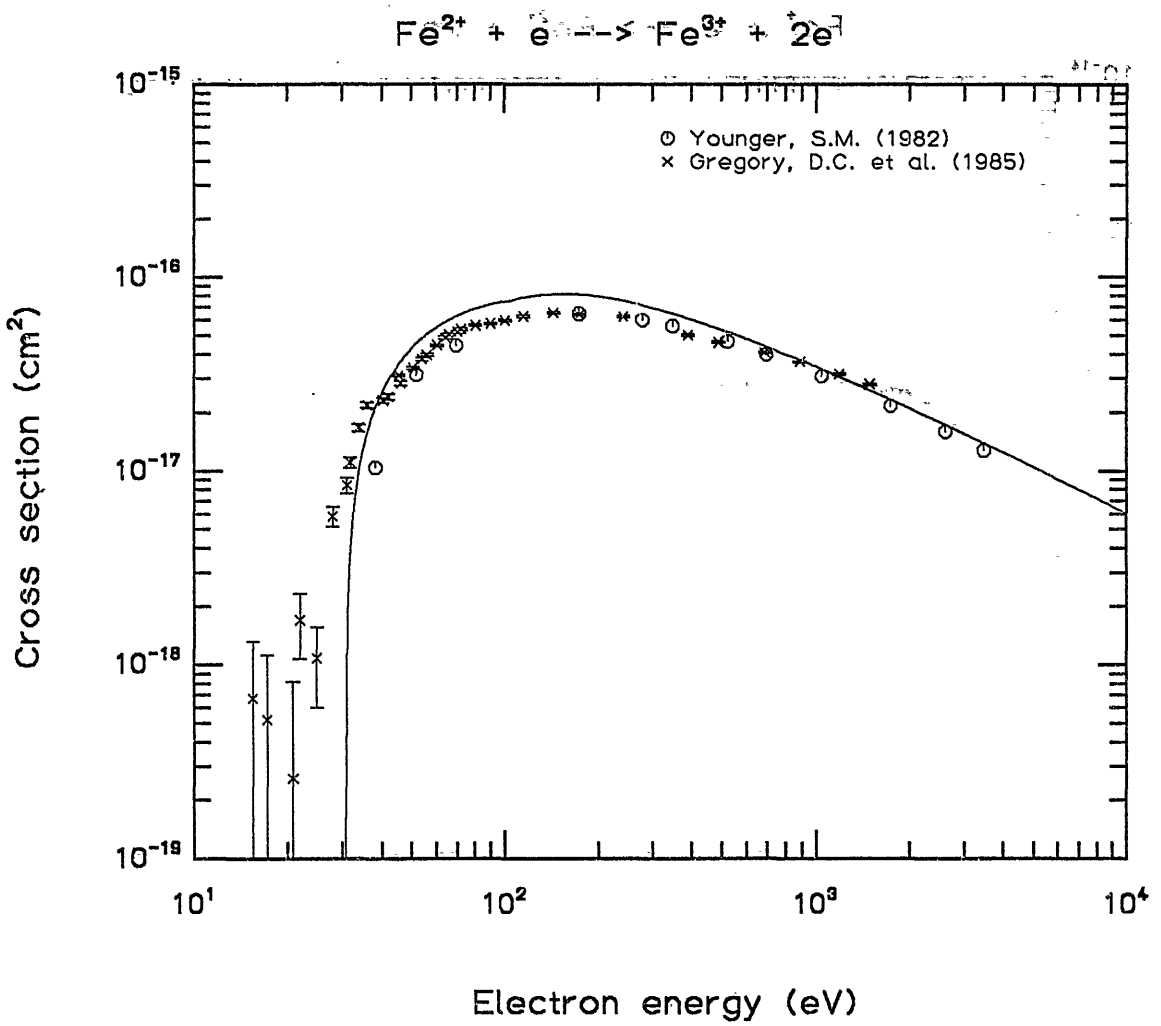


Fig. 151 Electron energy (eV)


Fe^{2+} + e --> Fe^{3+} + 2e
Younger, S.M. (1982)
Gregory, D.C. et al. (1985)
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^1
10^2
10^3
10^4
Electron energy (eV)

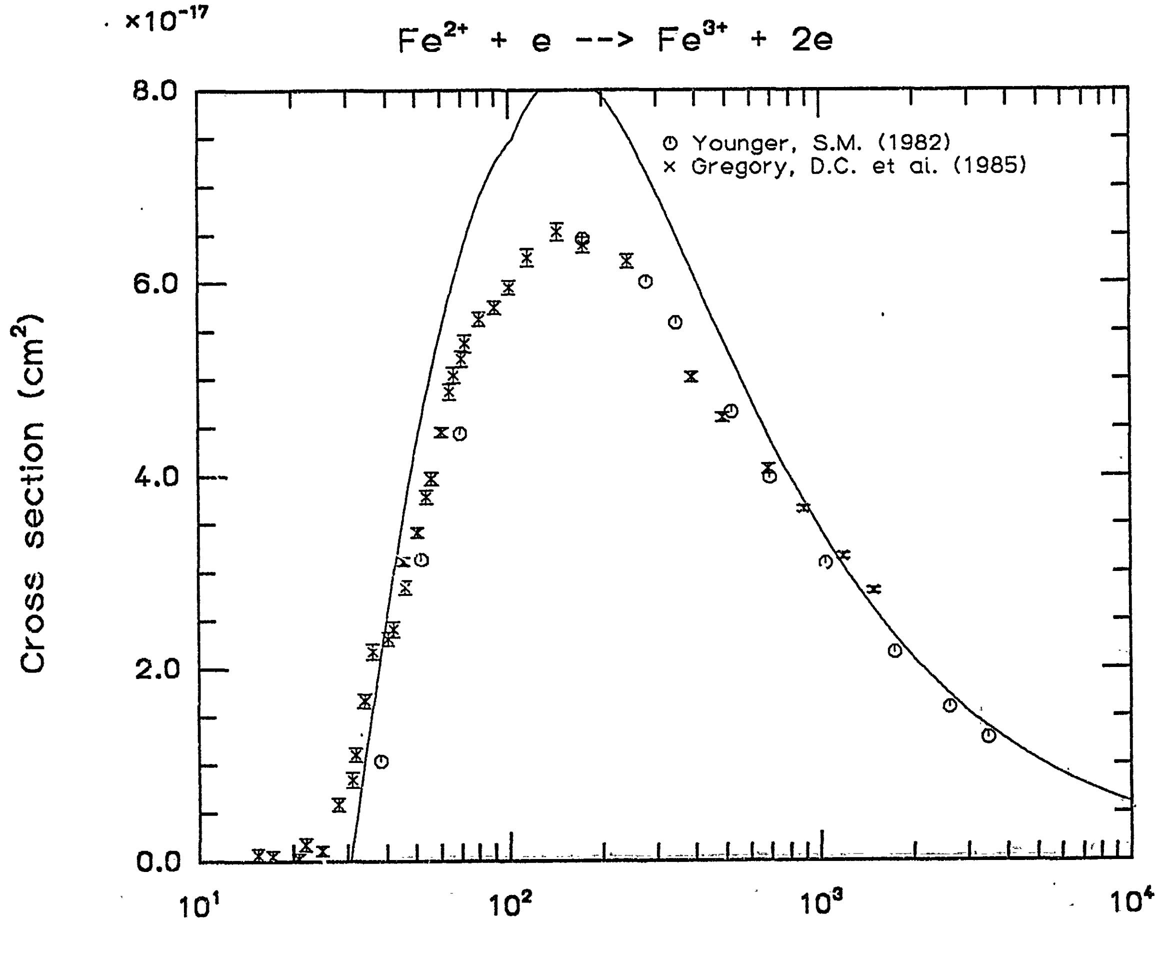
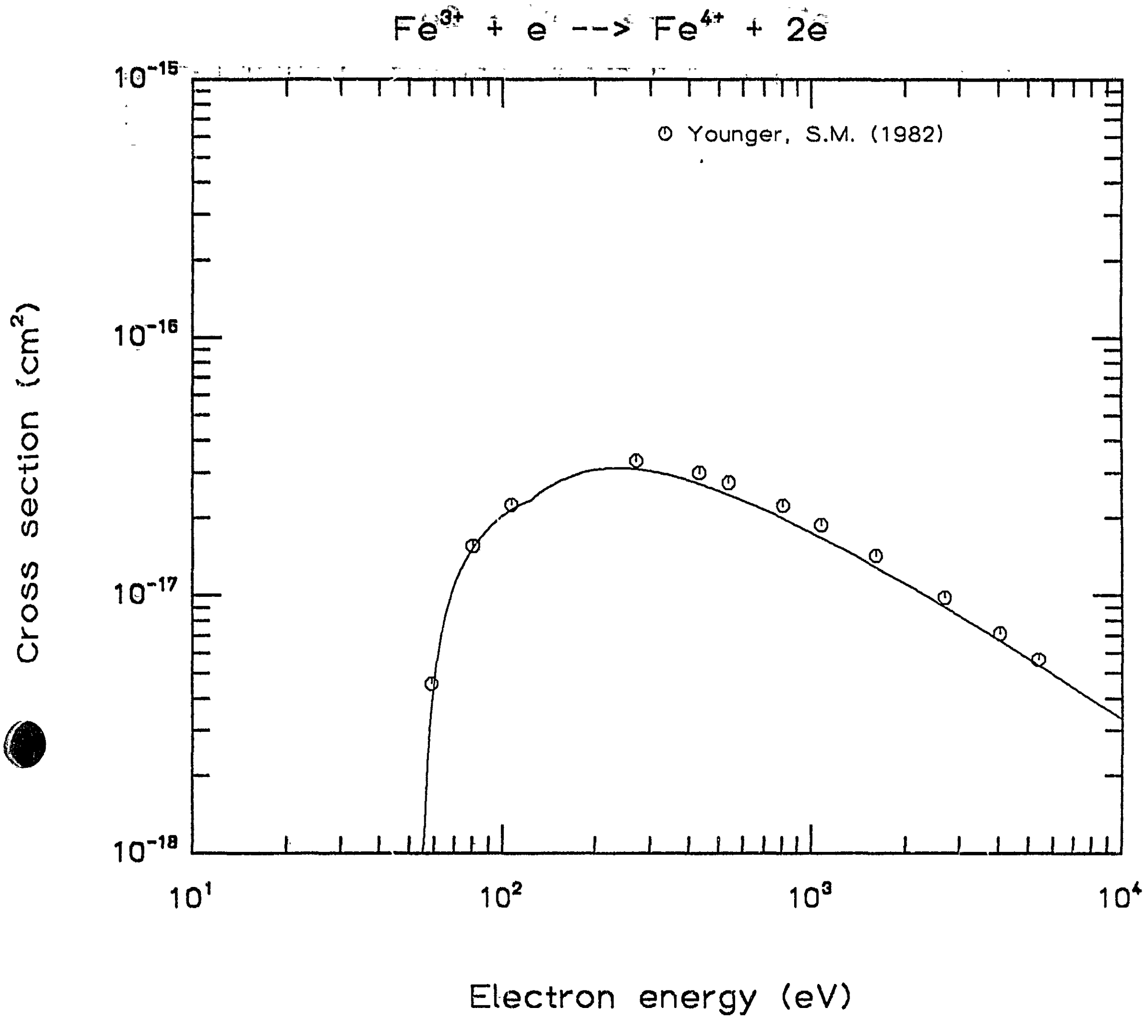
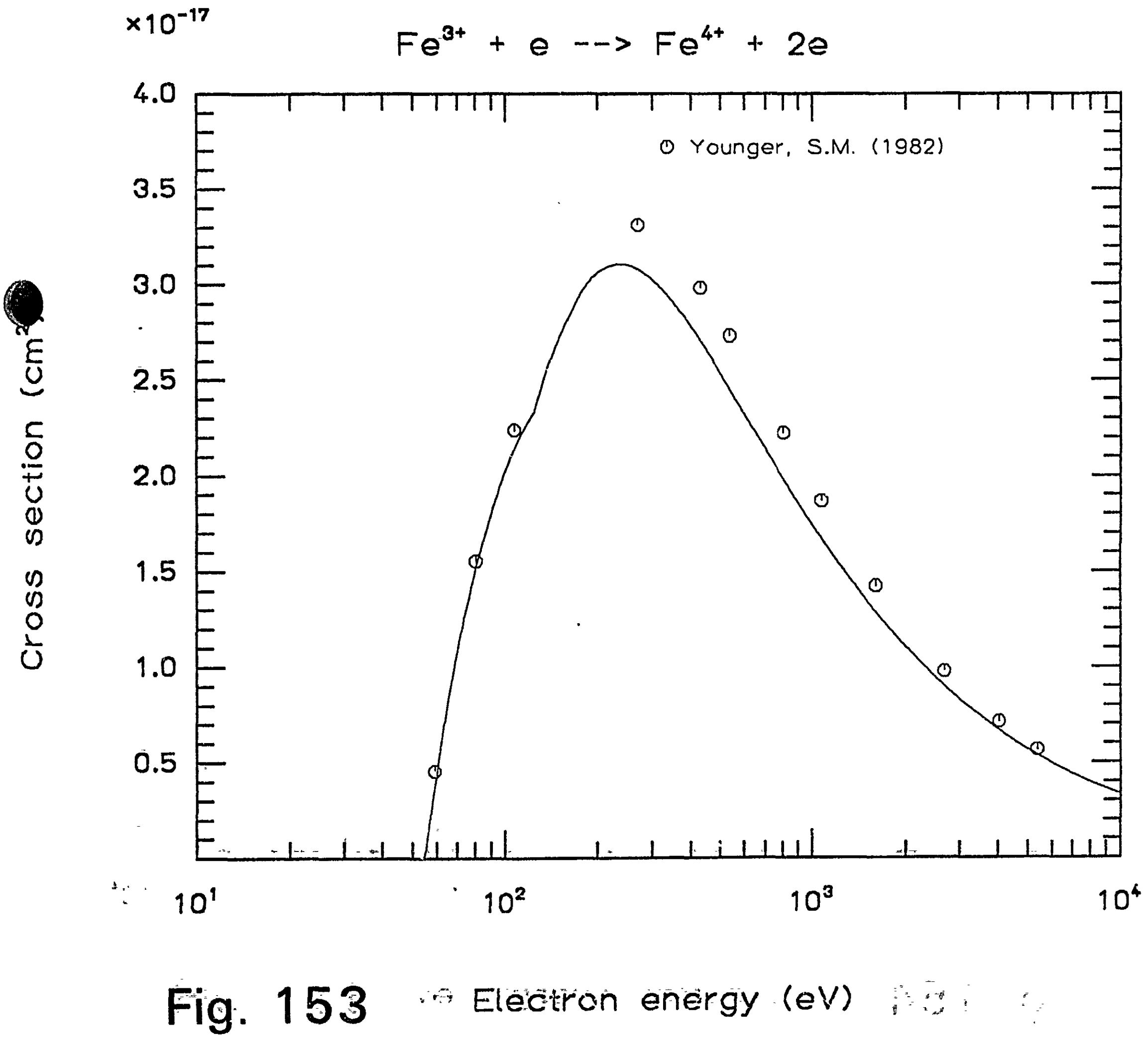

$\times 10^{-17}$
Fe^{2+} + e --> Fe^{3+} + 2e
Younger, S.M. (1982)
Gregory, D.C. et al. (1985)
Cross section (cm^2)
8.0
6.0
4.0
2.0
0.0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 152

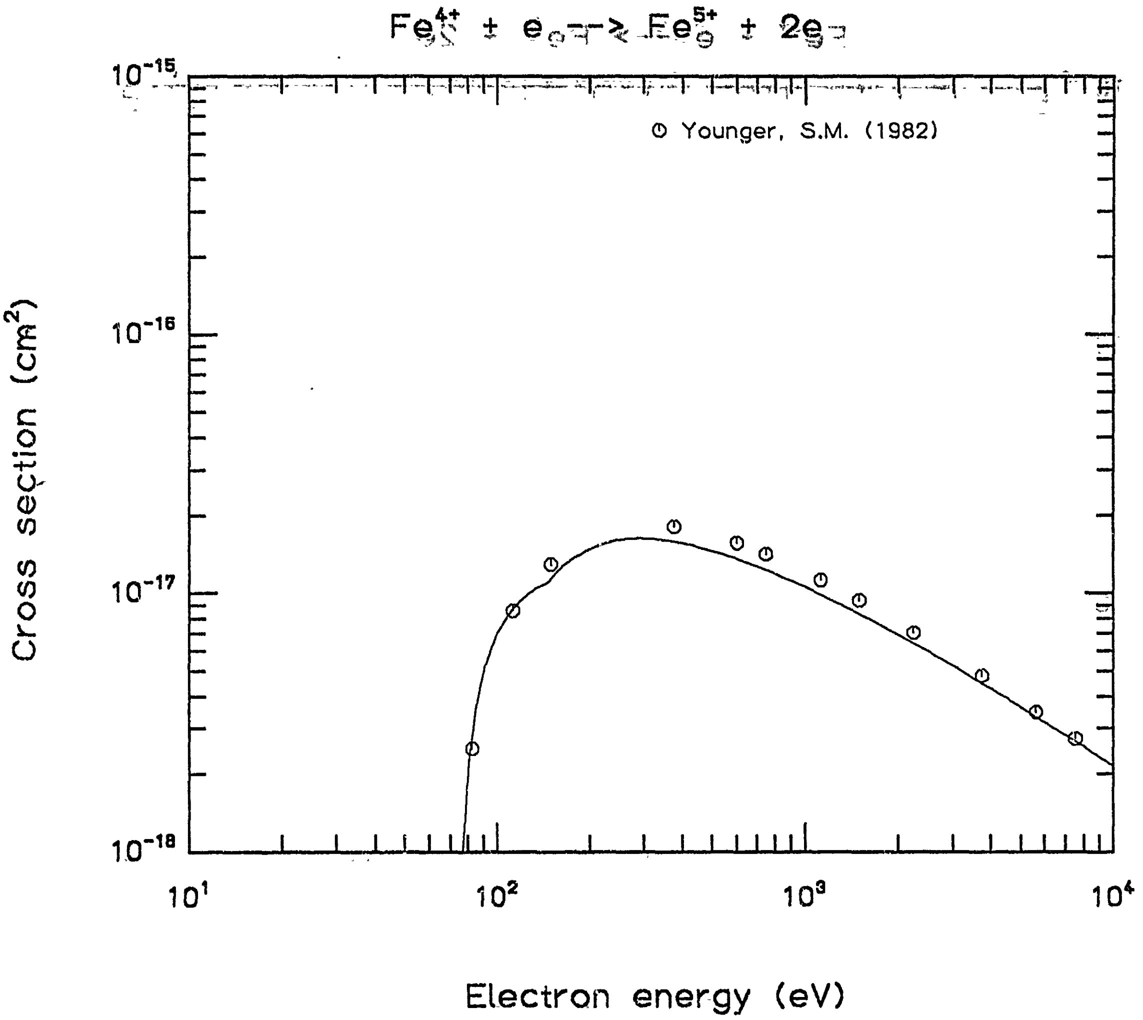


Fe^{3+} + e --> Fe^{4+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^1
10^2
10^3
10^4
Electron energy (eV)

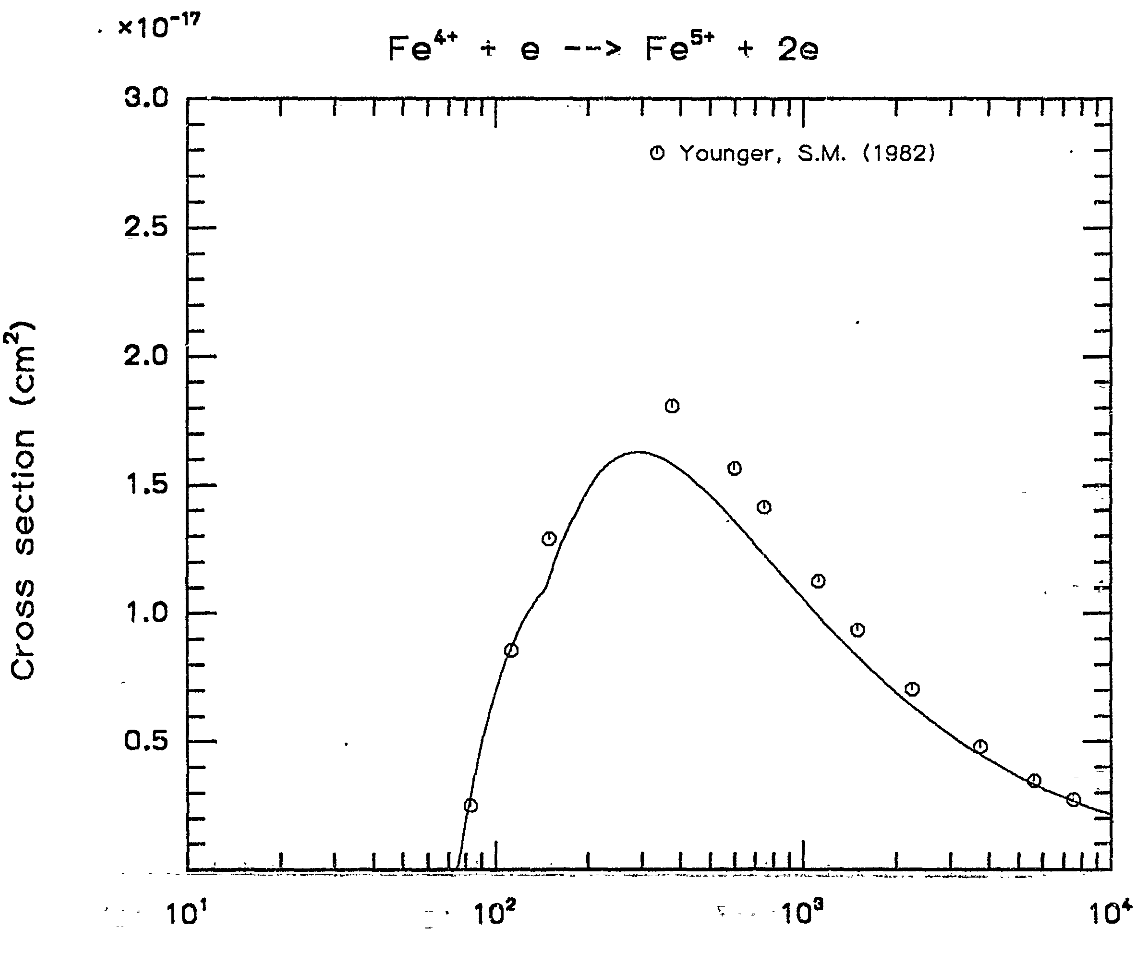


×10^{-17}
Fe^{3+} + e --> Fe^{4+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 153

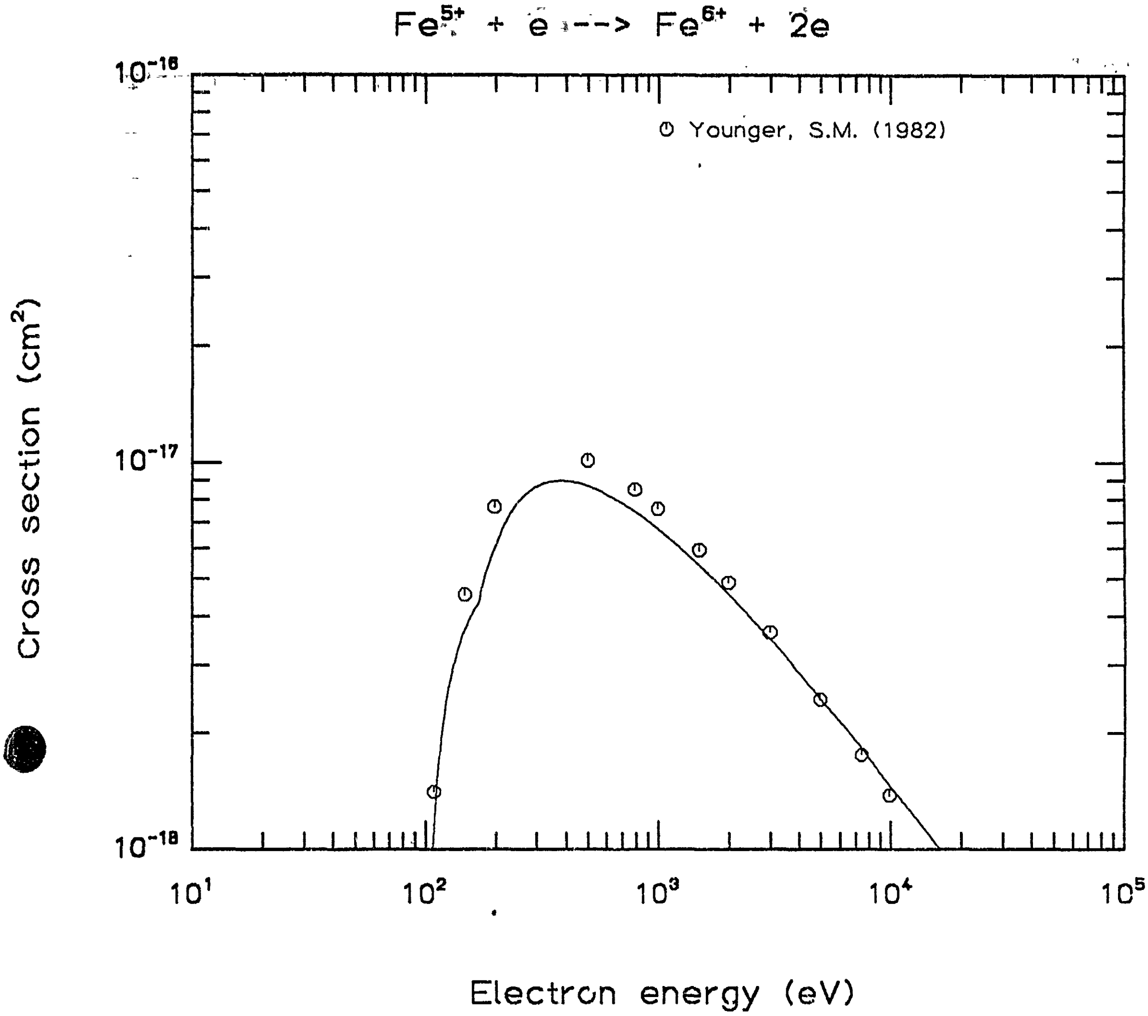


Fe4+ + e --> Fe5+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
10-15
10-16
10-17
10-18
101
102
103
104
Electron energy (eV)



×10-17
Fe4+ + e --> Fe5+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
3.0
2.5
2.0
1.5
1.0
0.5
101
102
103
104
Electron energy (eV)

Fig. 154



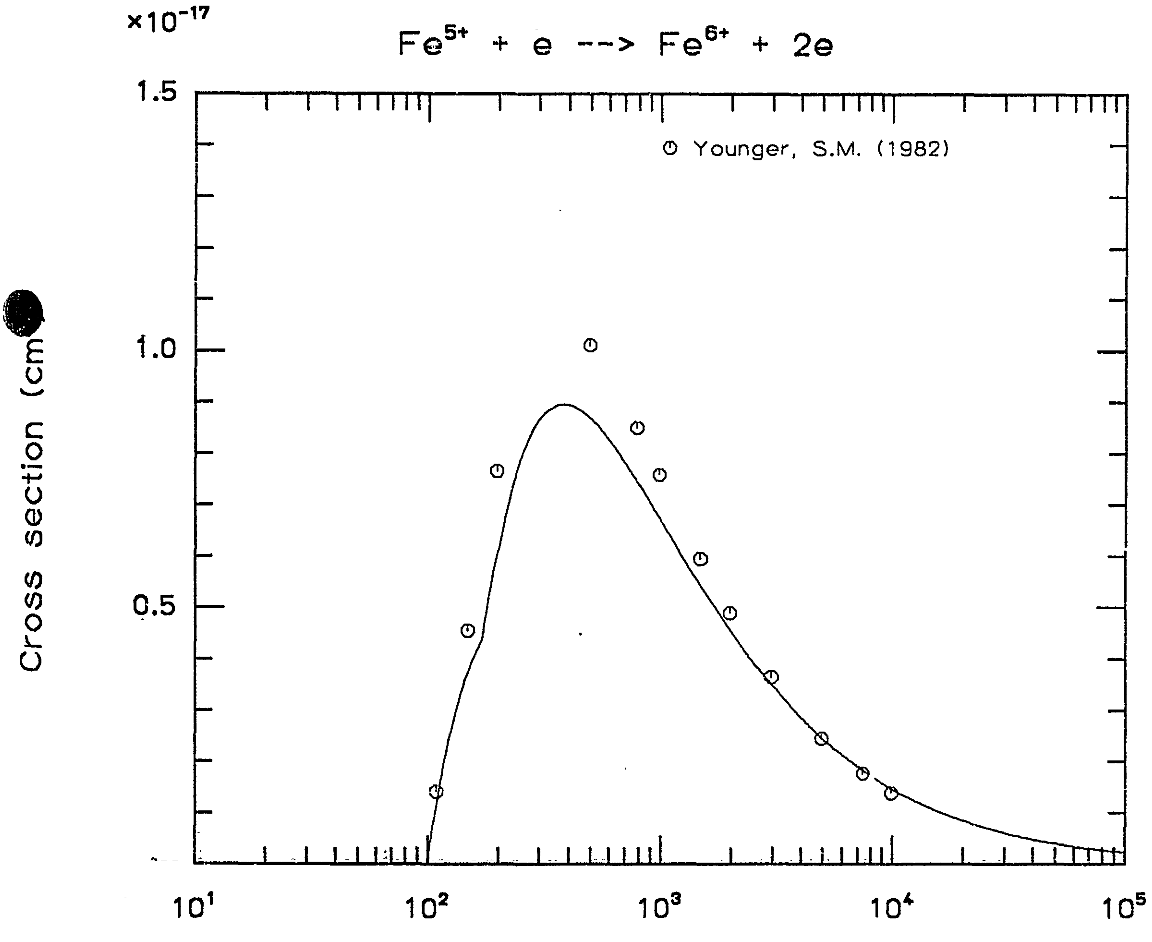
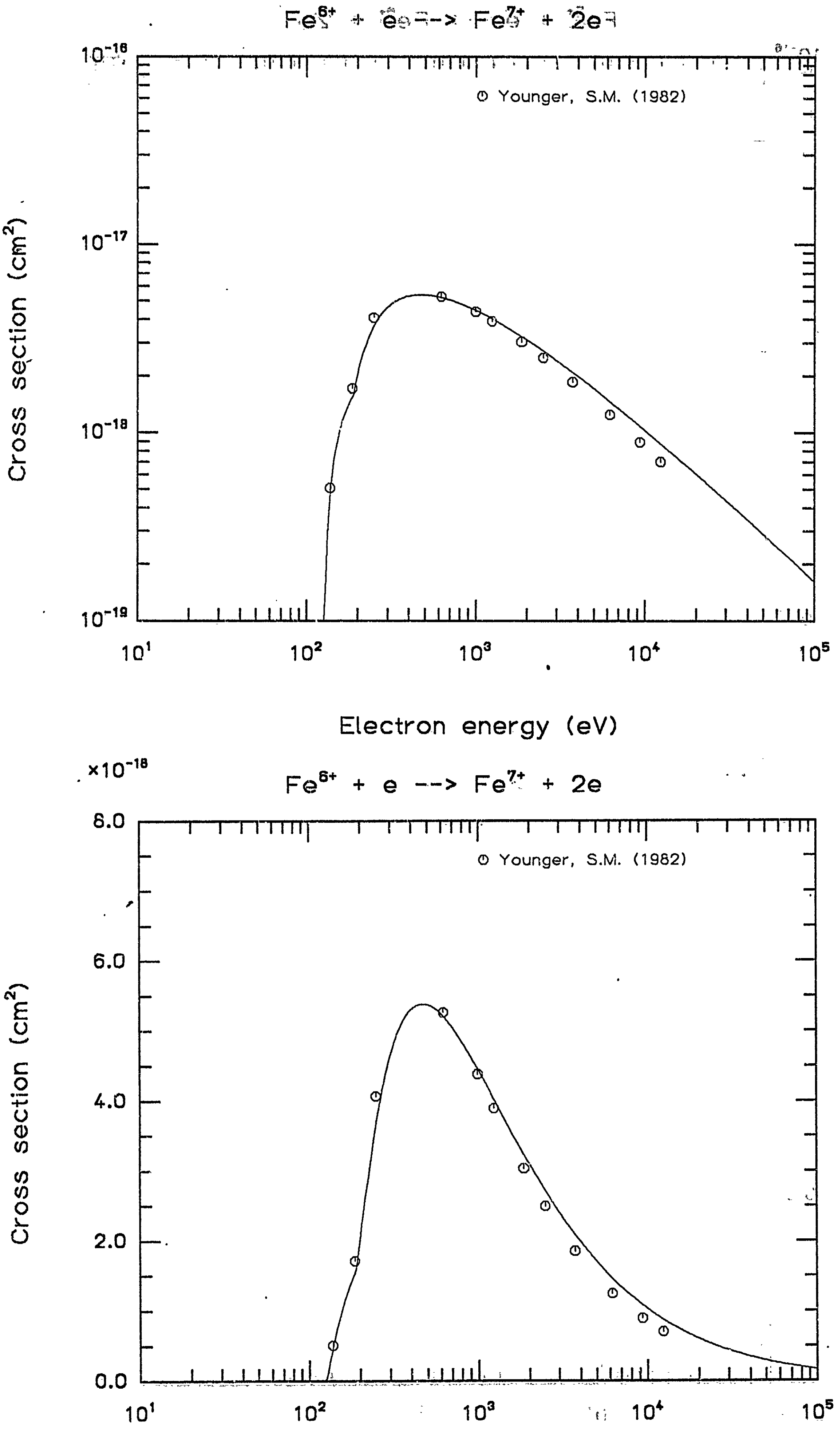
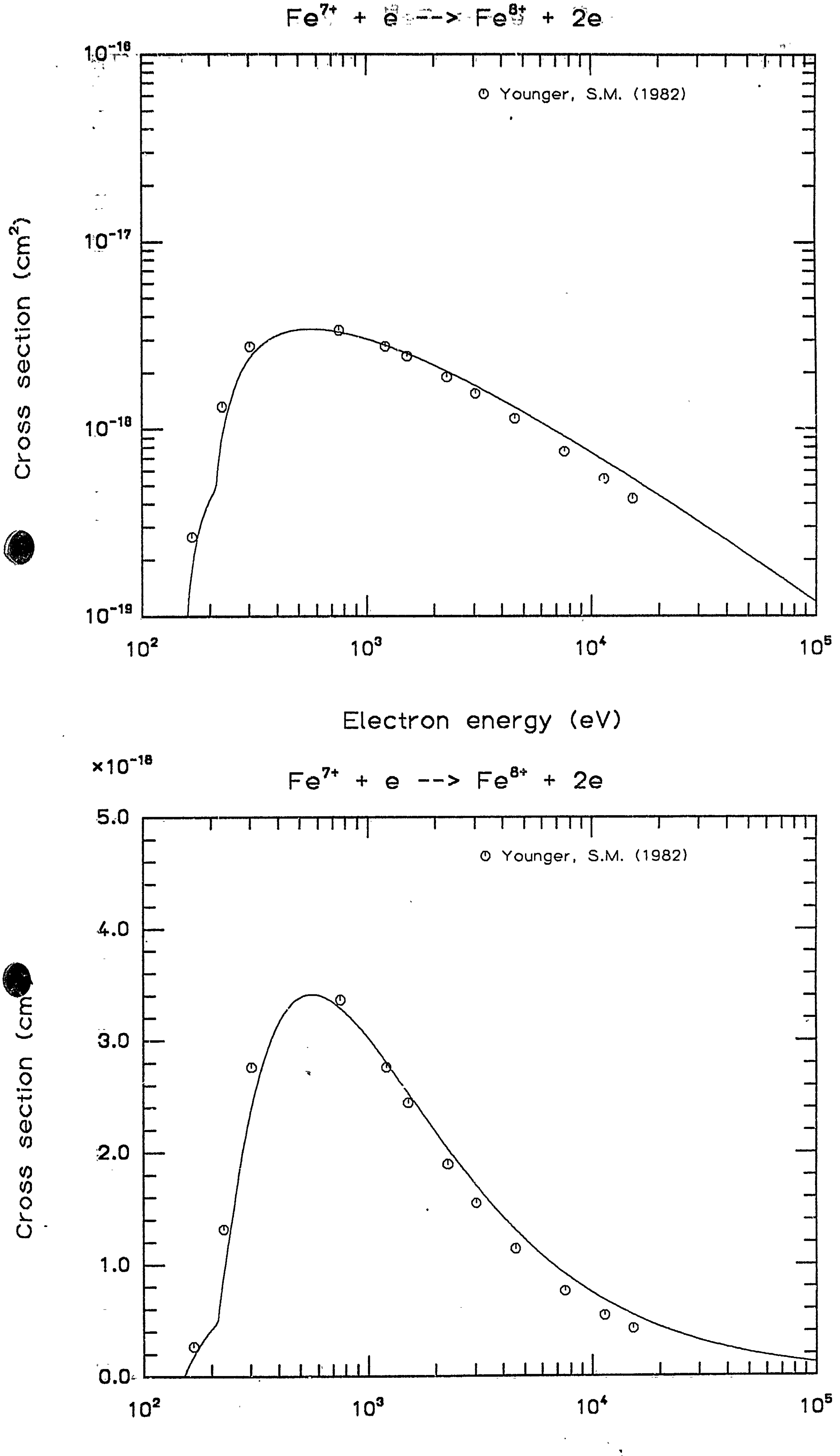


Fig. 155 Electron energy (eV)



Fe6+ + e --> Fe7+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
10-16
10-17
10-18
10-19
101
102
103
104
105
Electron energy (eV)
x10-18
Fe6+ + e --> Fe7+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
101
102
103
104
105
Electron energy (eV)

Fig. 156



Fe^{7+} + e --> Fe^{8+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^2
10^3
10^4
10^5
Electron energy (eV)
×10^{-18}
Fe^{7+} + e --> Fe^{8+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
5.0
4.0
3.0
2.0
1.0
0.0
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 157

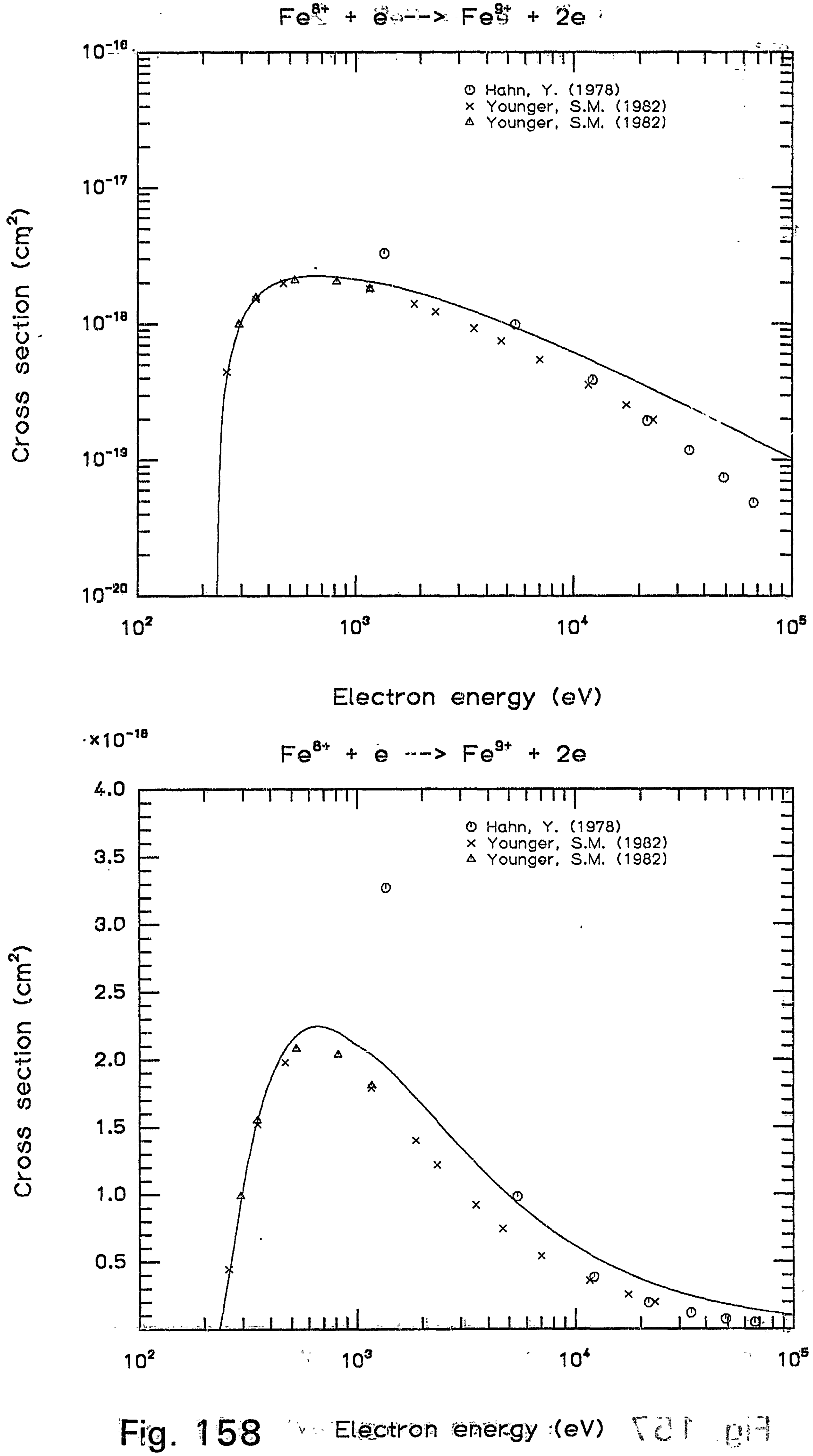

Fe^{8+} + e ---> Fe^{9+} + 2e
Hahn, Y. (1978)
Younger, S.M. (1982)
Younger, S.M. (1982)
Cross section (cm^2)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^2
10^3
10^4
10^5
Electron energy (eV)
$\times 10^{-18}$
Fe^{8+} + e ---> Fe^{9+} + 2e
Hahn, Y. (1978)
Younger, S.M. (1982)
Younger, S.M. (1982)
Cross section (cm^2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 158

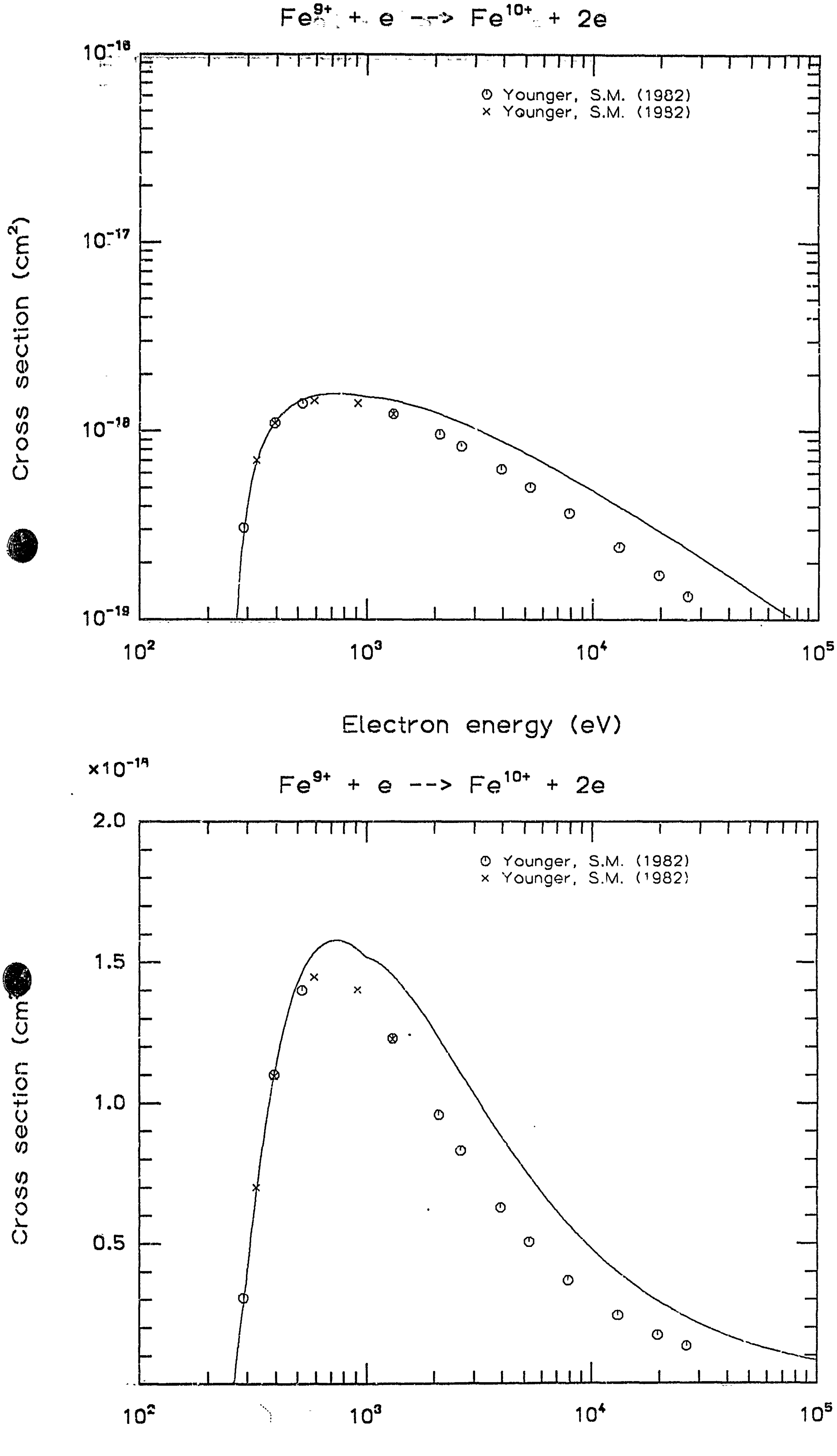
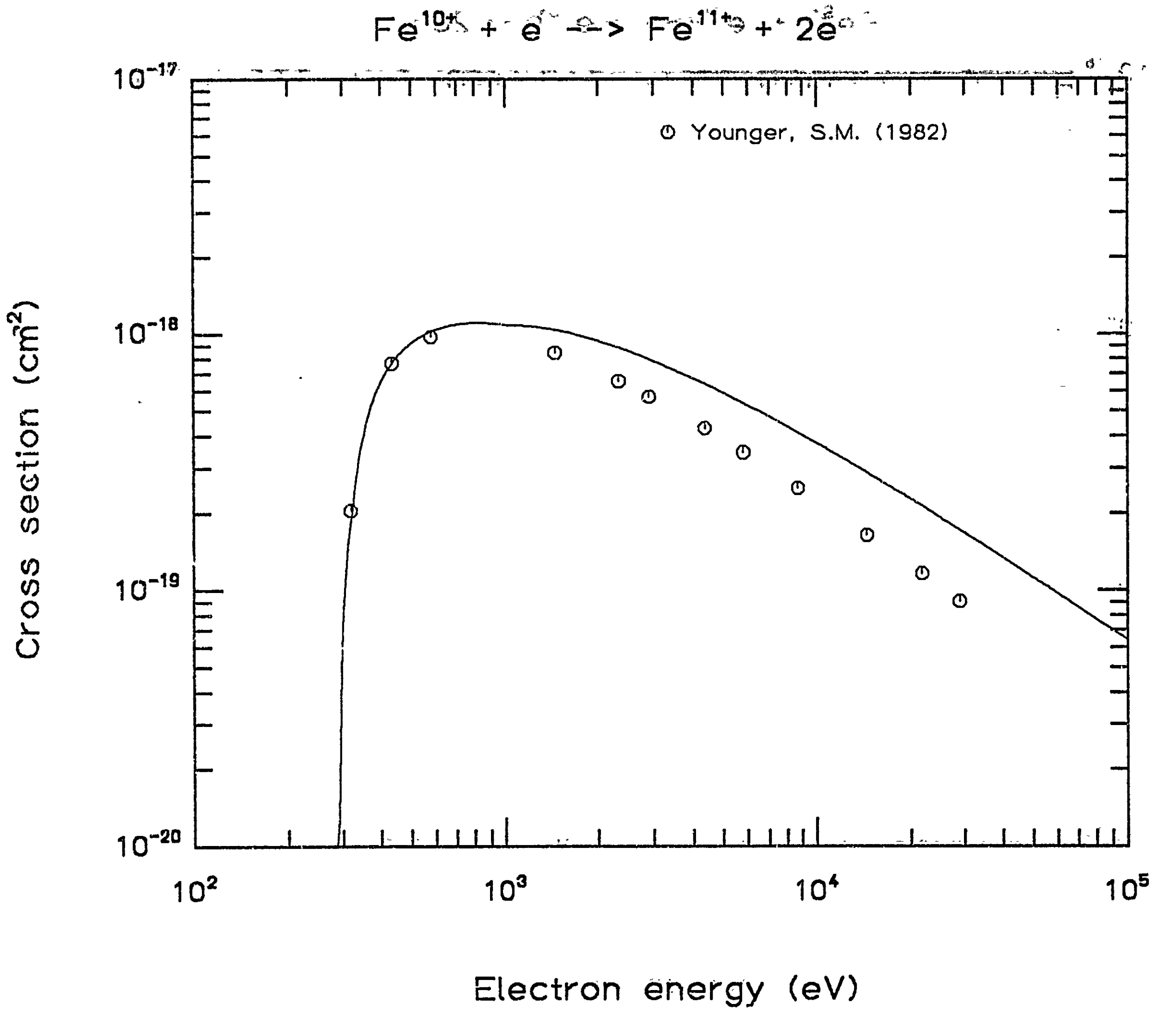
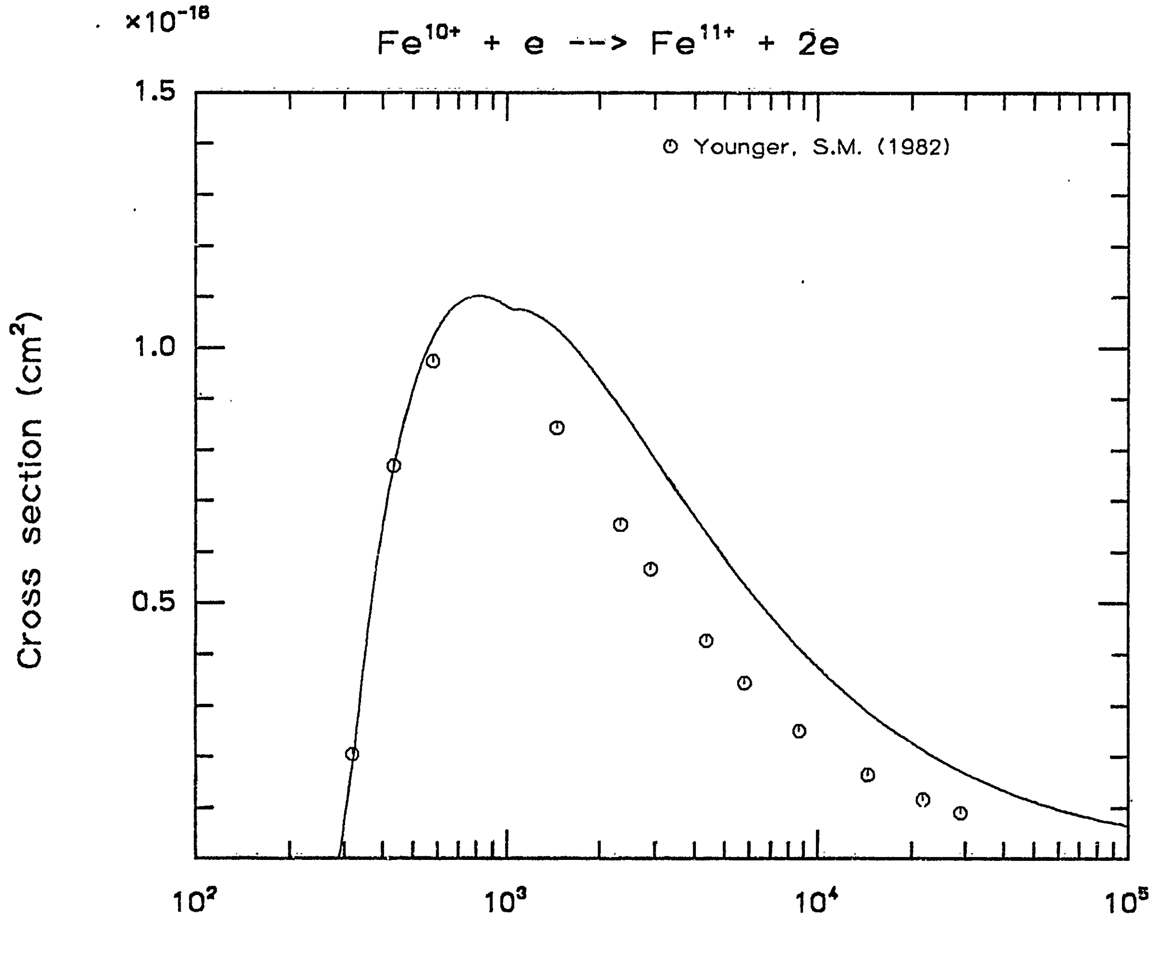


Fig. 159 Electron energy (eV)



Fe^{10+} + e --> Fe^{11+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^2
10^3
10^4
10^5
Electron energy (eV)



×10^{-18}
Fe^{10+} + e --> Fe^{11+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 160

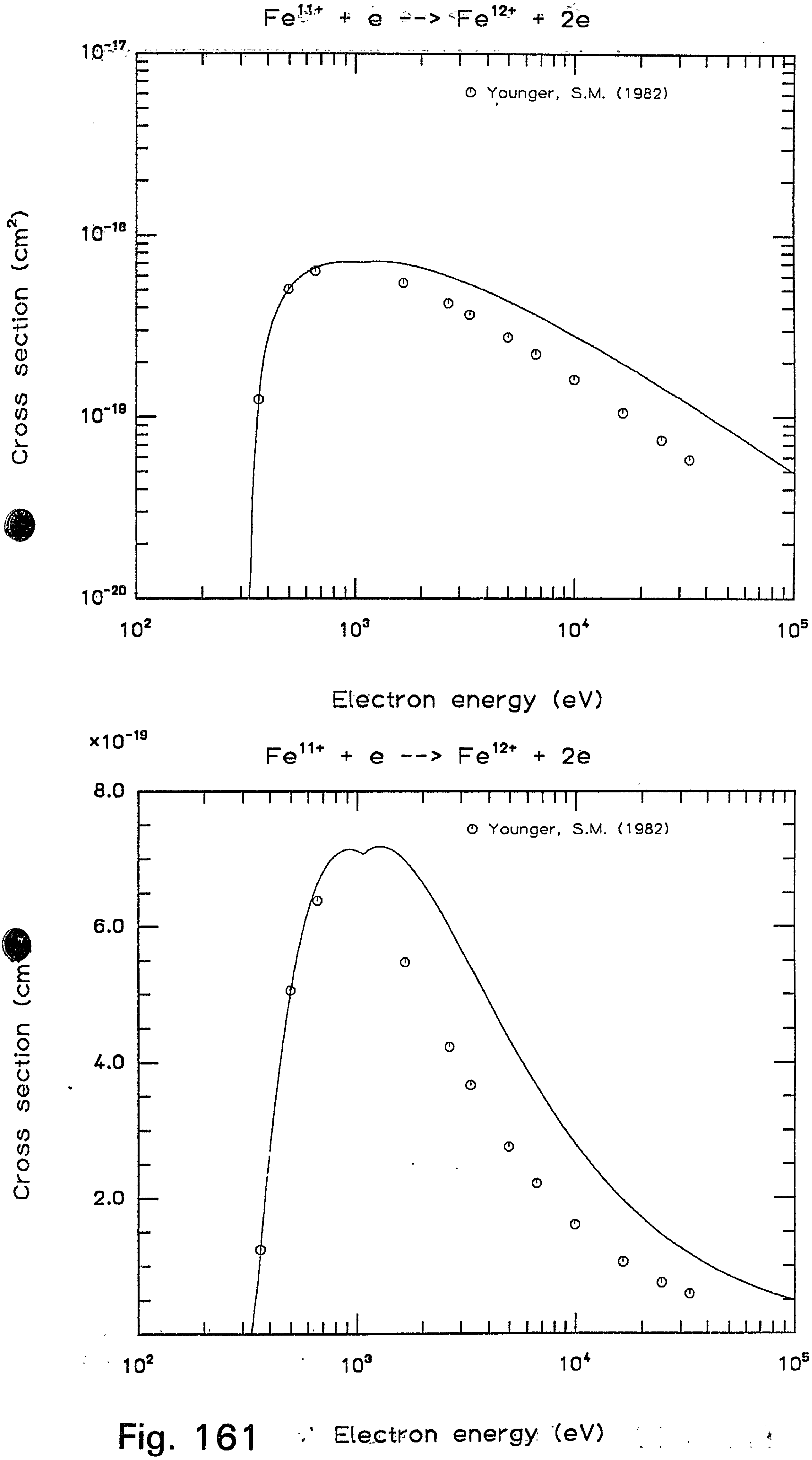

Fe11+ + e --> Fe12+ + 2e
Younger, S.M. (1982)
Cross section (cm²)
10⁻¹⁷
10⁻¹⁸
10⁻¹⁹
10⁻²⁰
10²
10³
10⁴
10⁵
Electron energy (eV)
×10⁻¹⁹
Fe11+ + e --> Fe12+ + 2e
Younger, S.M. (1982)
8.0
6.0
4.0
2.0
Cross section (cm
10²
10³
10⁴
10⁵
Electron energy (eV)

Fig. 161

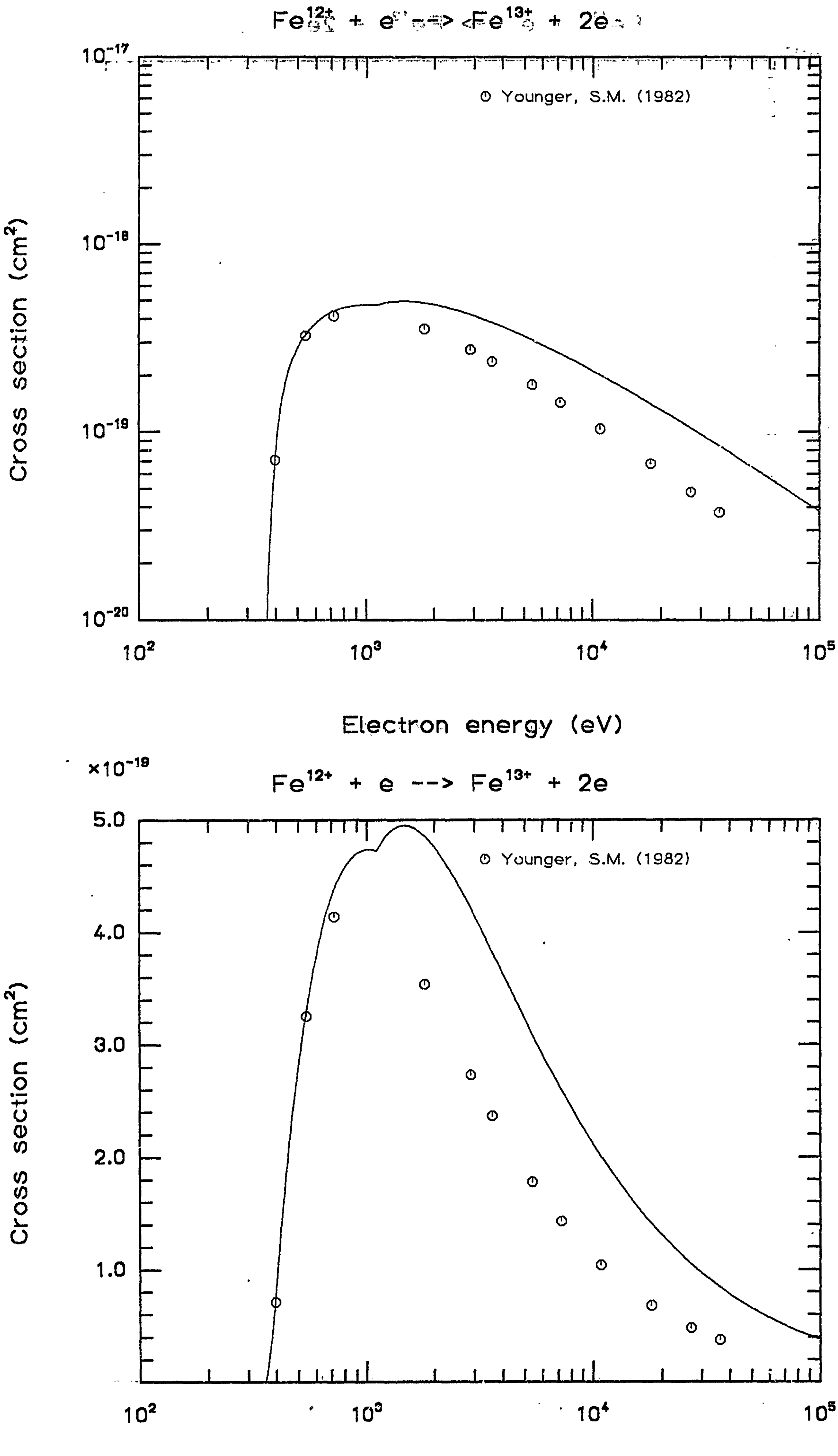

$Fe^{12+} + e --> Fe^{13+} + 2e$
Younger, S.M. (1982)
Cross section (cm²)
Electron energy (eV)
$\times 10^{-19}$
$Fe^{12+} + e --> Fe^{13+} + 2e$
Younger, S.M. (1982)
Cross section (cm²)
Electron energy (eV)

Fig. 162

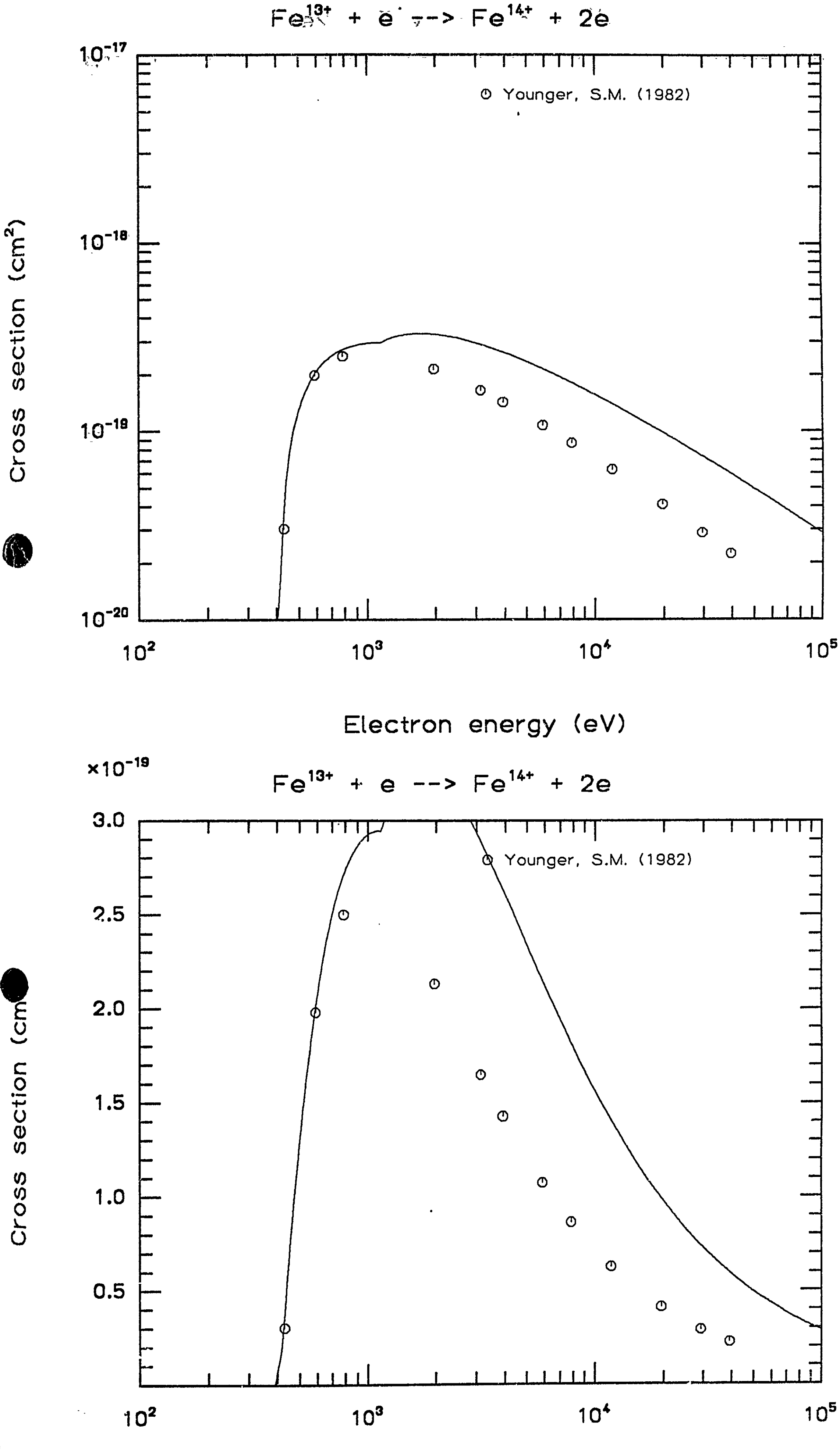
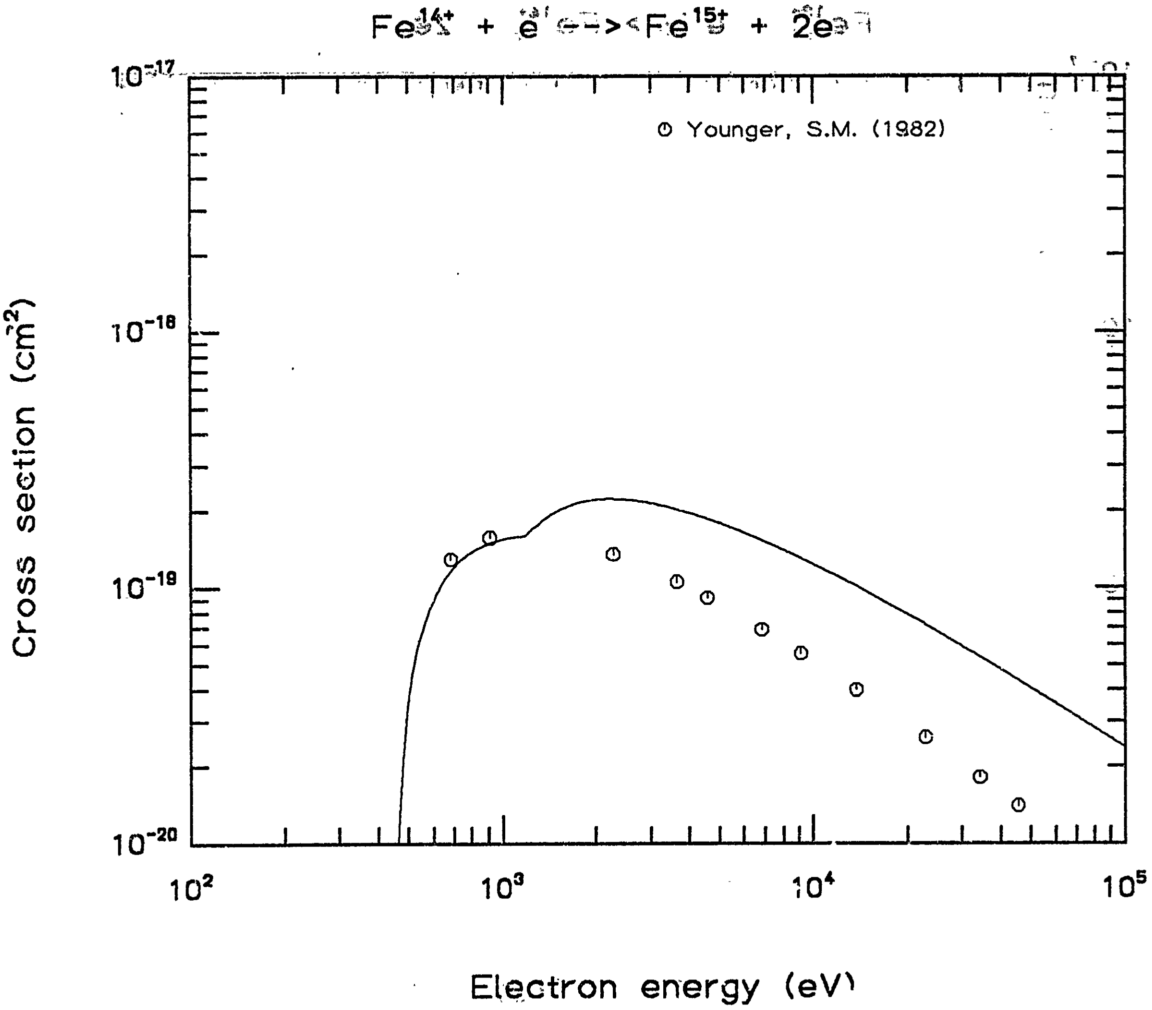


Fig. 163 Electron energy (eV)


Fe14+ + e --> Fe15+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
10-17
10-18
10-19
10-20
10²
10³
10⁴
10⁵
Electron energy (eV)

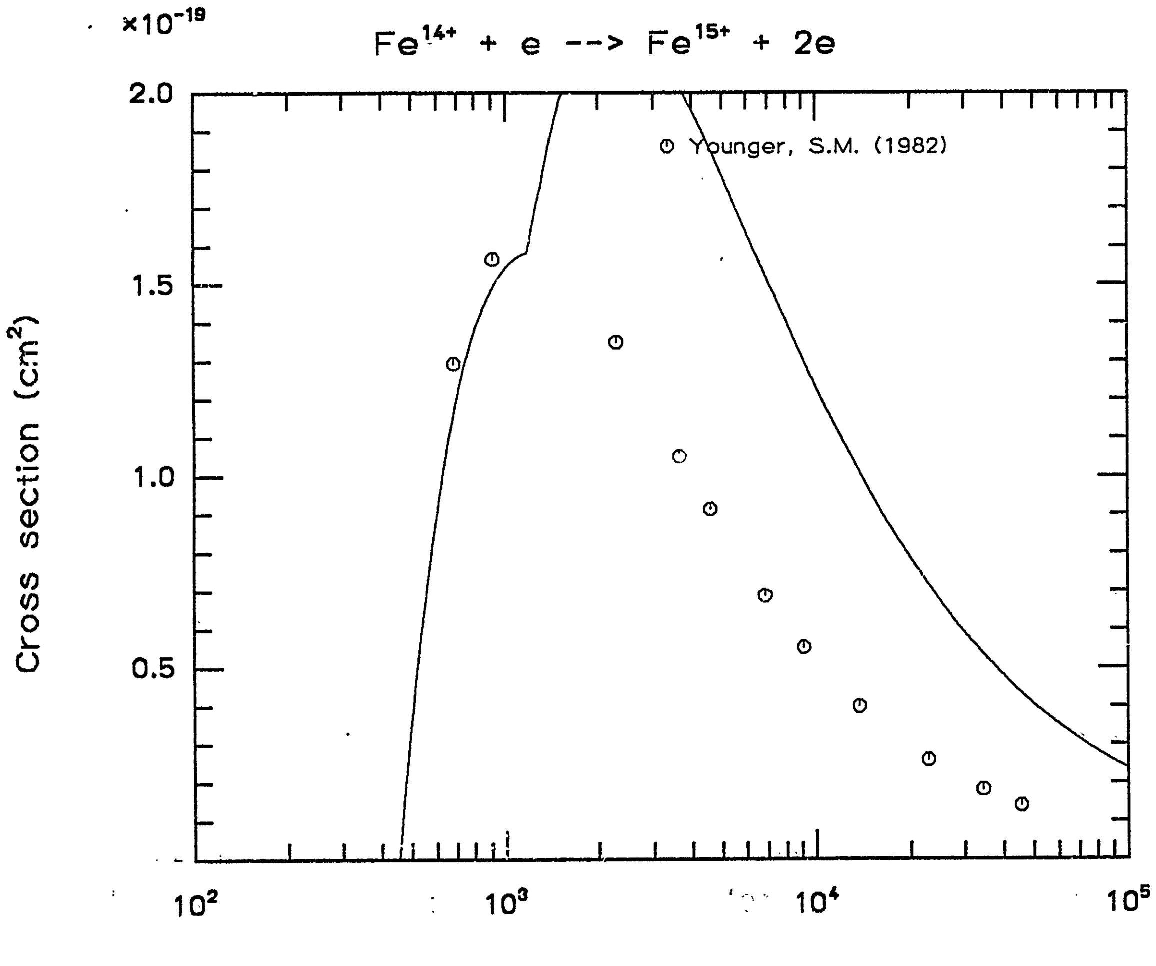
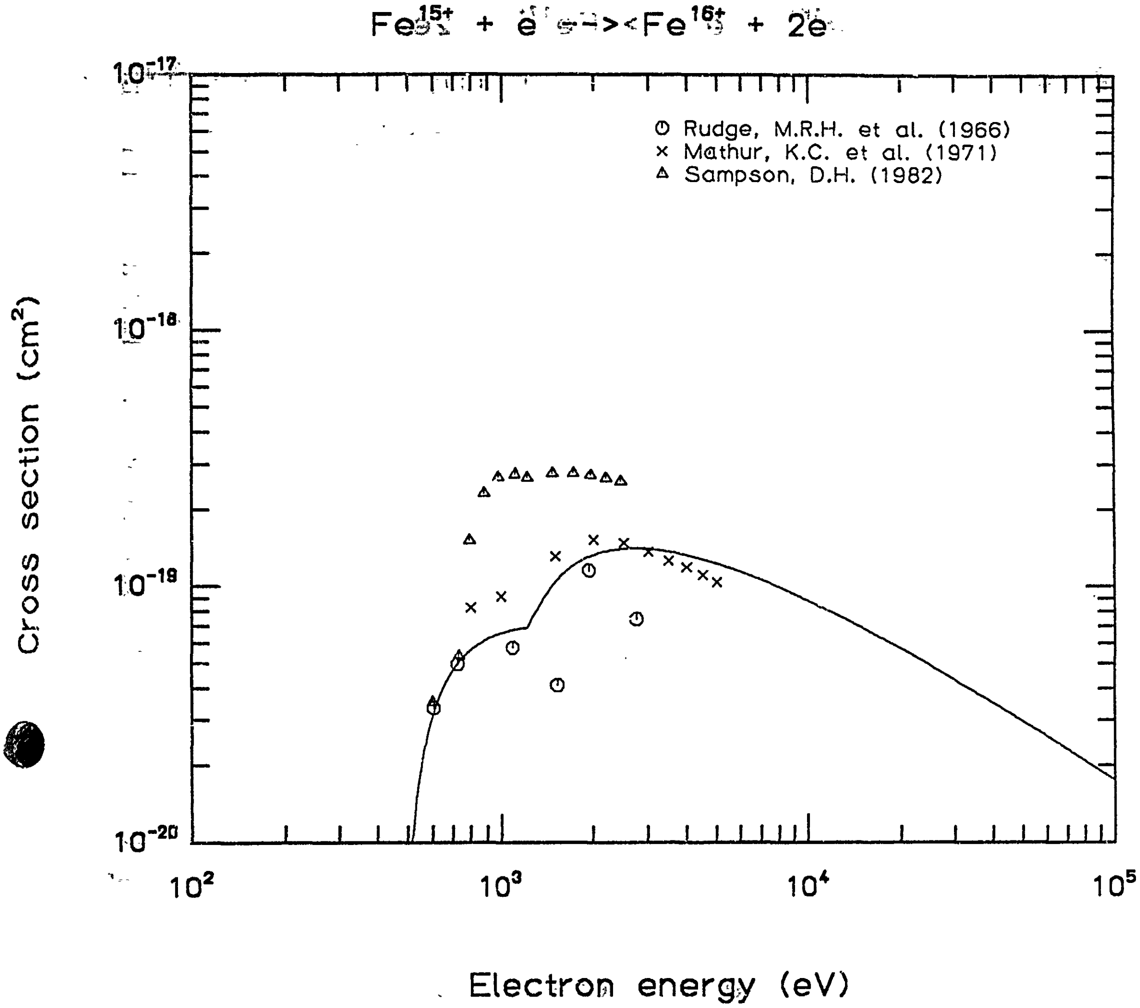
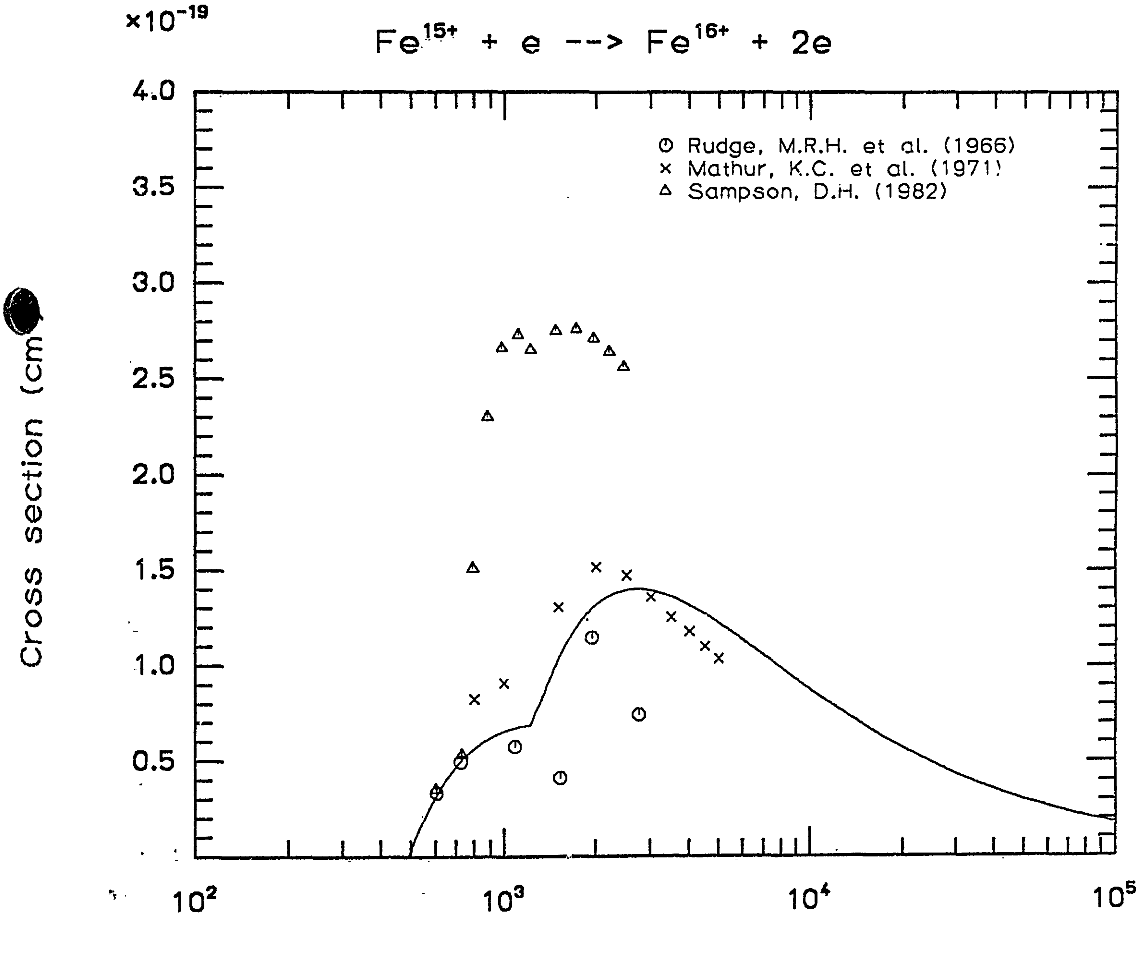

×10-19
Fe14+ + e --> Fe15+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
2.0
1.5
1.0
0.5
10²
10³
10⁴
10⁵
Electron energy (eV)

Fig. 164

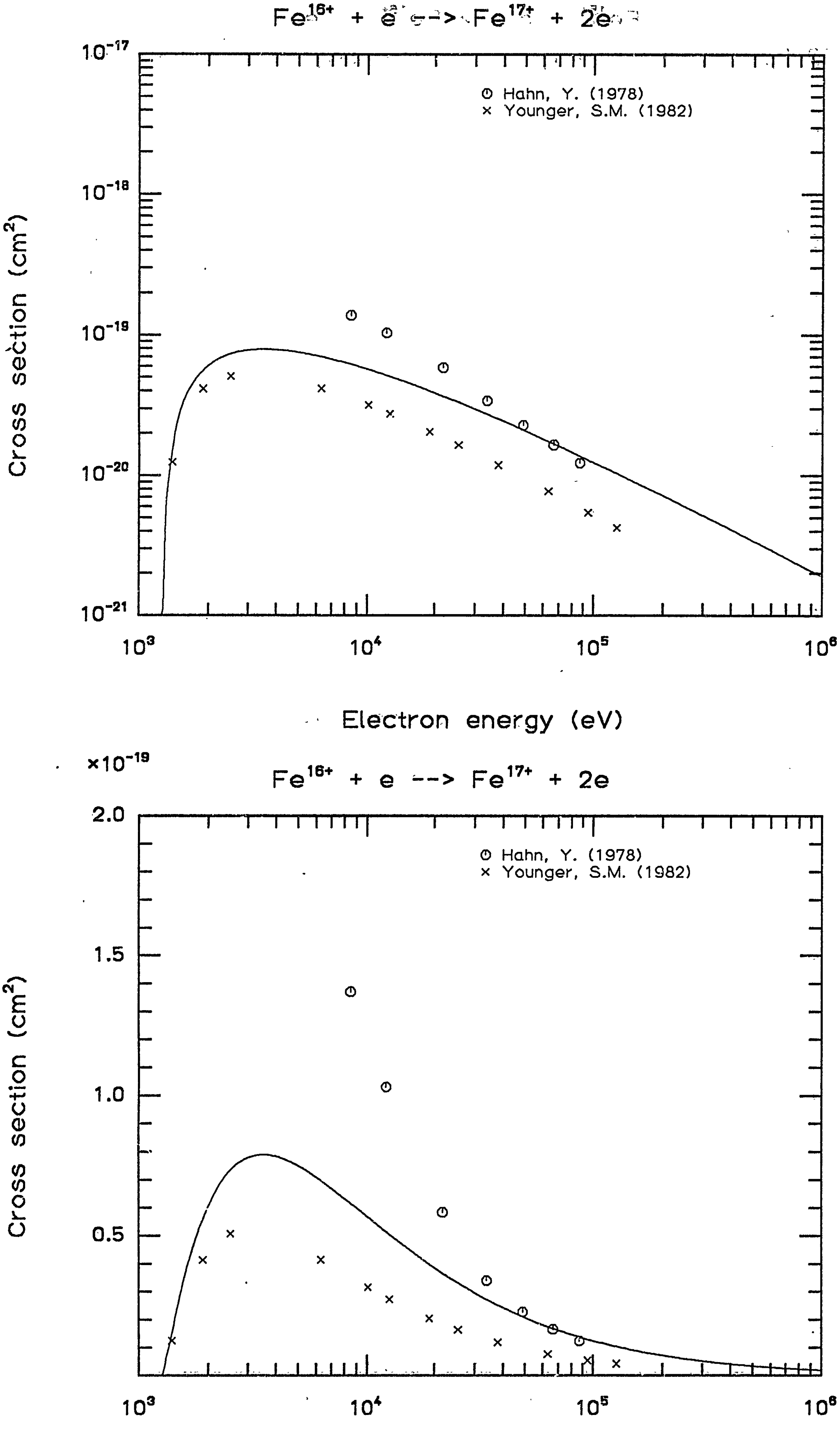


Fe^{15+} + e --> Fe^{16+} + 2e
Rudge, M.R.H. et al. (1966)
Mathur, K.C. et al. (1971)
Sampson, D.H. (1982)
Cross section (cm^2)
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^2
10^3
10^4
10^5
Electron energy (eV)



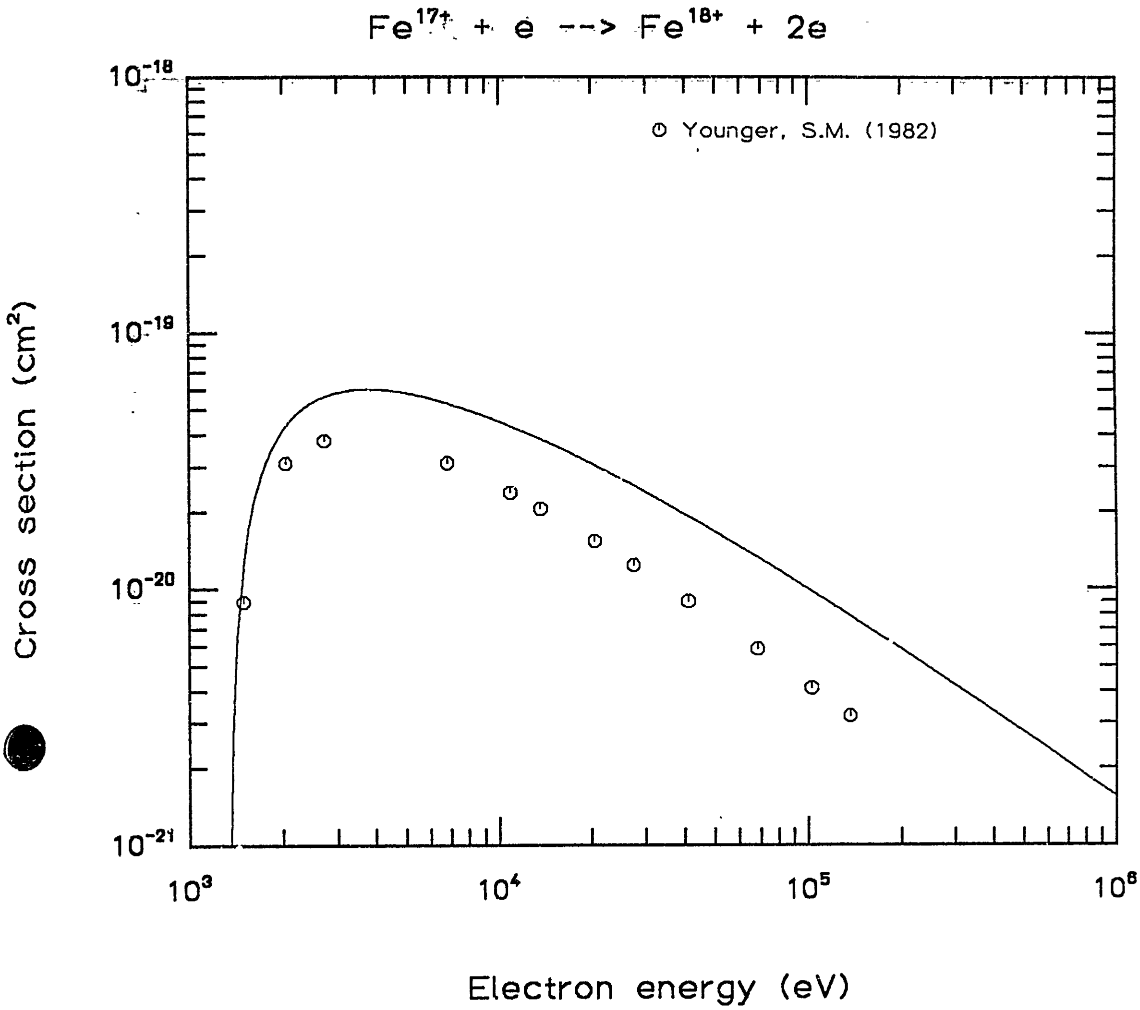
×10^{-19}
Fe^{15+} + e --> Fe^{16+} + 2e
Rudge, M.R.H. et al. (1966)
Mathur, K.C. et al. (1971)
Sampson, D.H. (1982)
Cross section (cm^2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 165

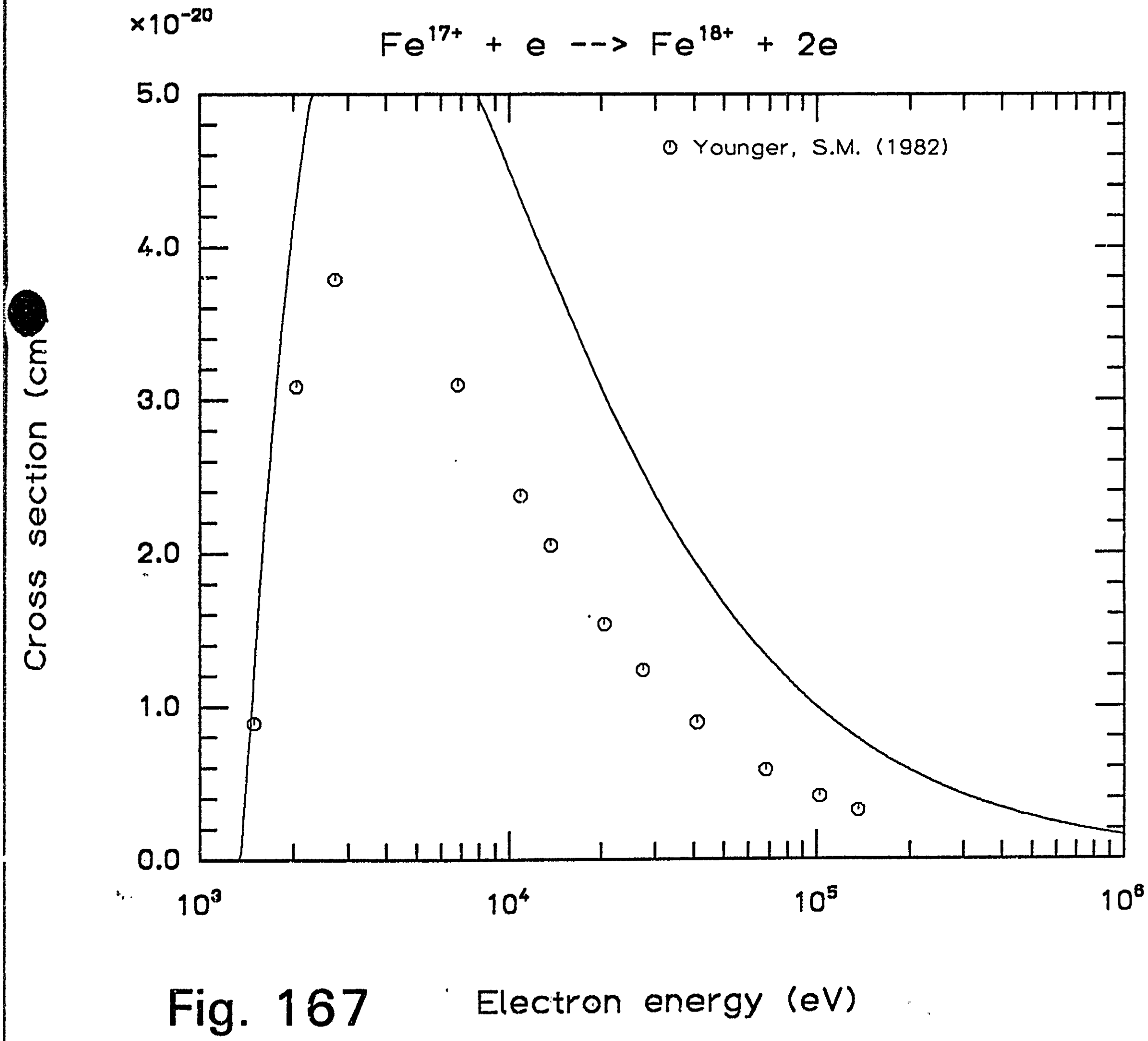


Fe16+ + e --> Fe17+ + 2e
Hahn, Y. (1978)
Younger, S.M. (1982)
Cross section (cm2)
Electron energy (eV)
×10-19
Fe16+ + e --> Fe17+ + 2e
Hahn, Y. (1978)
Younger, S.M. (1982)
Cross section (cm2)
Electron energy (eV)

Fig. 166

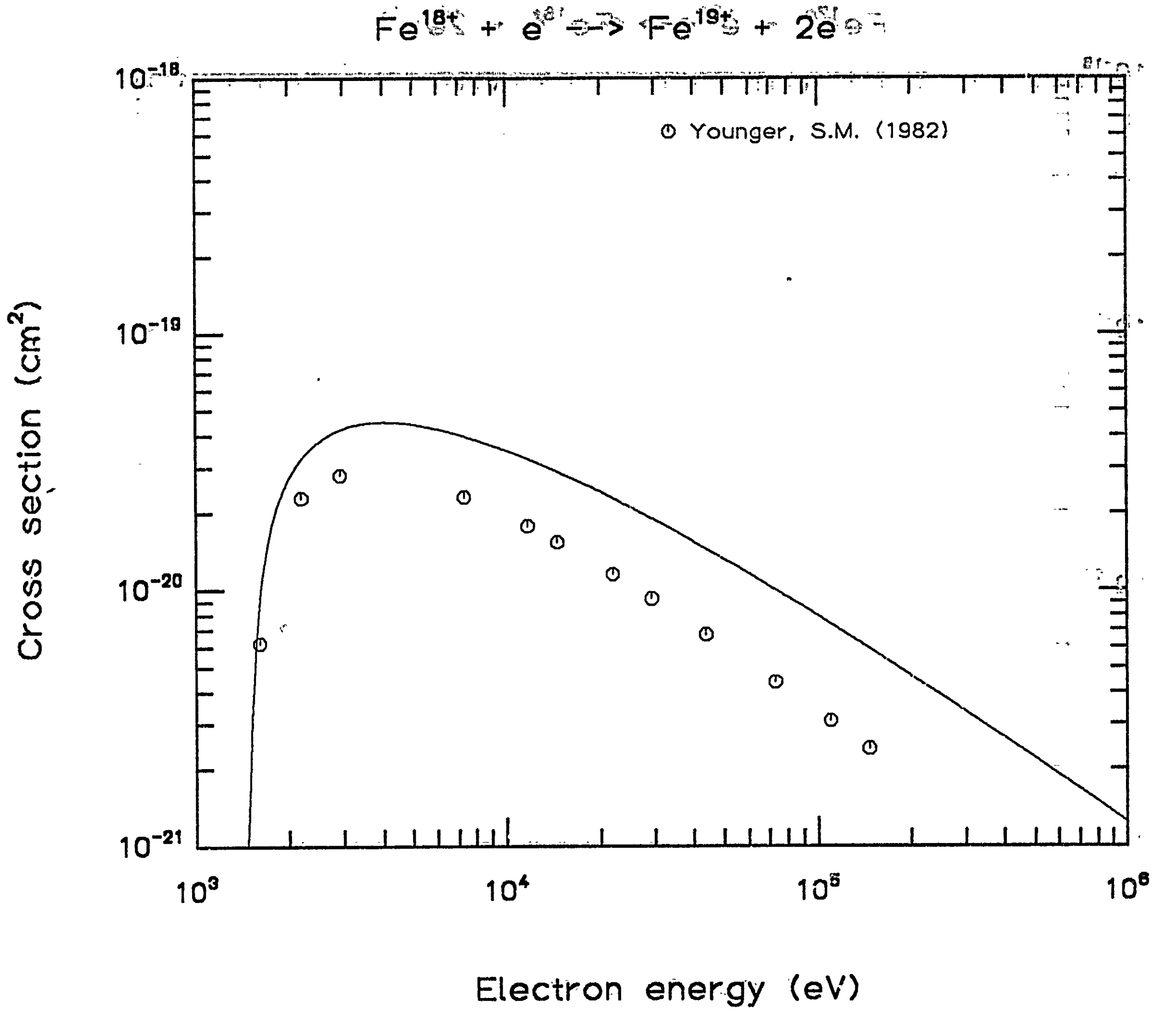


Fe^{17+} + e --> Fe^{18+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^3
10^4
10^5
10^6
Electron energy (eV)



×10^{-20}
Fe^{17+} + e --> Fe^{18+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
5.0
4.0
3.0
2.0
1.0
0.0
10^3
10^4
10^5
10^6
Electron energy (eV)

Fig. 167



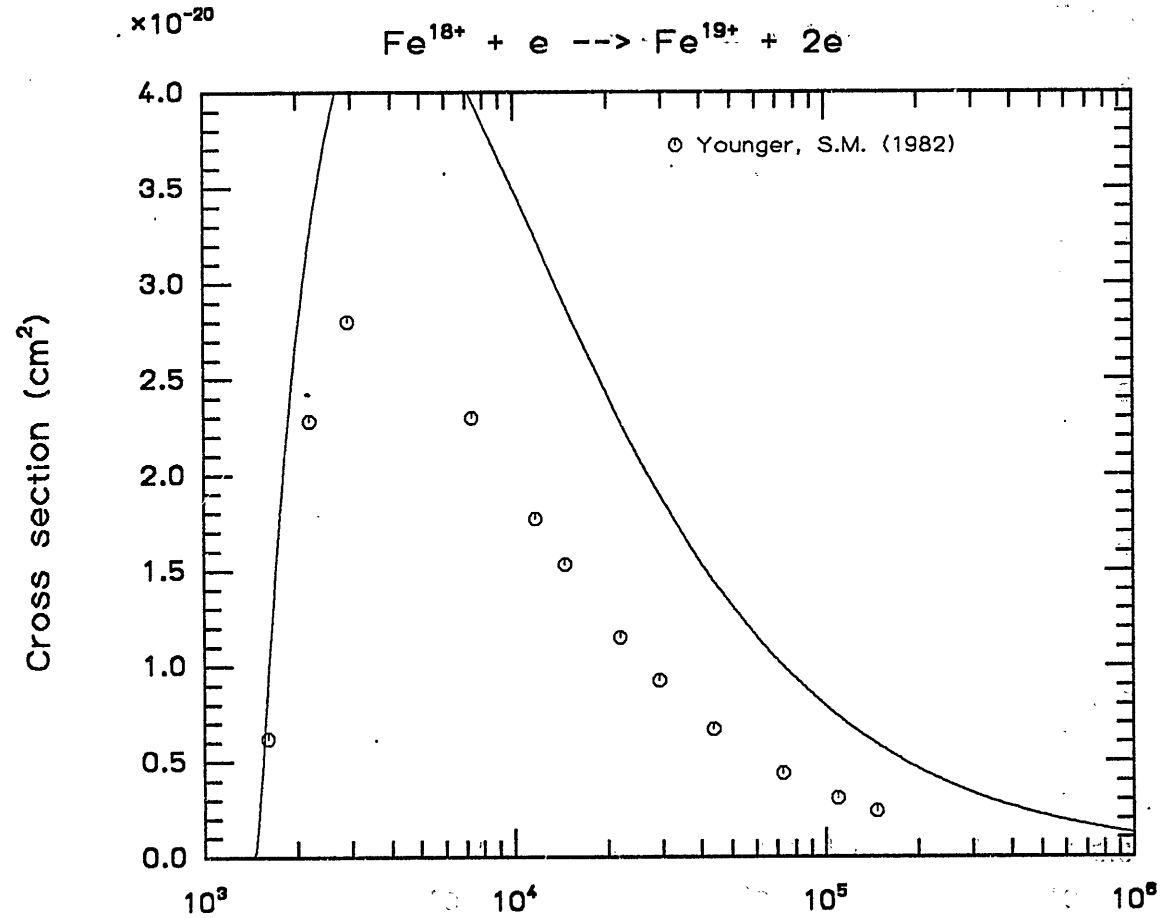
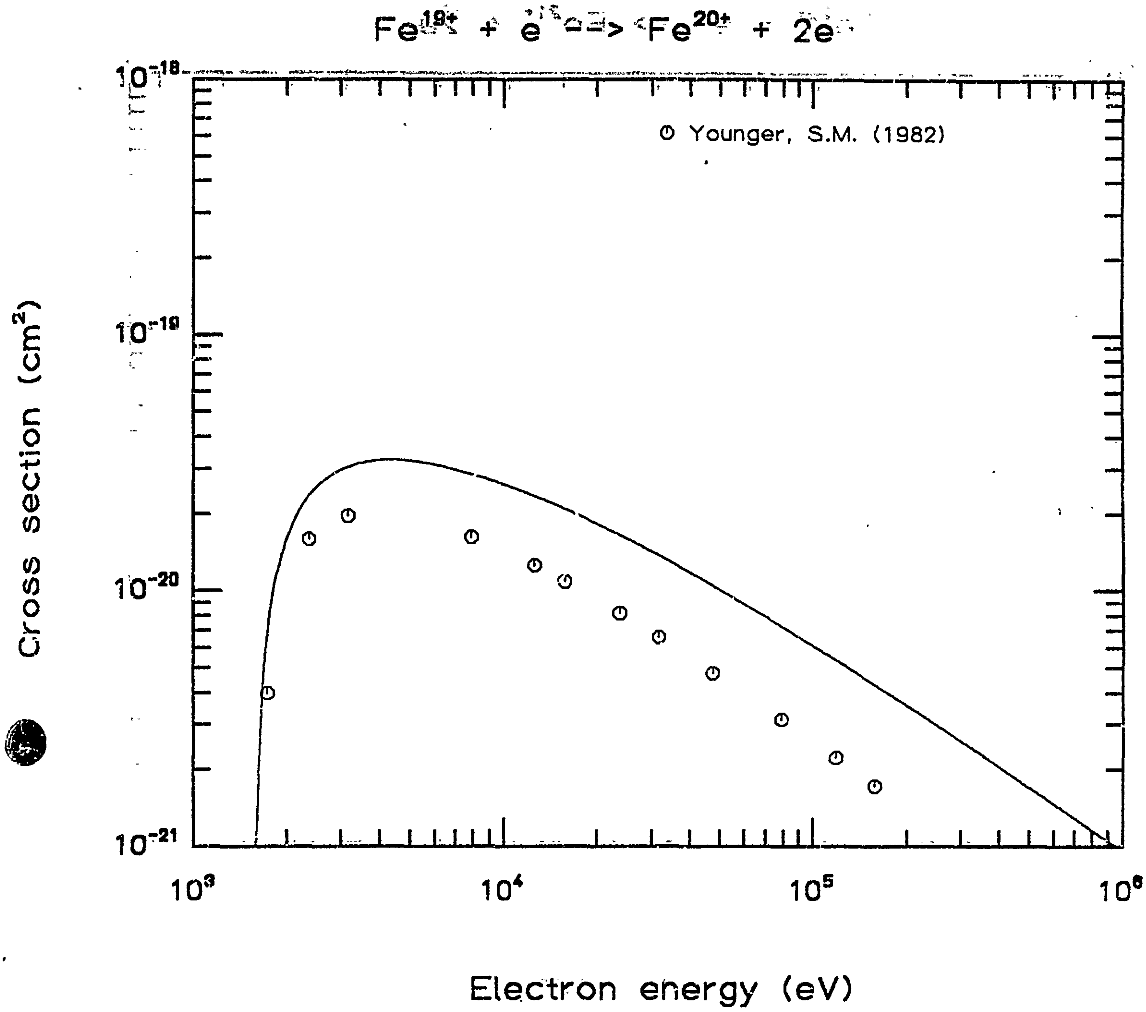


Fig. 168 Electron energy (eV)



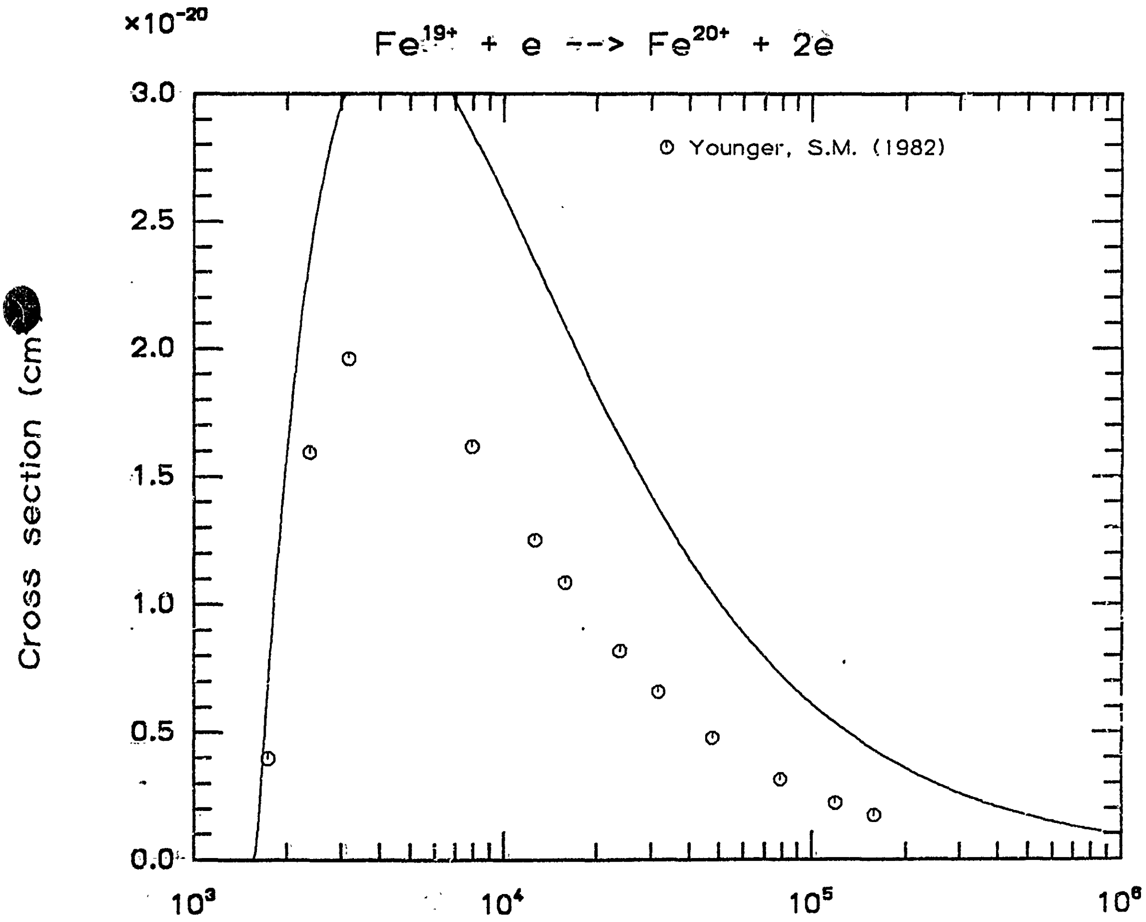
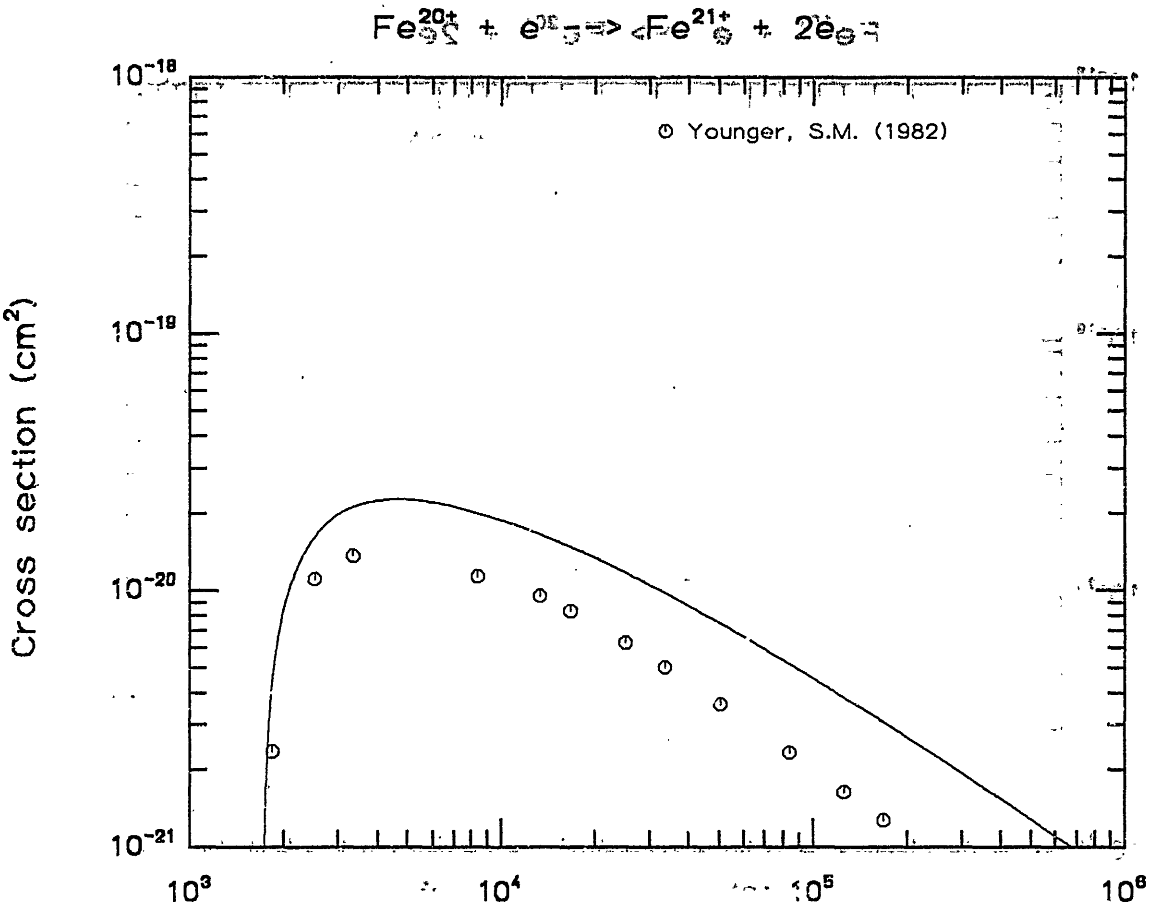


Fig. 169 Electron energy (eV)



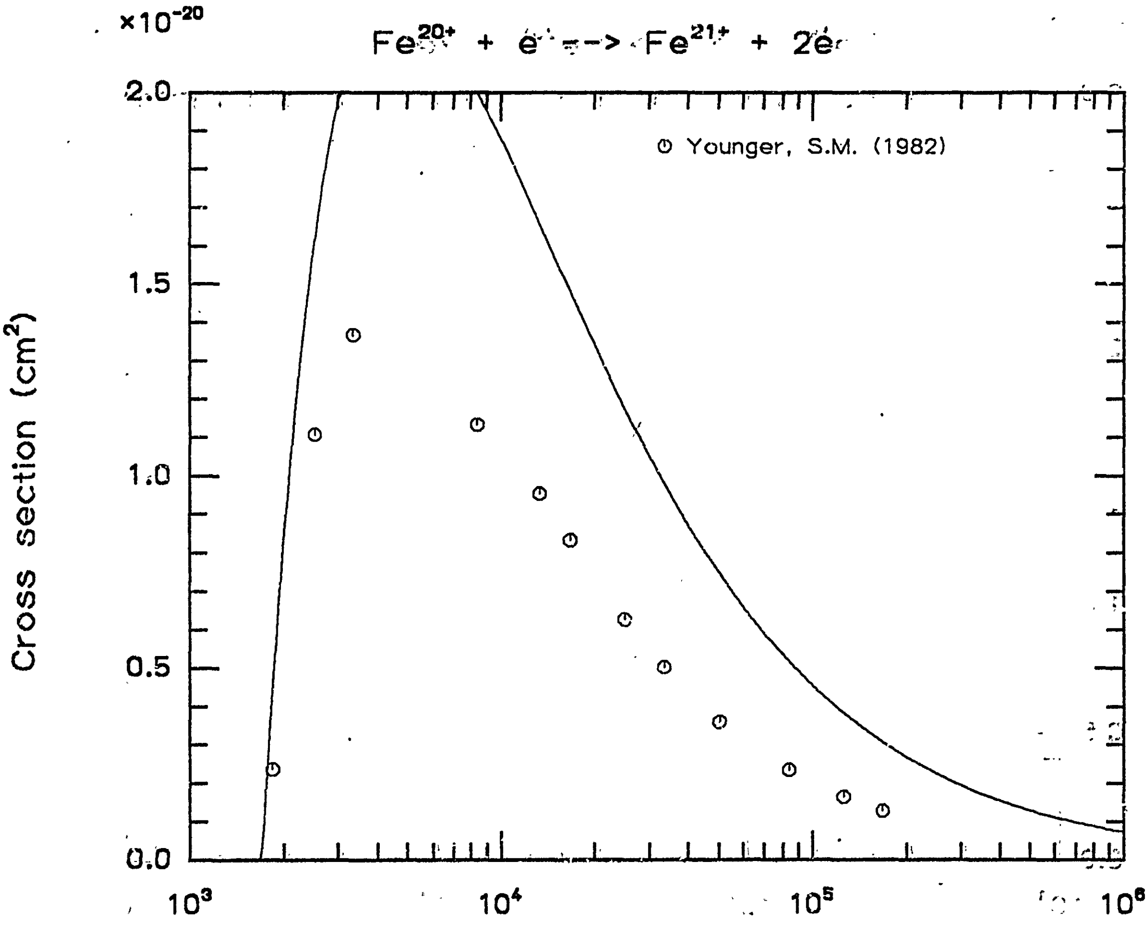
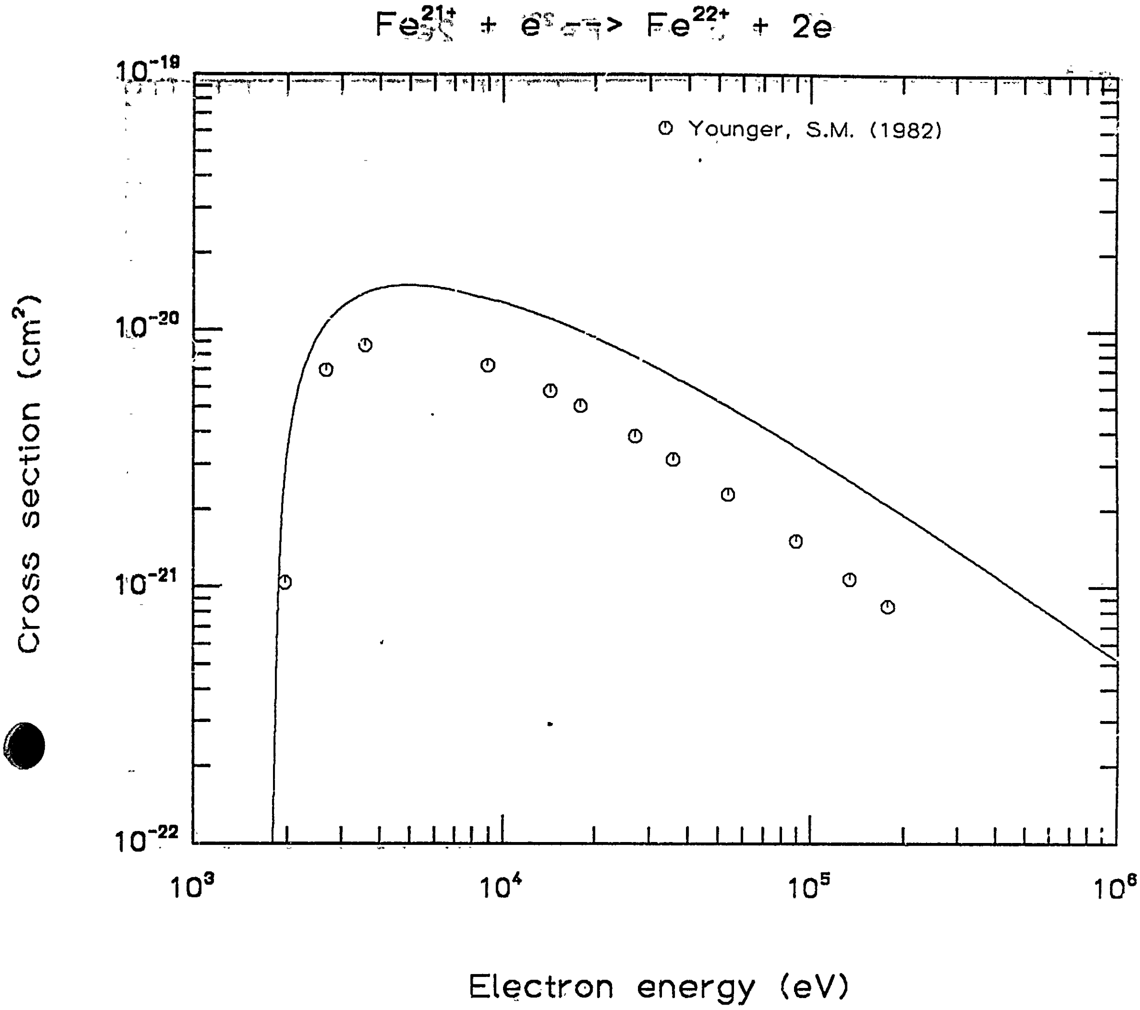


Fig. 170 Electron energy (eV)


Fe21+ + e --> Fe22+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
10-19
10-20
10-21
10-22
103
104
105
106
Electron energy (eV)

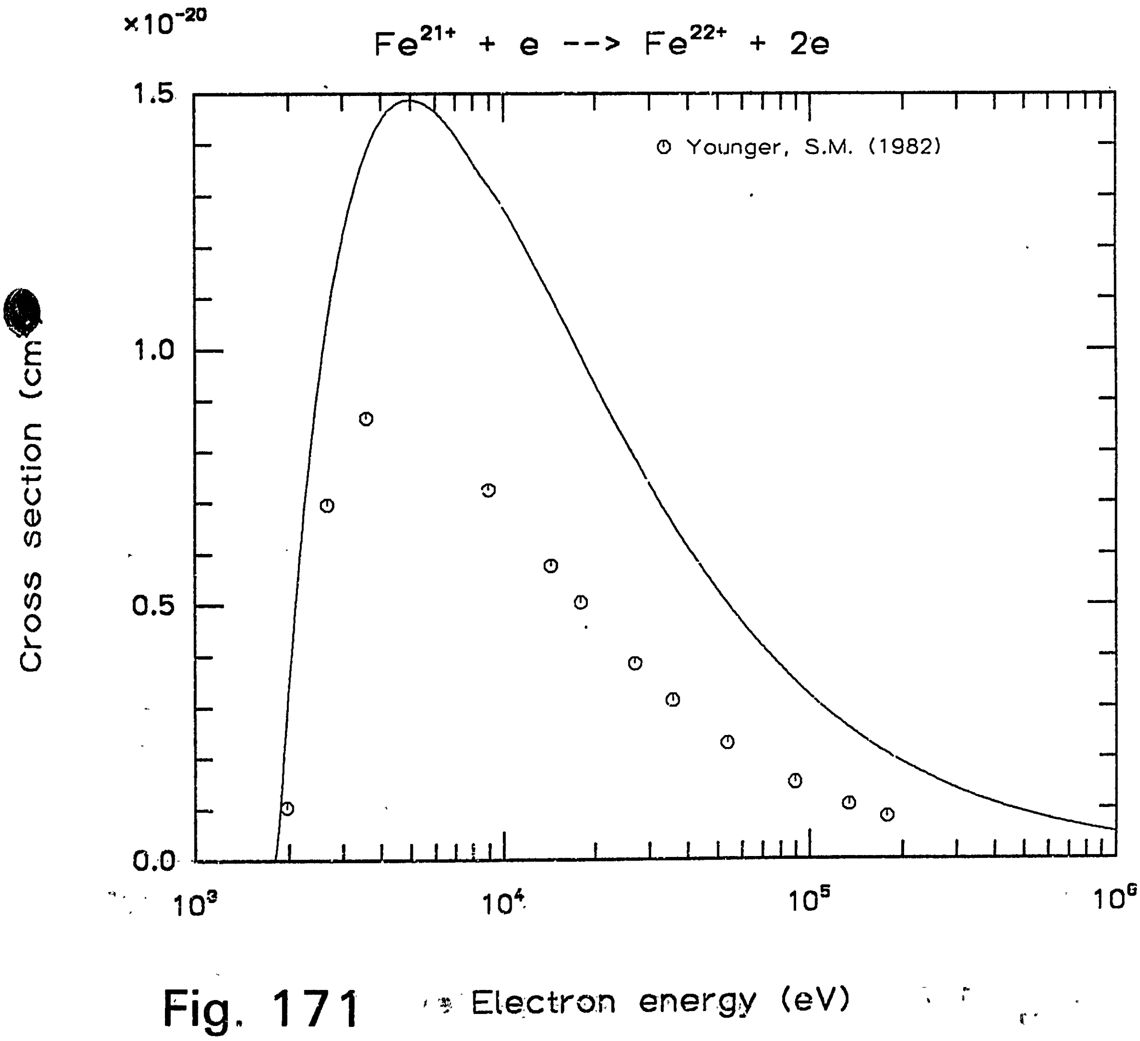
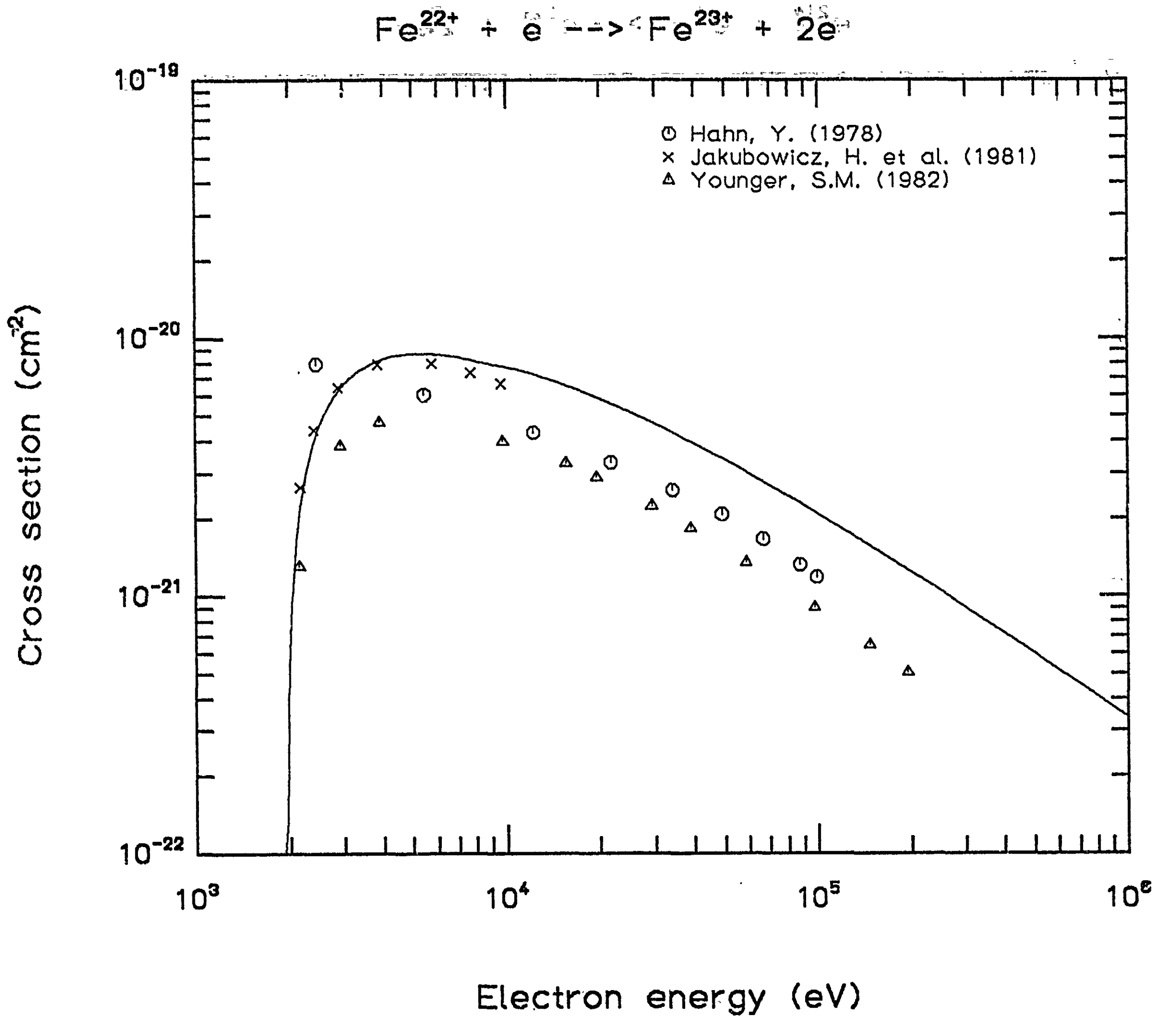

×10-20
Fe21+ + e --> Fe22+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
1.5
1.0
0.5
0.0
103
104
105
106
Electron energy (eV)

Fig. 171


$Fe^{22+} + e \rightarrow Fe^{23+} + 2e$
Hahn, Y. (1978)
Jakubowicz, H. et al. (1981)
Younger, S.M. (1982)
Cross section (cm^2)
10^{-19}
10^{-20}
10^{-21}
10^{-22}
10^3
10^4
10^5
10^6
Electron energy (eV)

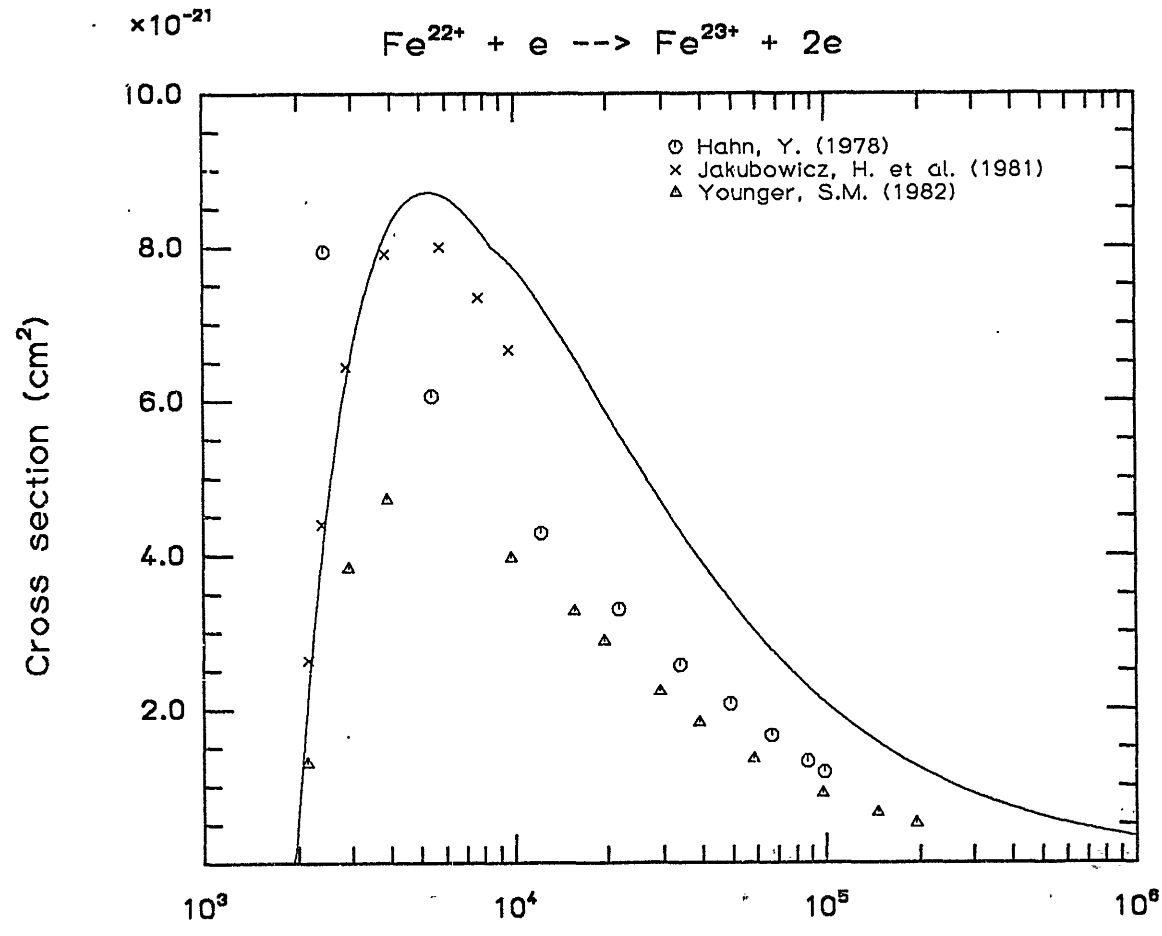
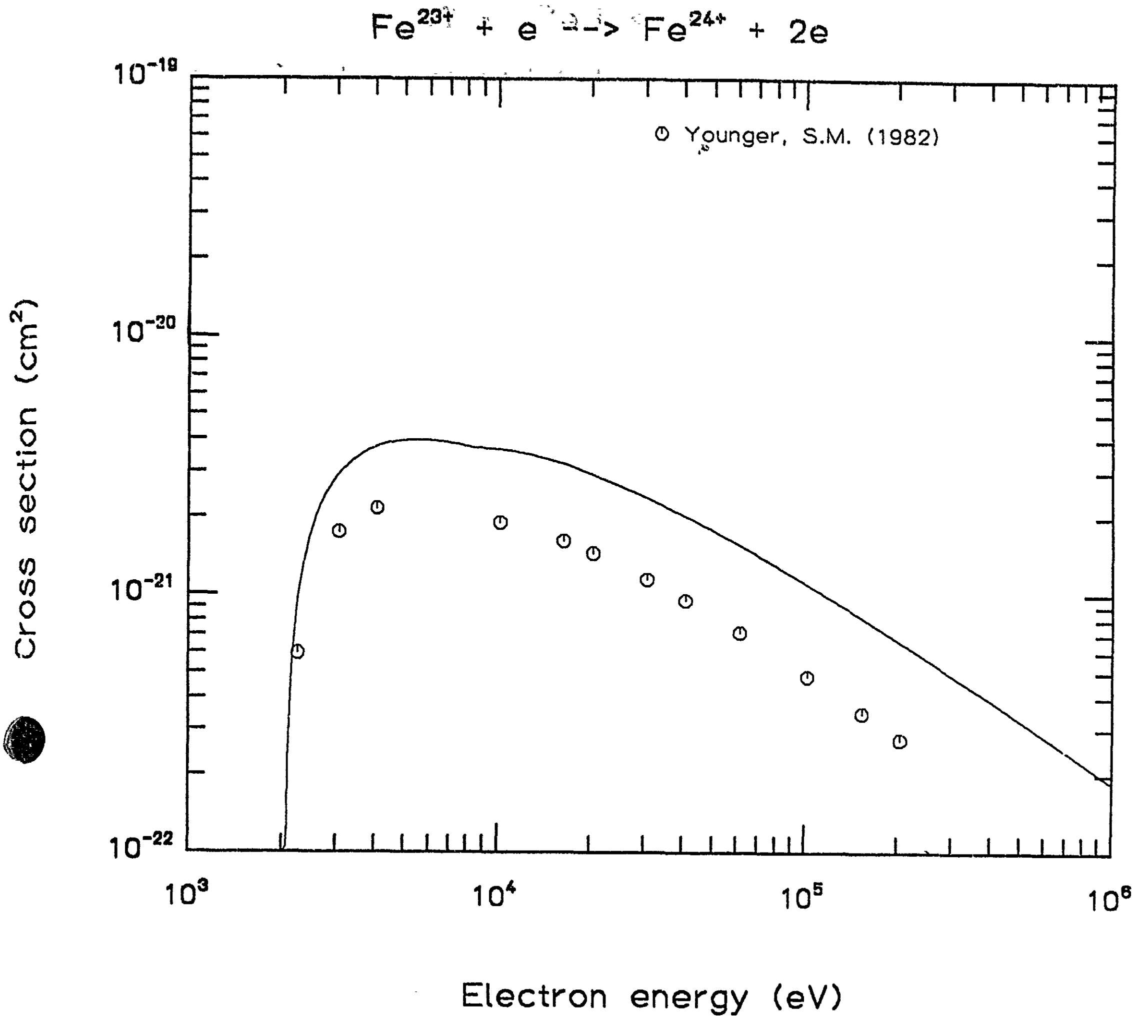
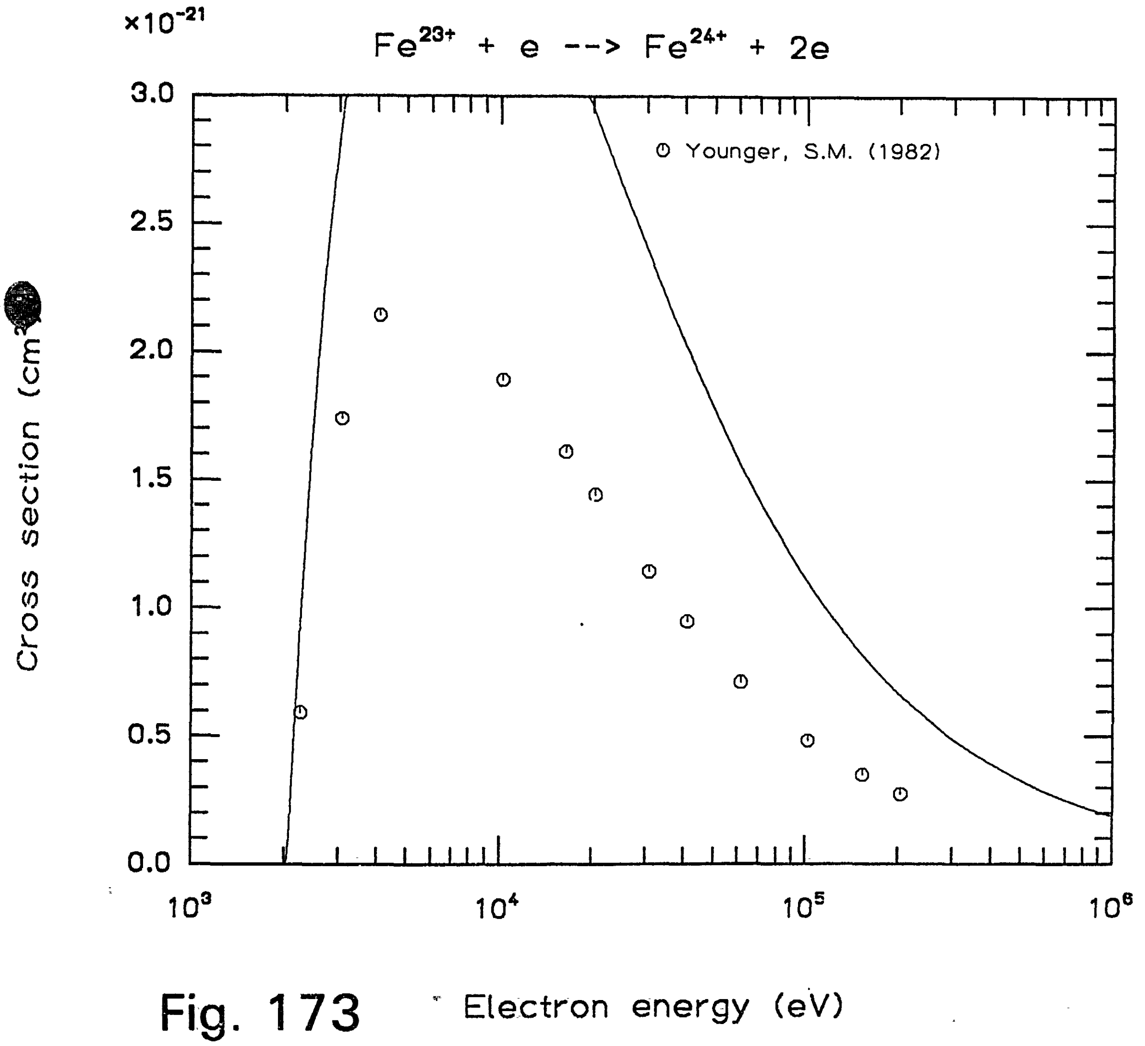

$\times 10^{-21}$
$Fe^{22+} + e \rightarrow Fe^{23+} + 2e$
Hahn, Y. (1978)
Jakubowicz, H. et al. (1981)
Younger, S.M. (1982)
Cross section (cm^2)
10.0
8.0
6.0
4.0
2.0
10^3
10^4
10^5
10^6
Electron energy (eV)

Fig. 172

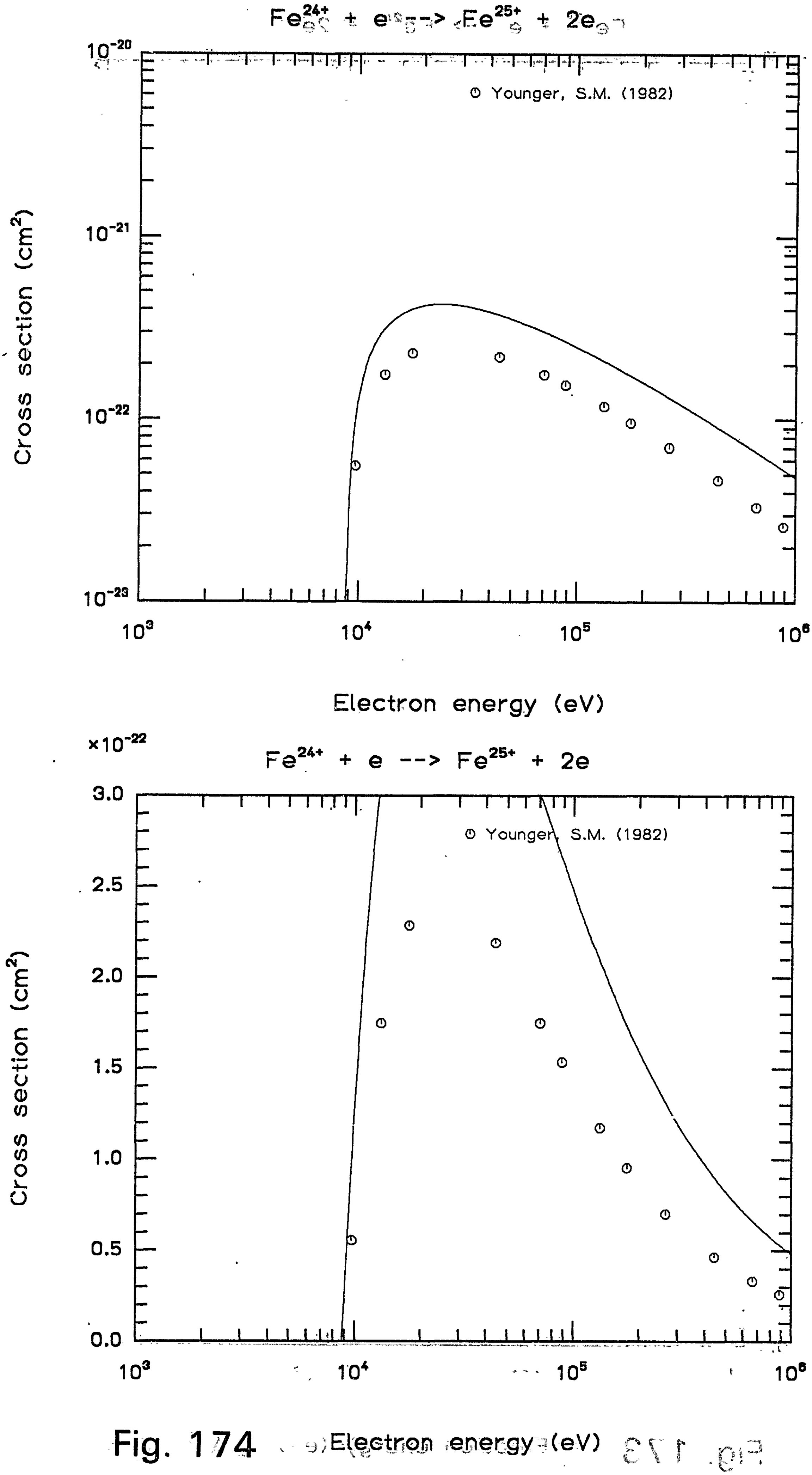


Fe23+ + e --> Fe24+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
10-19
10-20
10-21
10-22
103
104
105
106
Electron energy (eV)



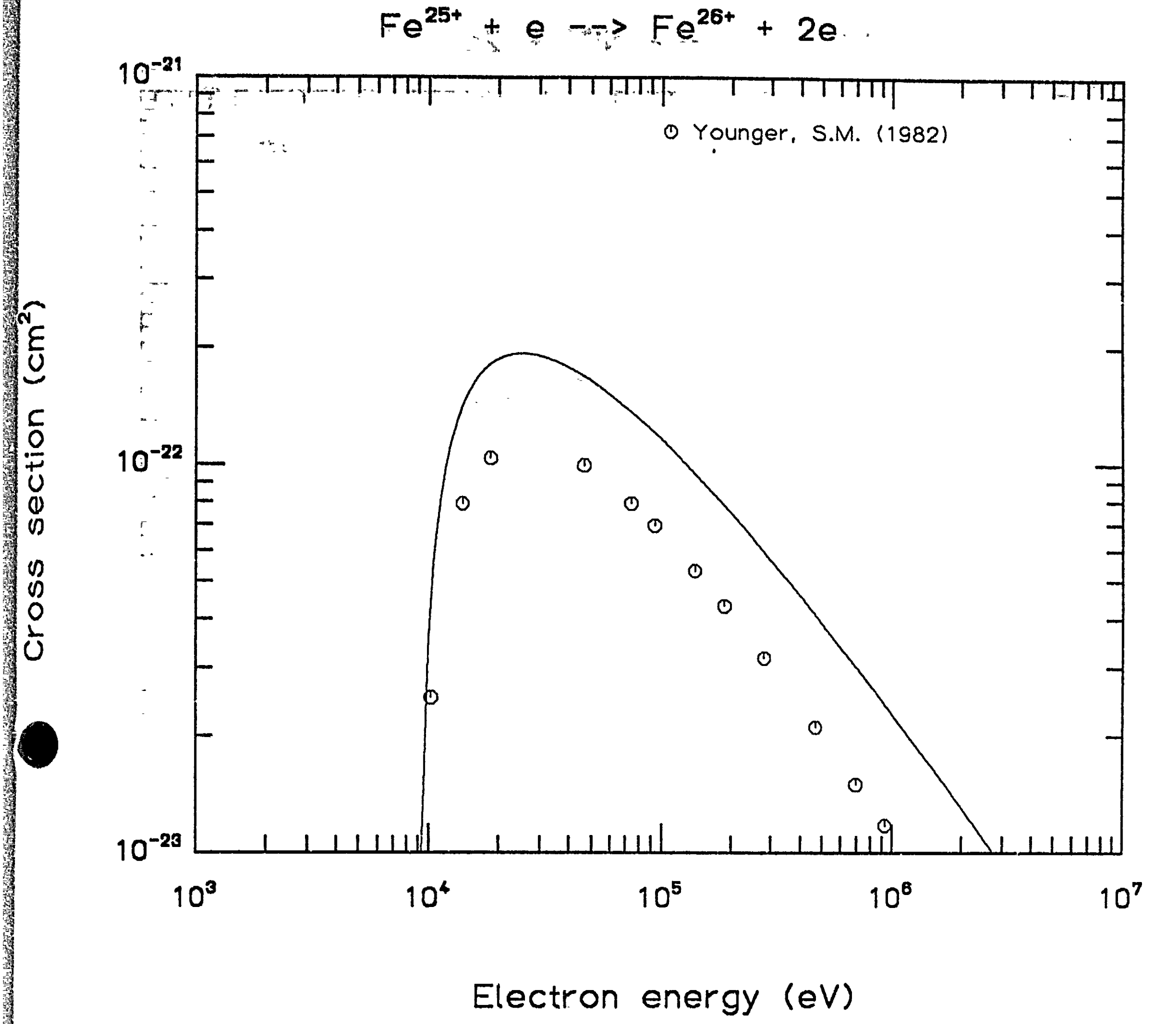
×10-21
Fe23+ + e --> Fe24+ + 2e
Younger, S.M. (1982)
Cross section (cm2)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
103
104
105
106
Electron energy (eV)

Fig. 173

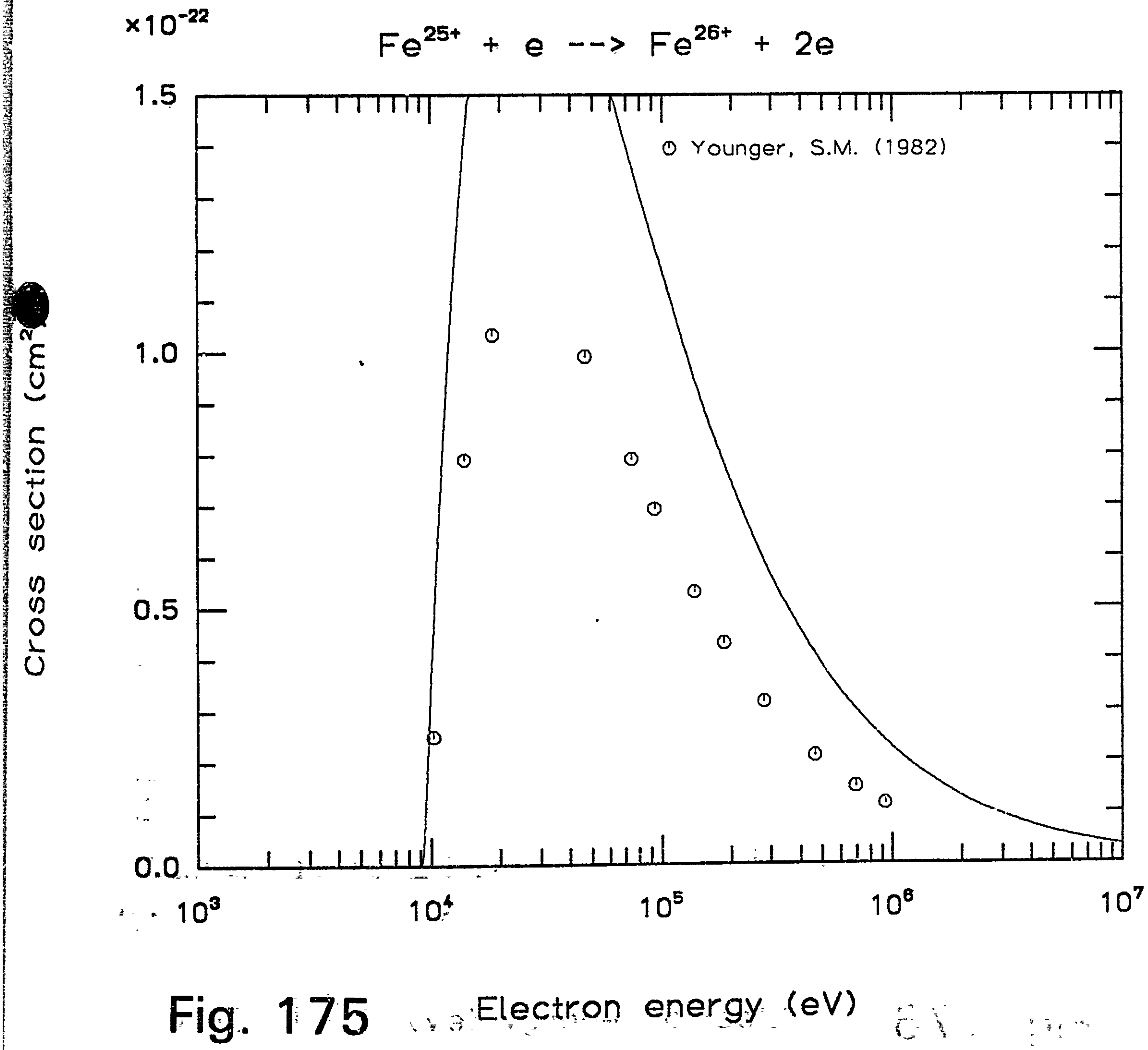


Fe24+ + e --> Fe25+ + 2e
Younger, S.M. (1982)
10-20
10-21
10-22
10-23
Cross section (cm2)
103
104
105
106
Electron energy (eV)
×10-22
Fe24+ + e --> Fe25+ + 2e
Younger, S.M. (1982)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Cross section (cm2)
103
104
105
106
Electron energy (eV)

Fig. 174

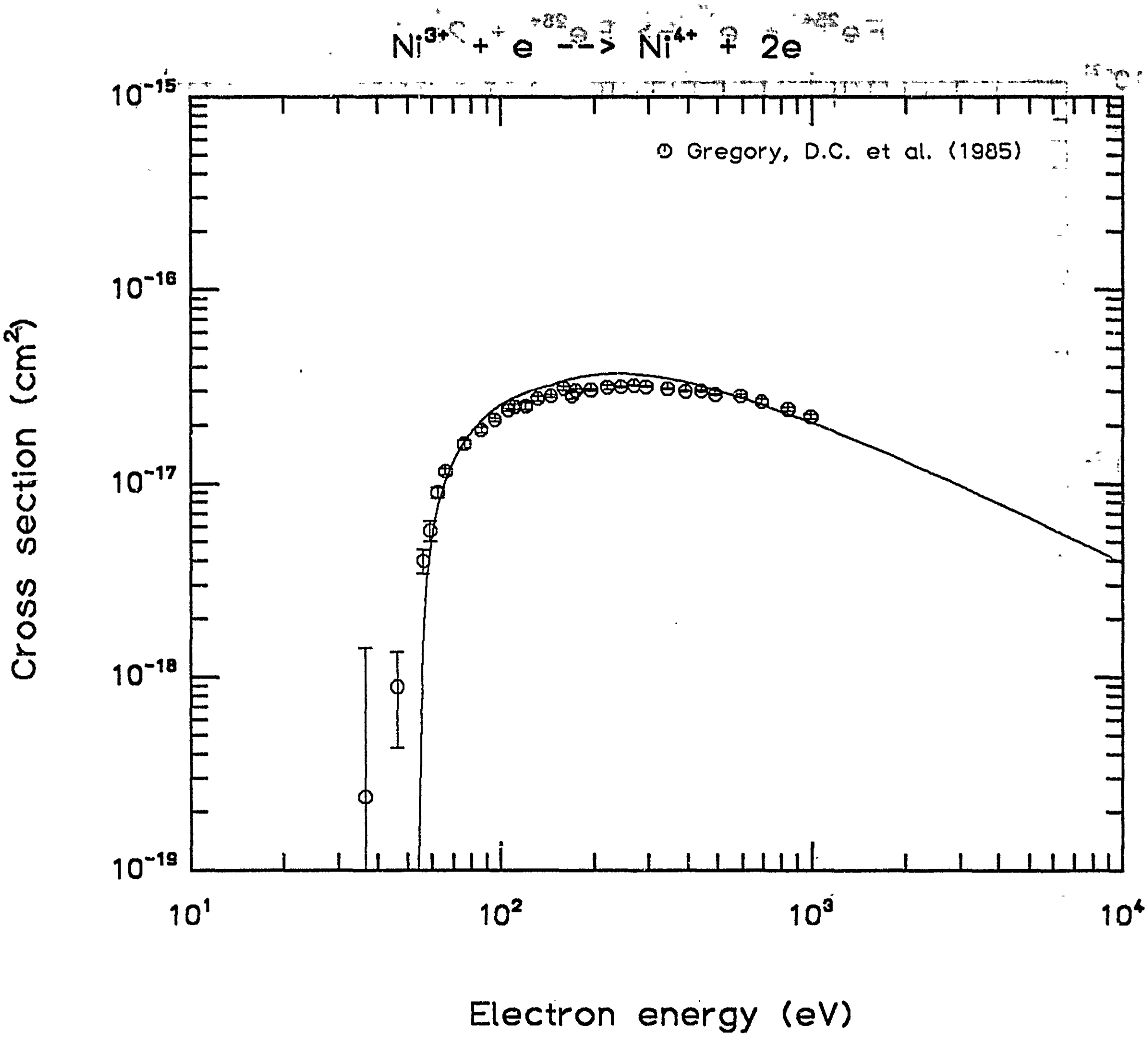


Fe^{25+} + e --> Fe^{26+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
10^{-21}
10^{-22}
10^{-23}
10^3
10^4
10^5
10^6
10^7
Electron energy (eV)



$\times 10^{-22}$
Fe^{25+} + e --> Fe^{26+} + 2e
Younger, S.M. (1982)
Cross section (cm^2)
1.5
1.0
0.5
0.0
10^3
10^4
10^5
10^6
10^7
Electron energy (eV)

Fig. 175



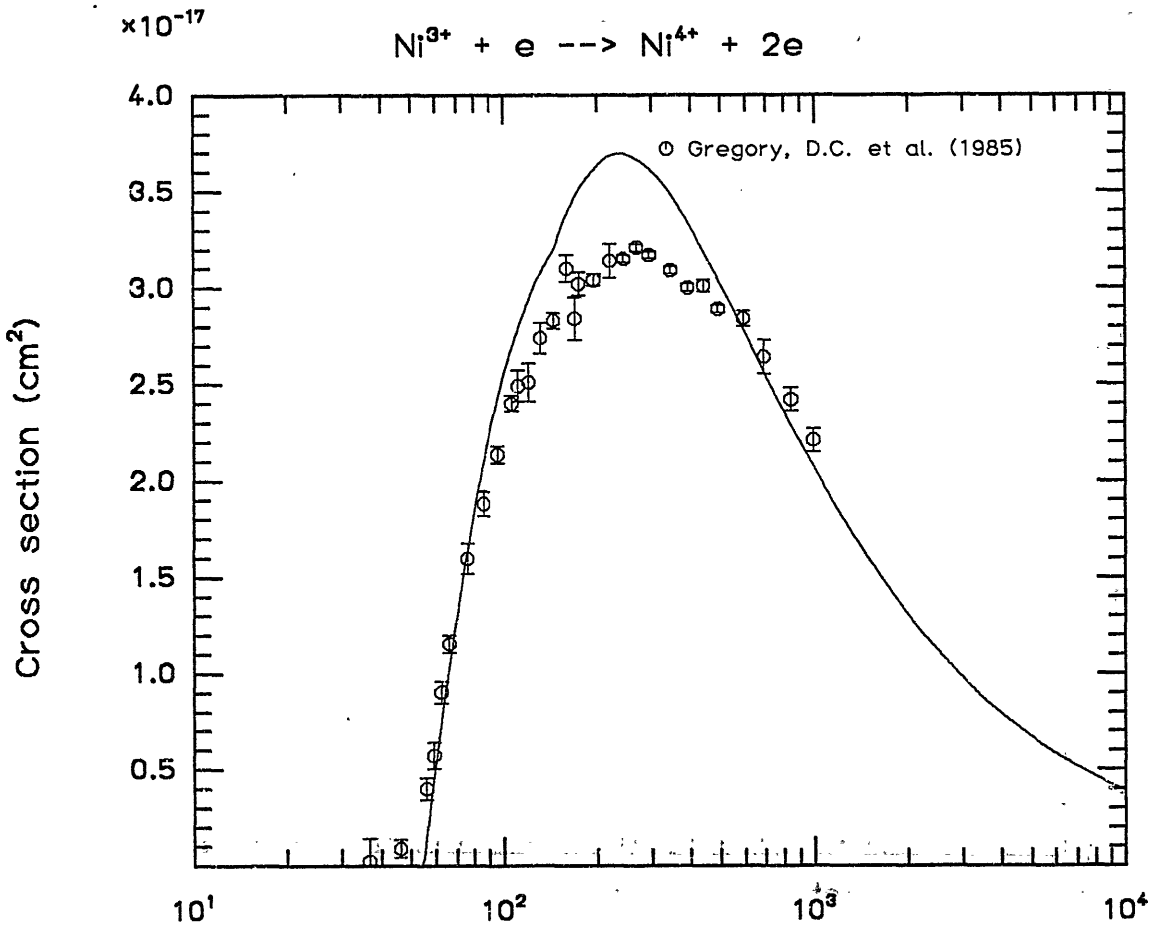
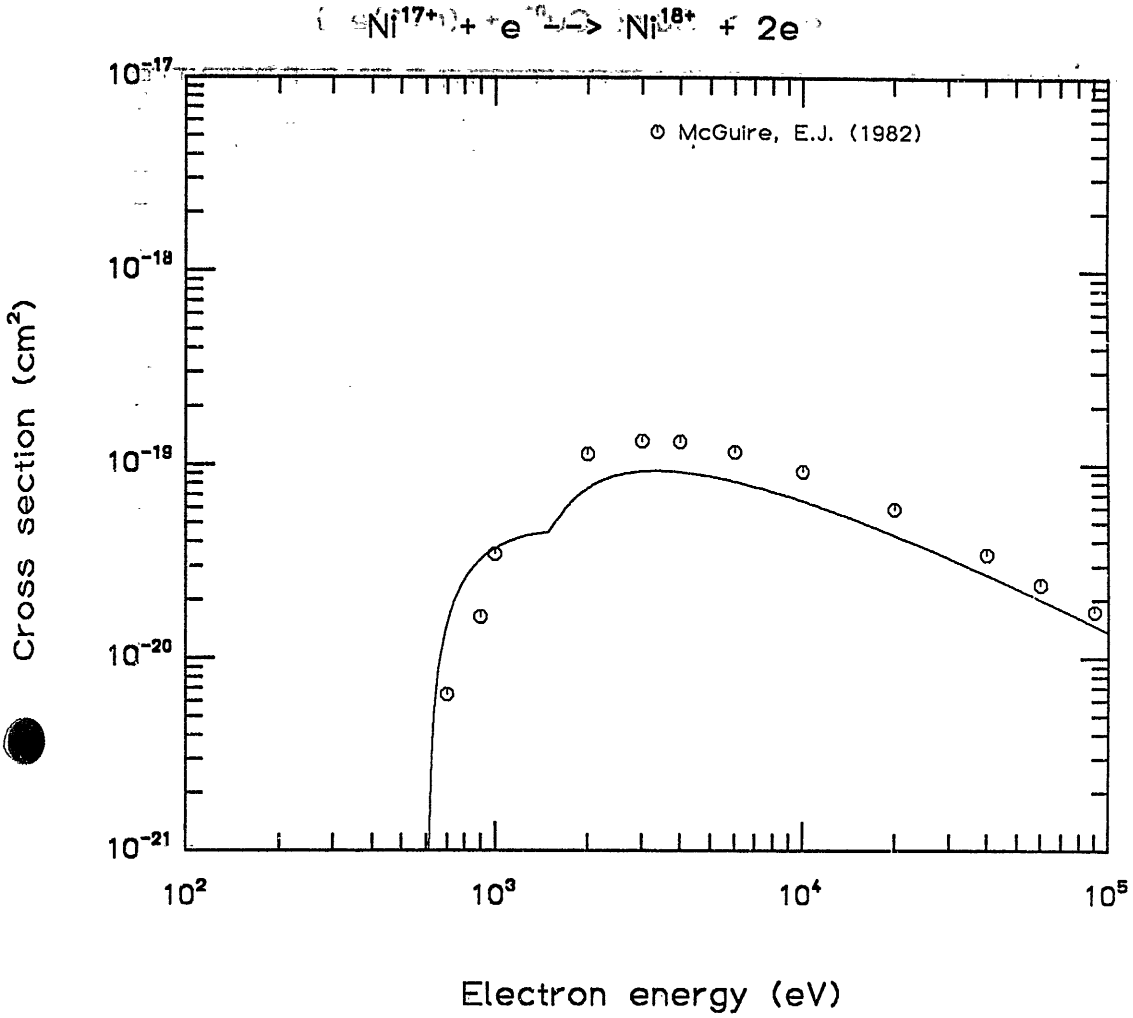


Fig. 176 Electron energy (eV)



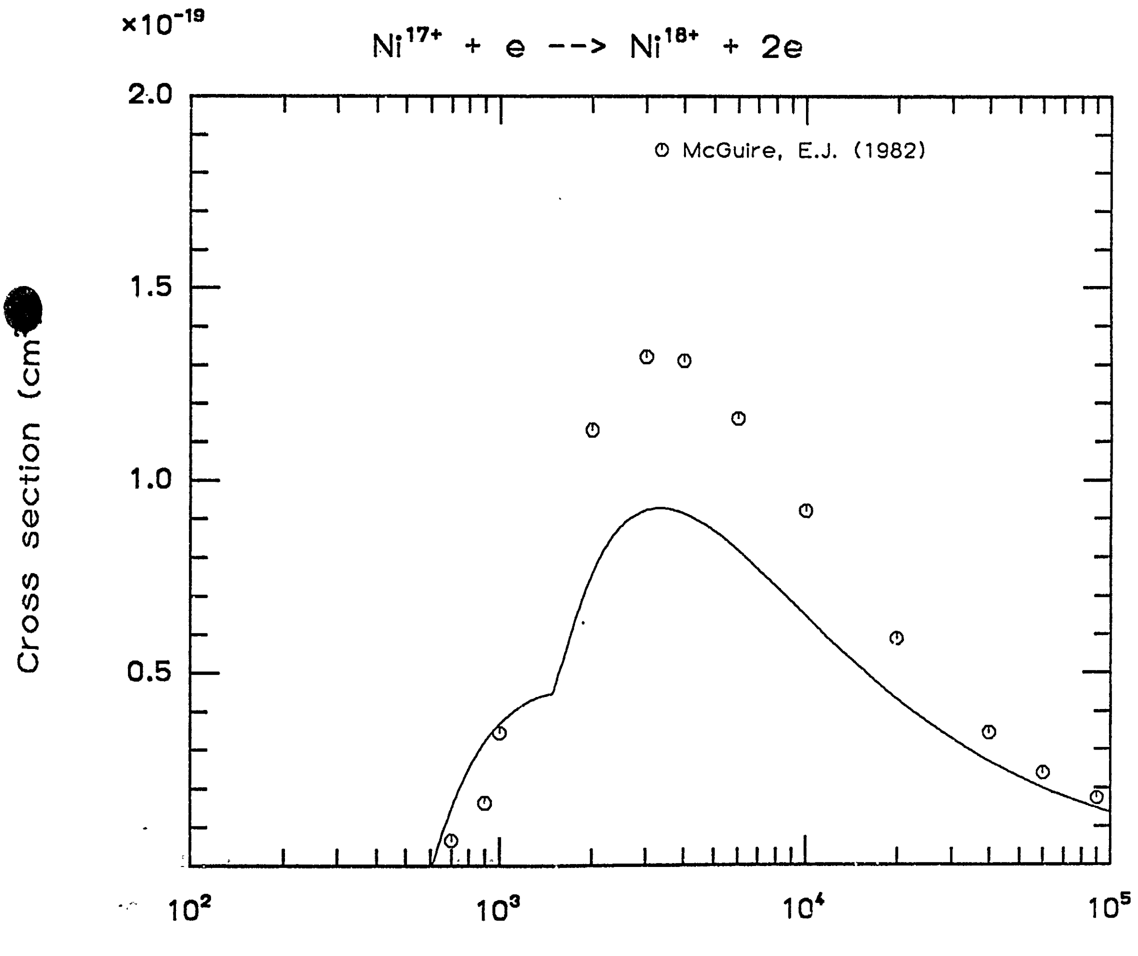
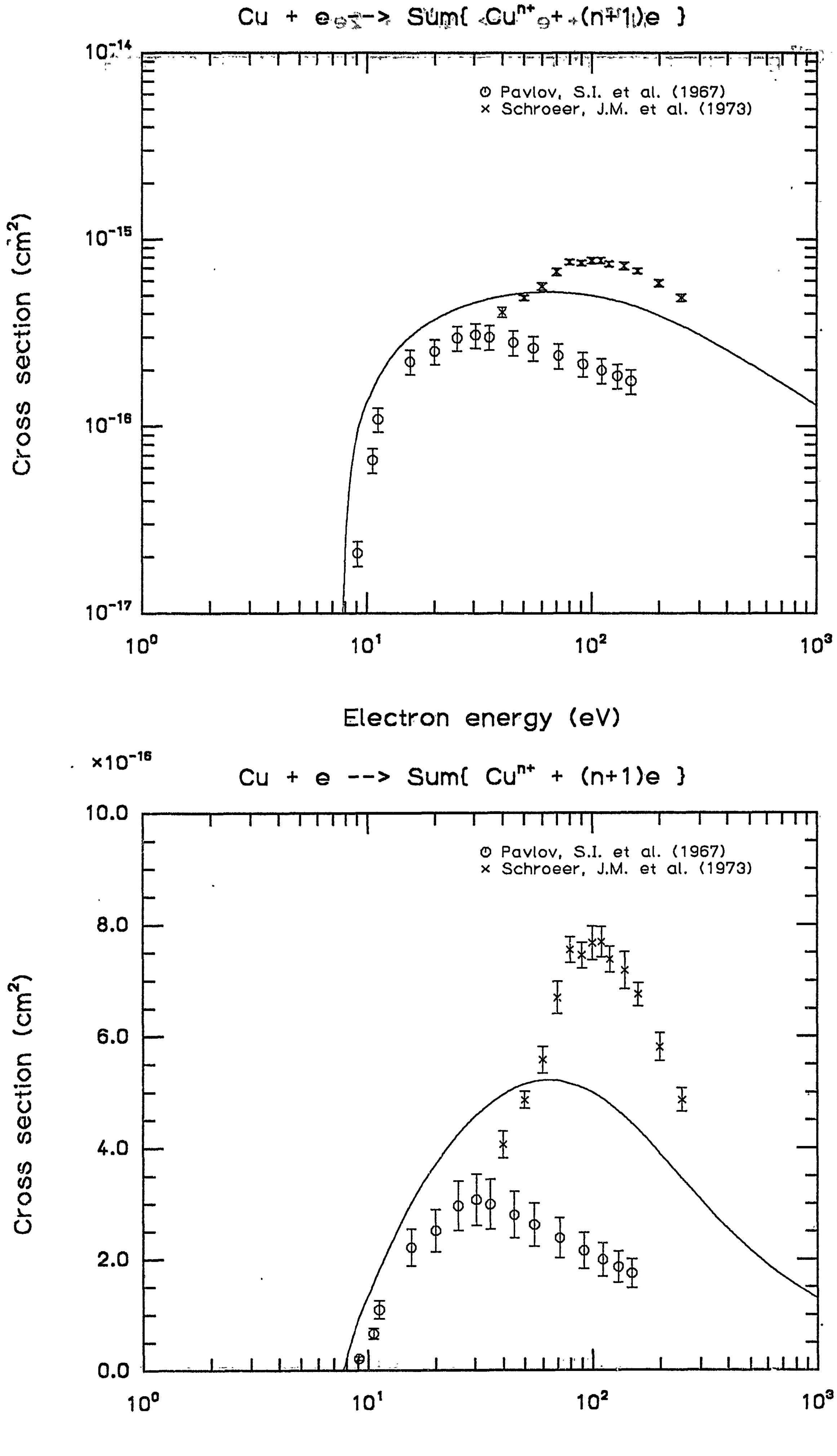
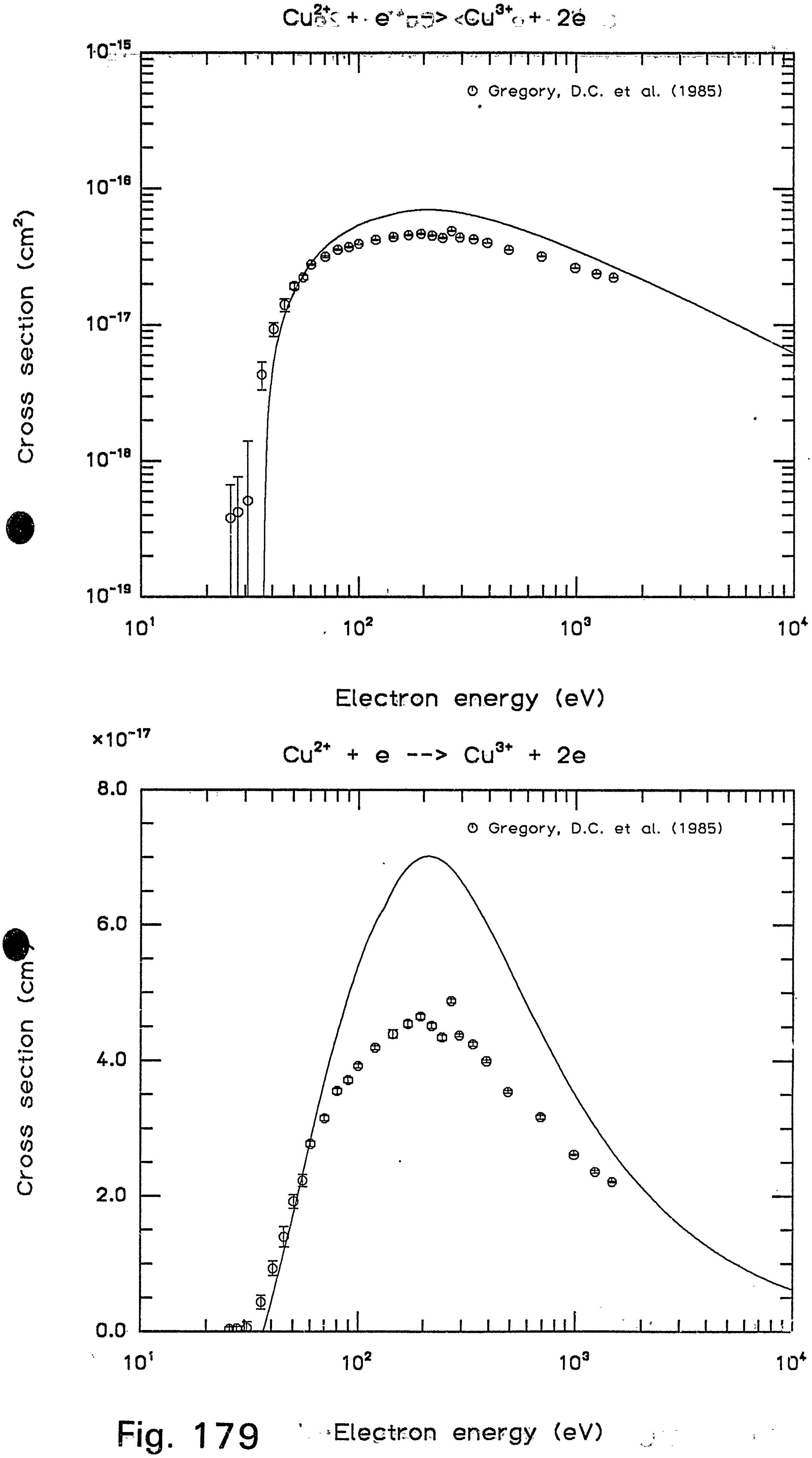


Fig. 177 Electron energy (eV)



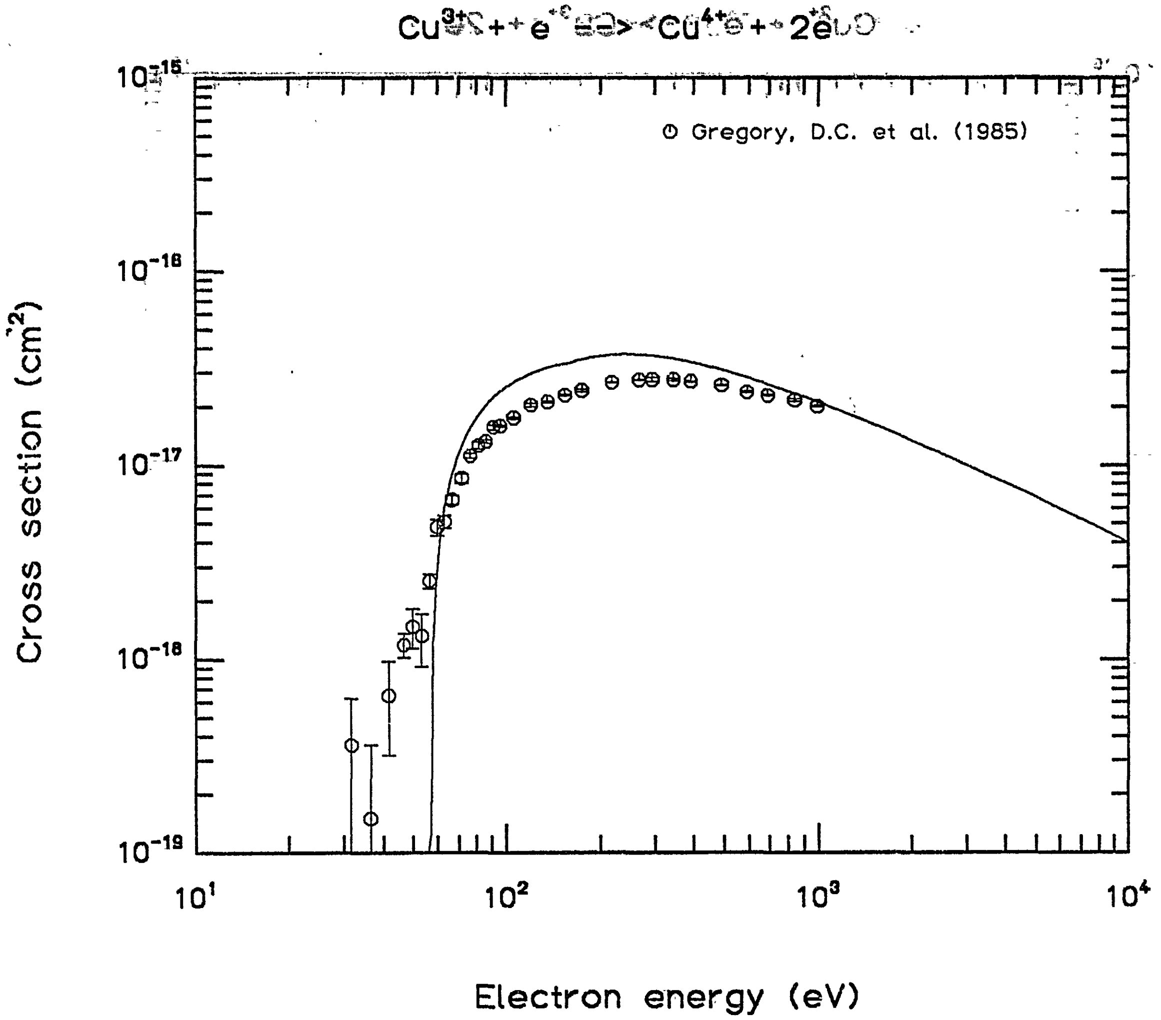
Cu + e --> Sum{ Cu^{n+} + (n+1)e }
Pavlov, S.I. et al. (1967)
Schroeer, J.M. et al. (1973)
Cross section (cm^2)
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^0
10^1
10^2
10^3
Electron energy (eV)
$\times10^{-16}$
Cu + e --> Sum{ Cu^{n+} + (n+1)e }
Pavlov, S.I. et al. (1967)
Schroeer, J.M. et al. (1973)
Cross section (cm^2)
10.0
8.0
6.0
4.0
2.0
0.0
10^0
10^1
10^2
10^3
Electron energy (eV)

Fig. 178

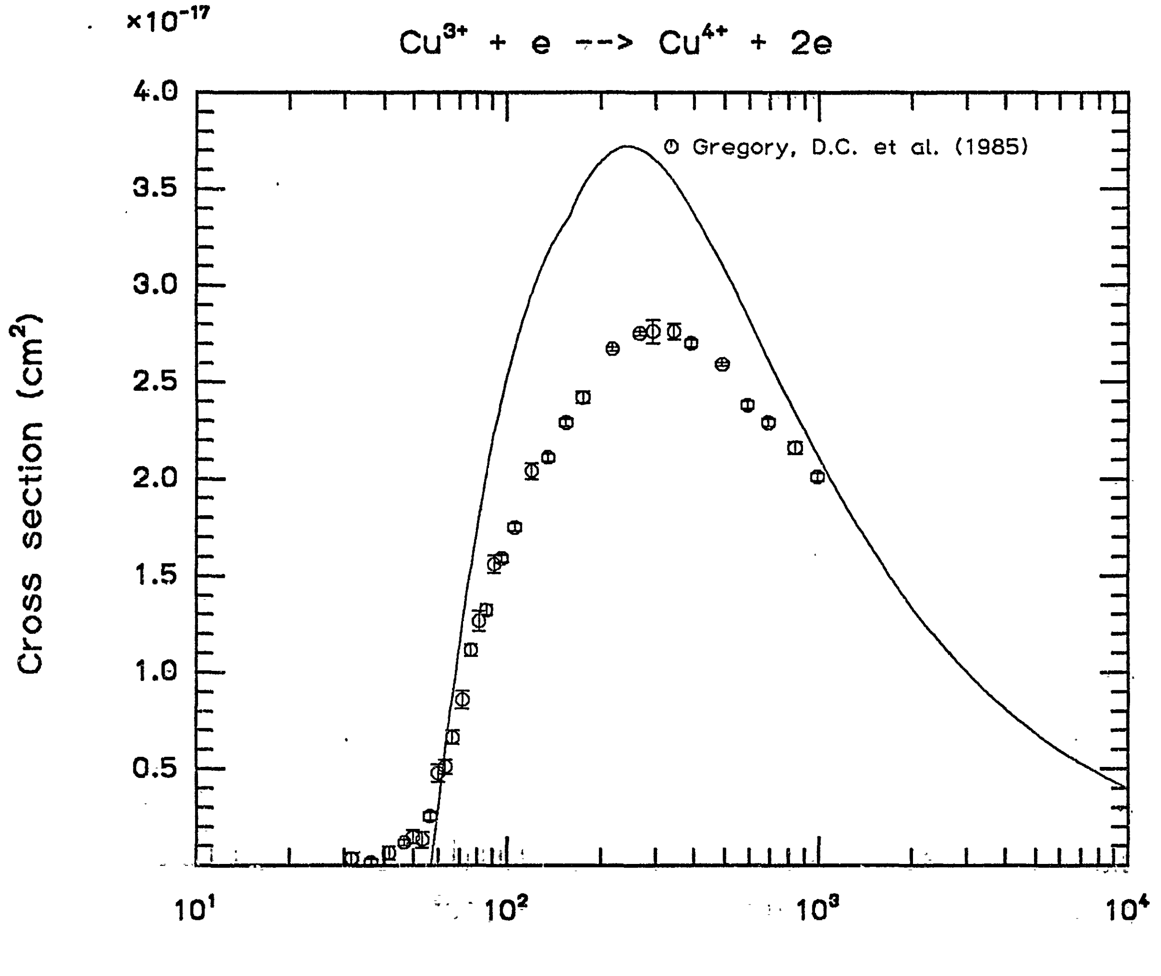


$Cu^{2+} + e --> Cu^{3+} + 2e$
○ Gregory, D.C. et al. (1985)
Cross section (cm²)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{1}
10^{2}
10^{3}
10^{4}
Electron energy (eV)
$\times 10^{-17}$
$Cu^{2+} + e --> Cu^{3+} + 2e$
○ Gregory, D.C. et al. (1985)
Cross section (cm²)
8.0
6.0
4.0
2.0
0.0
10^{1}
10^{2}
10^{3}
10^{4}
Electron energy (eV)

Fig. 179



$Cu^{3+} + e \rightarrow Cu^{4+} + 2e$
Gregory, D.C. et al. (1985)
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^1
10^2
10^3
10^4
Electron energy (eV)



$\times 10^{-17}$
Cu^{3+} + e --> Cu^{4+} + 2e
Gregory, D.C. et al. (1985)
Cross section (cm^2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 180

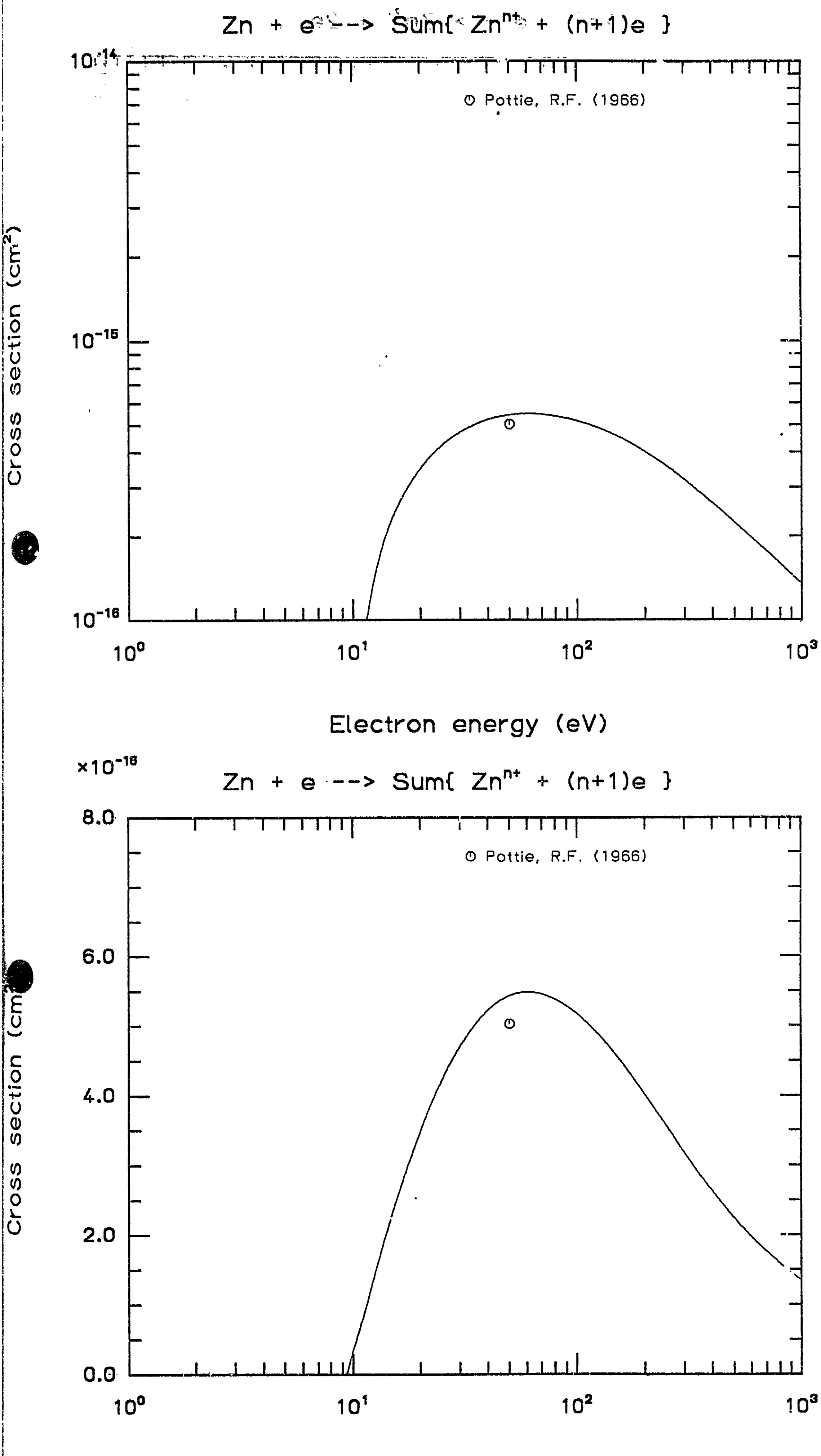
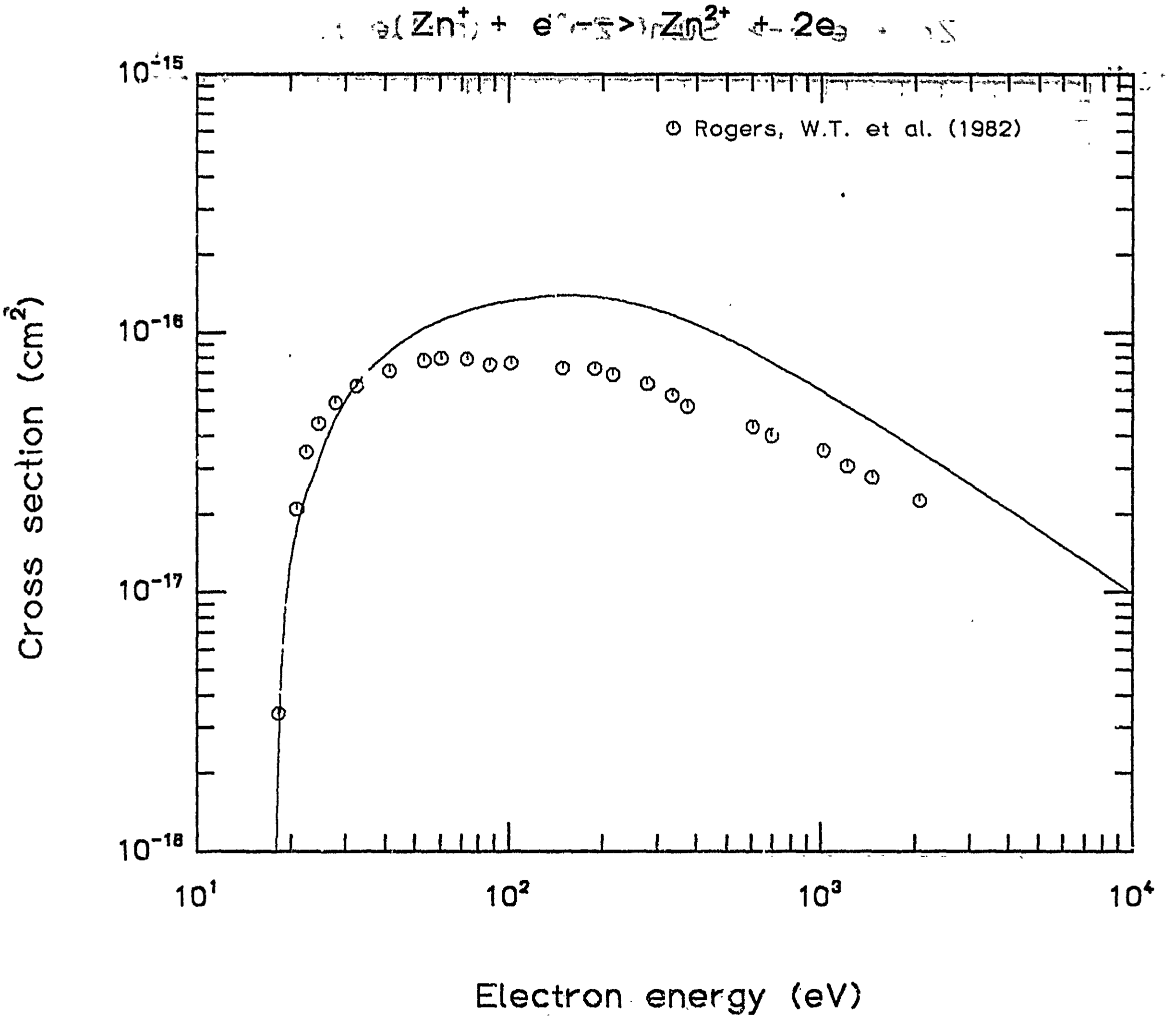
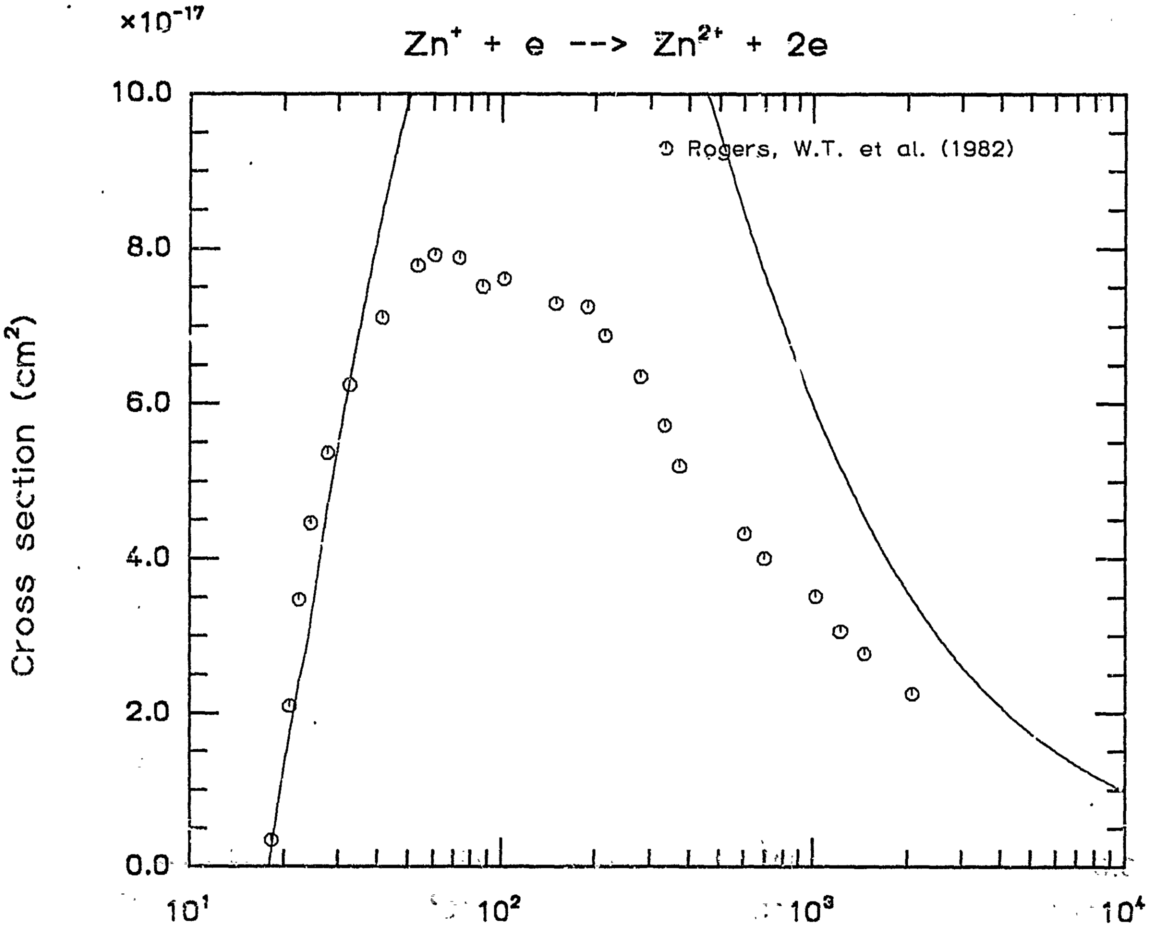


Fig. 181 Electron energy (eV)

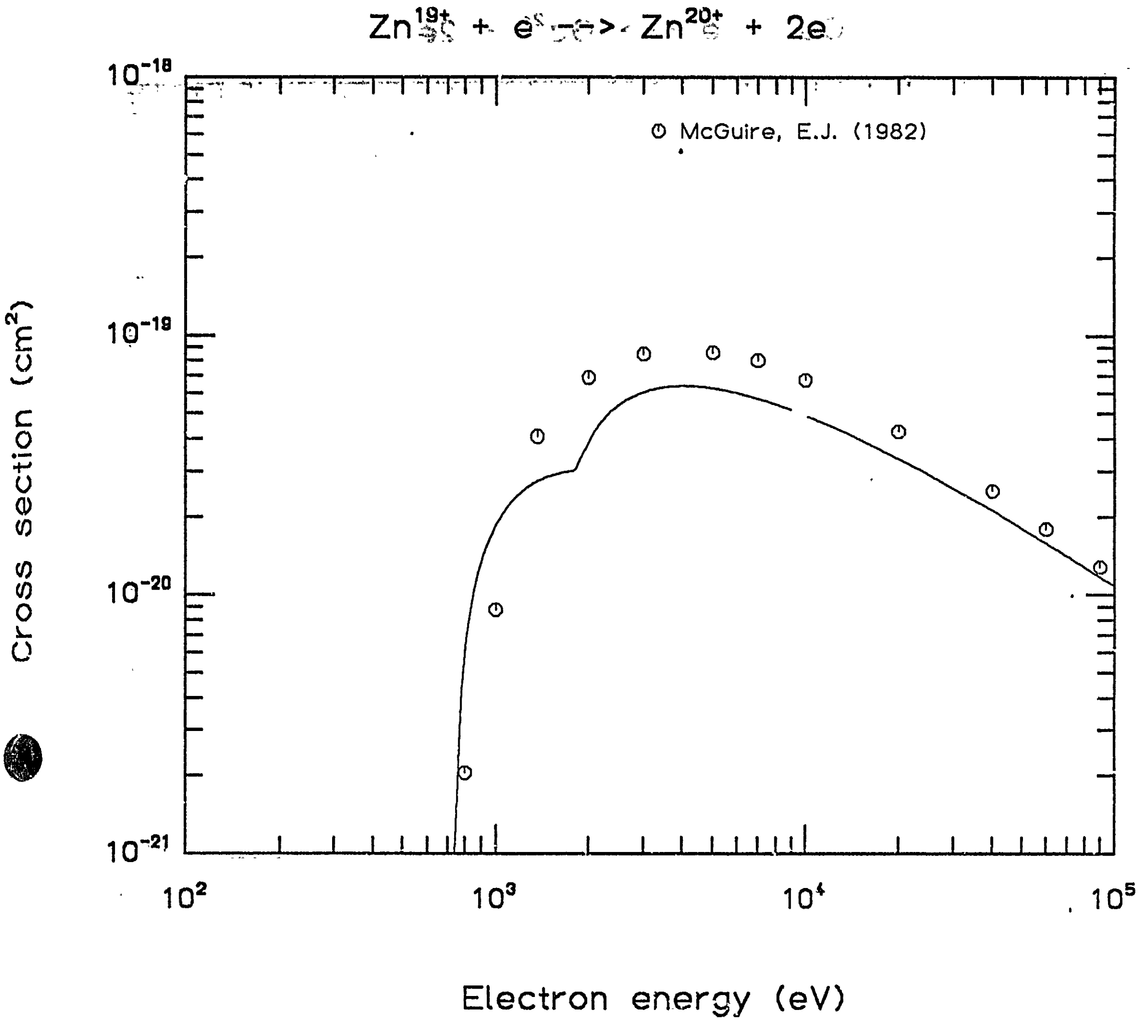


Zn+ + e --> Zn2+ + 2e
Rogers, W.T. et al. (1982)
Cross section (cm2)
10-15
10-16
10-17
10-18
101
102
103
104
Electron energy (eV)



x10-17
Zn+ + e --> Zn2+ + 2e
Rogers, W.T. et al. (1982)
Cross section (cm2)
10.0
8.0
6.0
4.0
2.0
0.0
101
102
103
104
Electron energy (eV)

Fig. 182



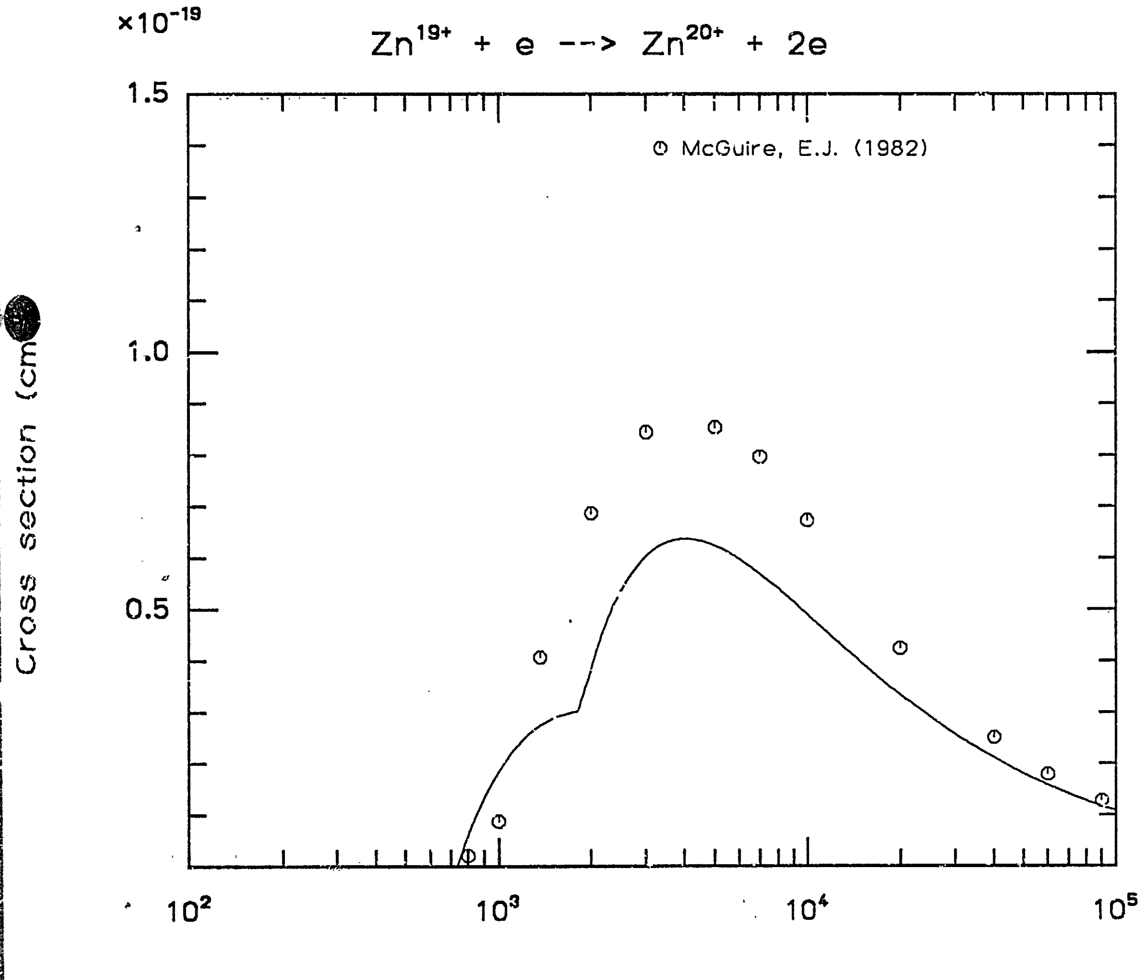
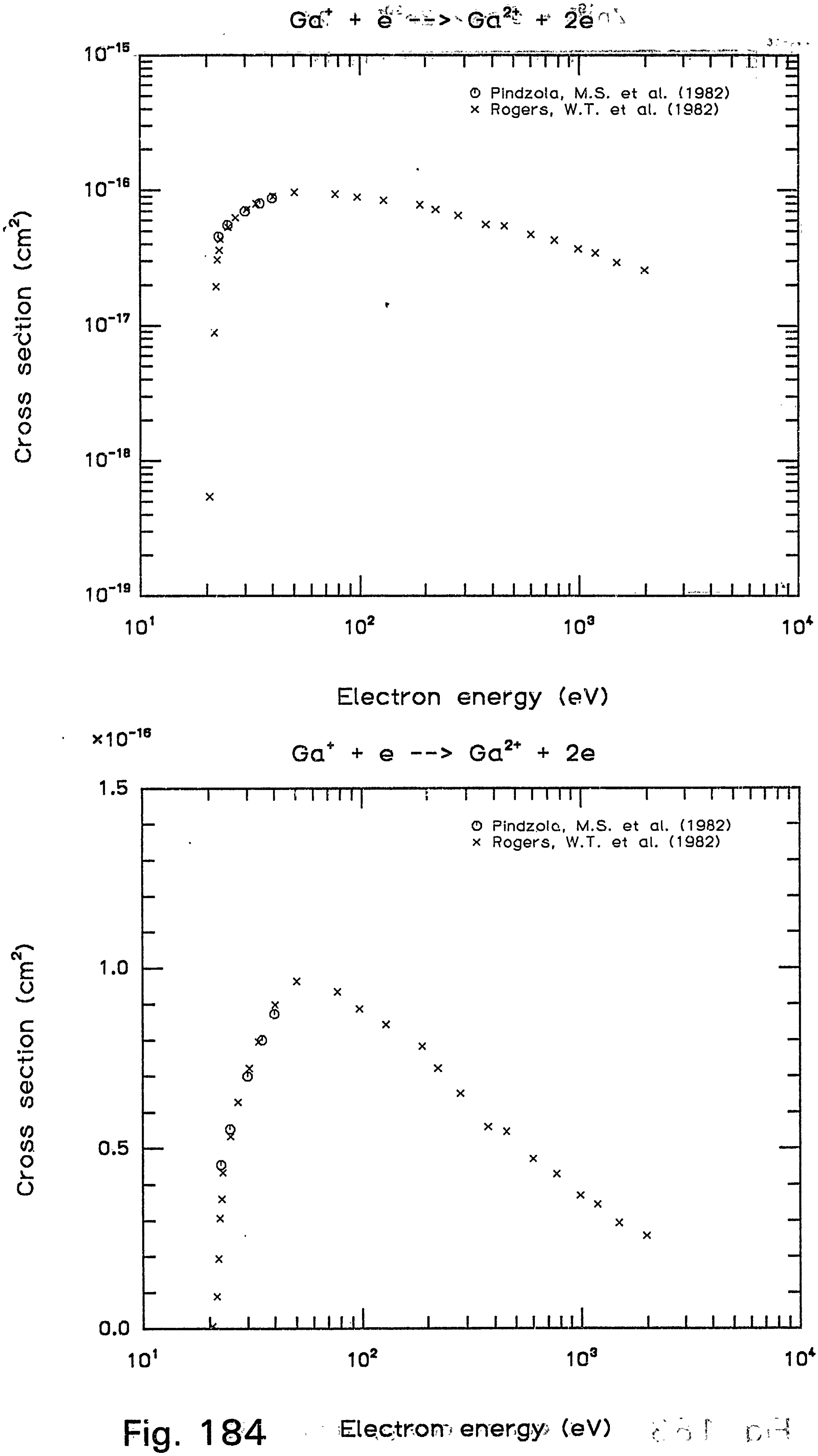
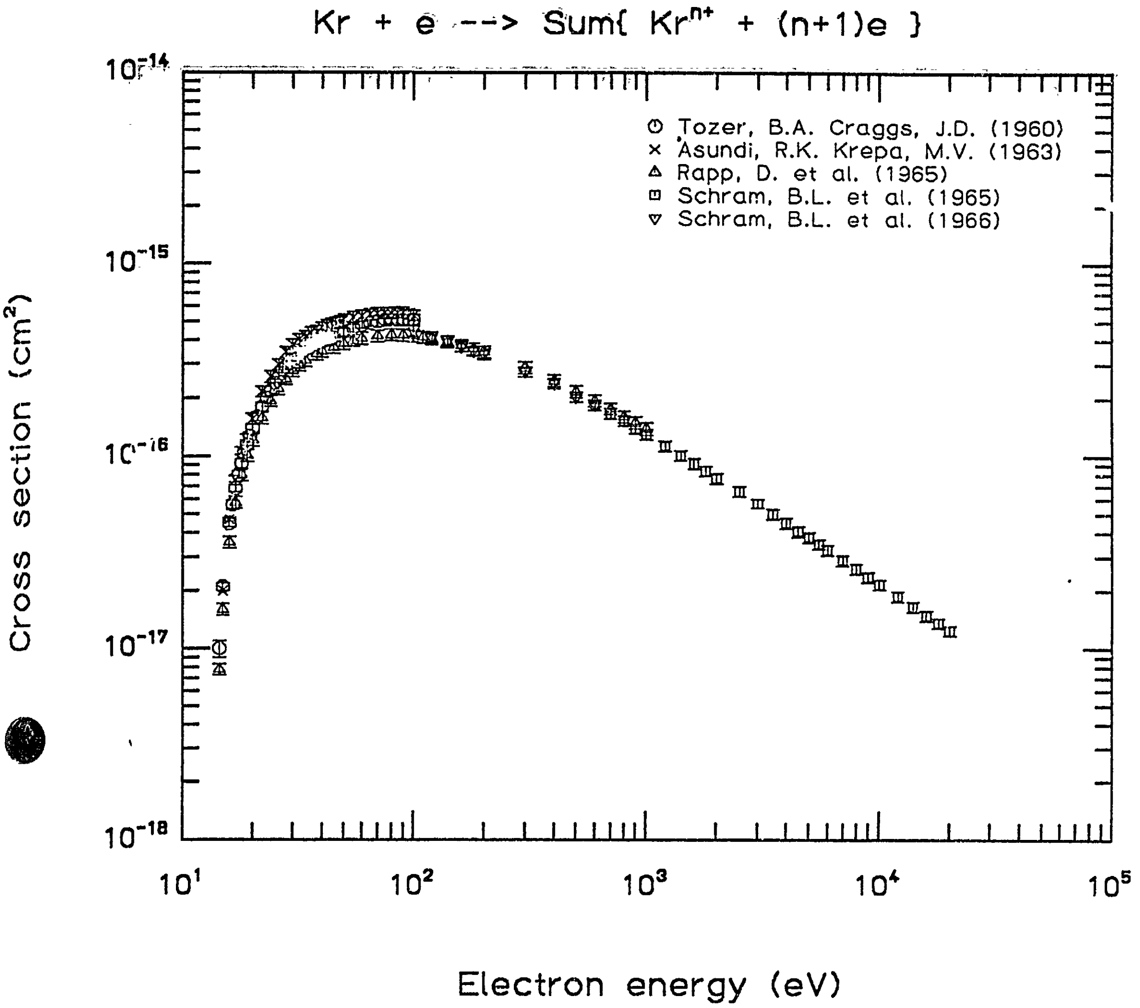


Fig. 183 Electron energy (eV)



Ga⁺ + e --> Ga²⁺ + 2e
Pindzola, M.S. et al. (1982)
Rogers, W.T. et al. (1982)
Cross section (cm²)
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10⁻¹⁹
10¹
10²
10³
10⁴
Electron energy (eV)
×10⁻¹⁶
Ga⁺ + e --> Ga²⁺ + 2e
Pindzola, M.S. et al. (1982)
Rogers, W.T. et al. (1982)
Cross section (cm²)
1.5
1.0
0.5
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 184


Kr + e --> Sum{ Kr^n+ + (n+1)e }
Tozer, B.A. Craggs, J.D. (1960)
Asundi, R.K. Krepa, M.V. (1963)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Cross section (cm²)
Electron energy (eV)
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10¹
10²
10³
10⁴
10⁵

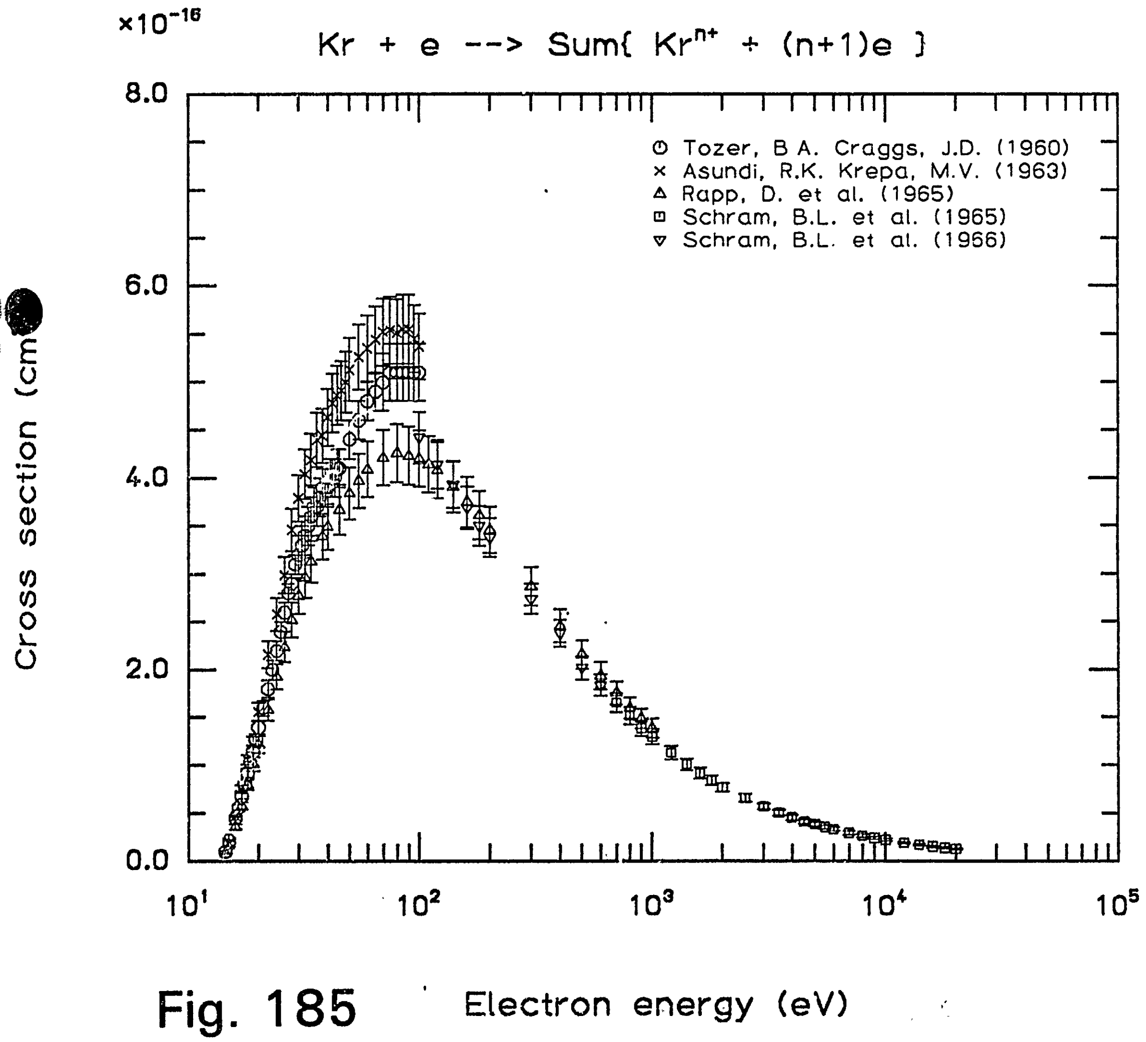
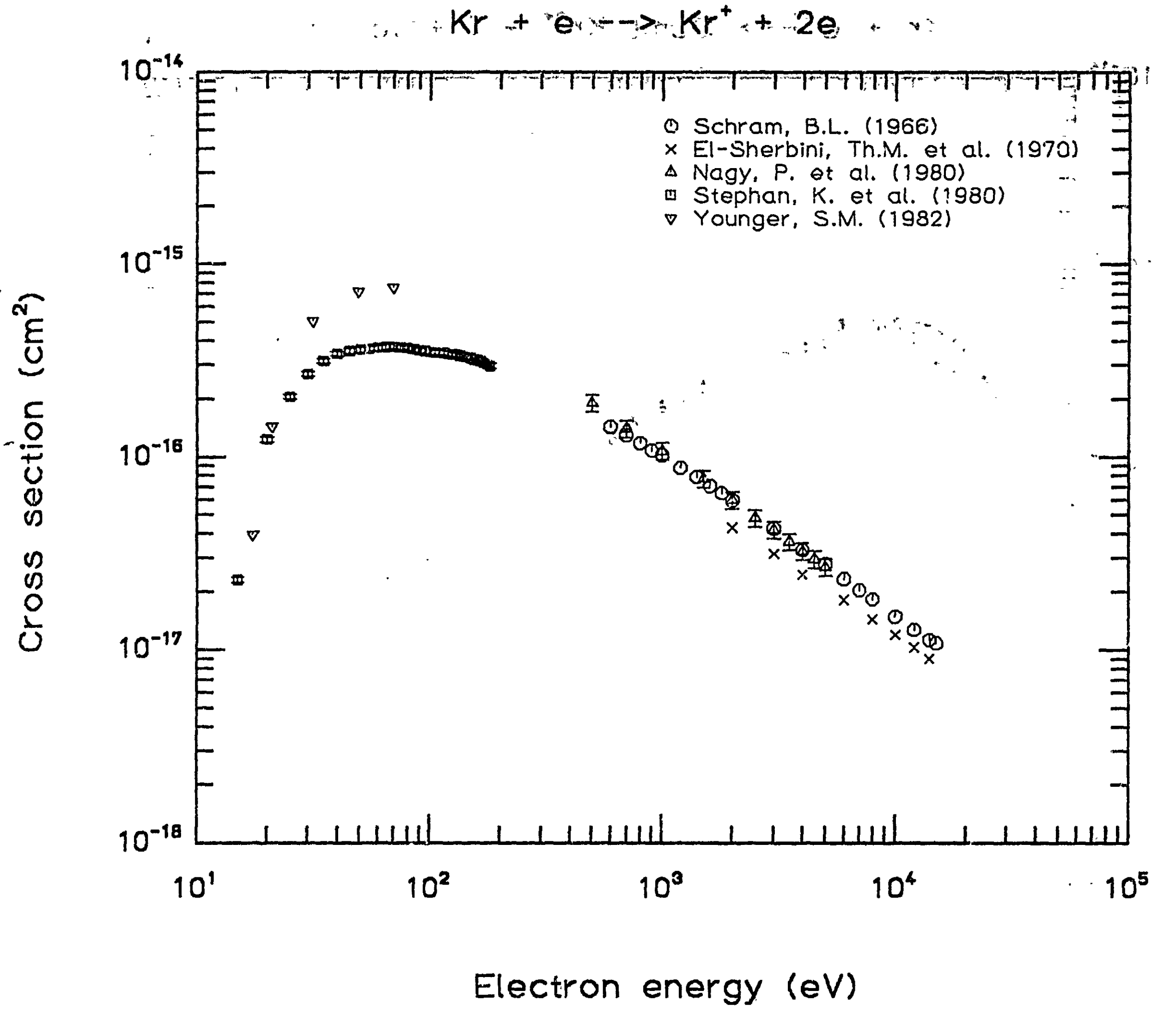

×10⁻¹⁶
Kr + e --> Sum{ Kr^n+ + (n+1)e }
Tozer, B A. Craggs, J.D. (1960)
Asundi, R.K. Krepa, M.V. (1963)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Cross section (cm
8.0
6.0
4.0
2.0
0.0
10¹
10²
10³
10⁴
10⁵
Electron energy (eV)

Fig. 185


Kr + e --> Kr⁺ + 2e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
Younger, S.M. (1982)
Cross section (cm²)
Electron energy (eV)

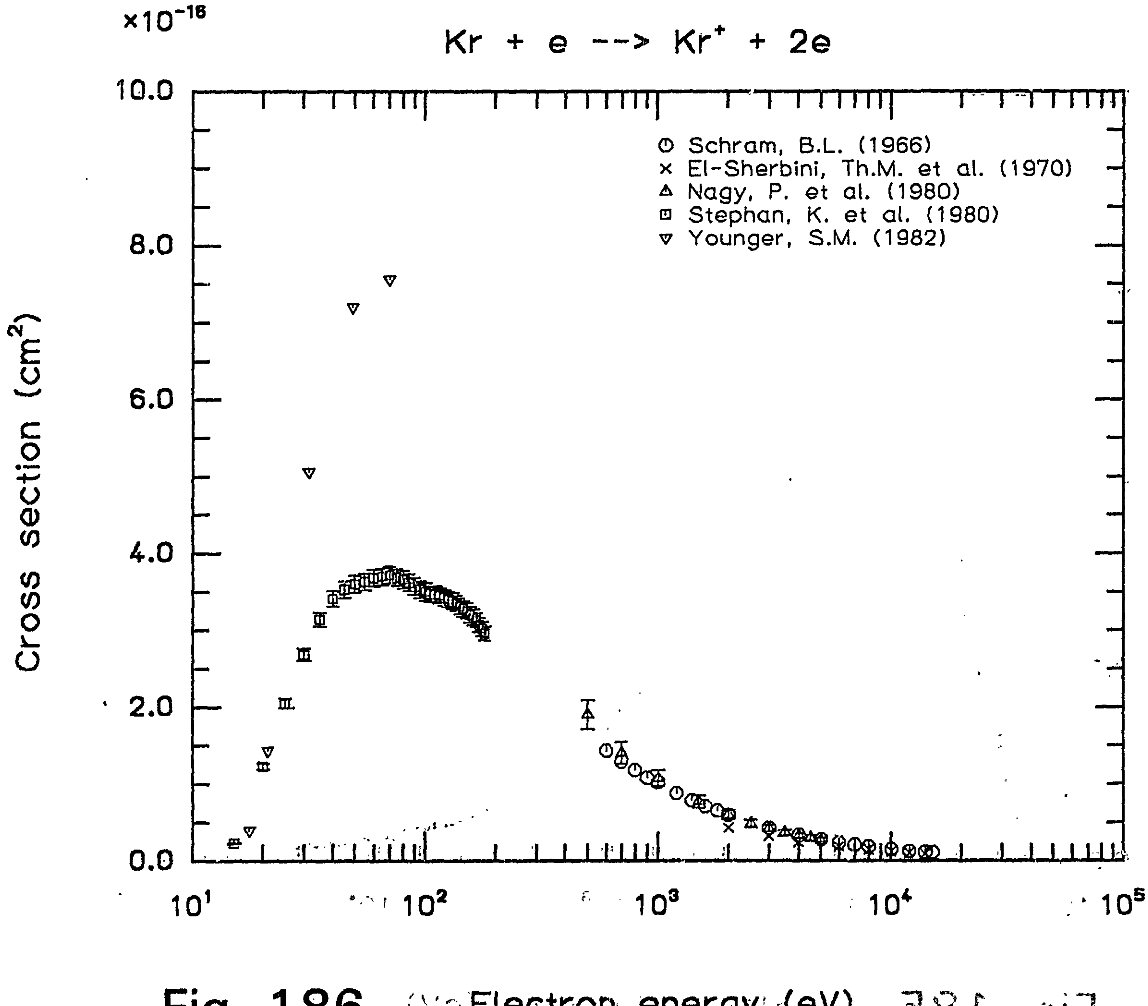

×10⁻¹⁶
Kr + e --> Kr⁺ + 2e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
Younger, S.M. (1982)
Cross section (cm²)
Electron energy (eV)

Fig. 186

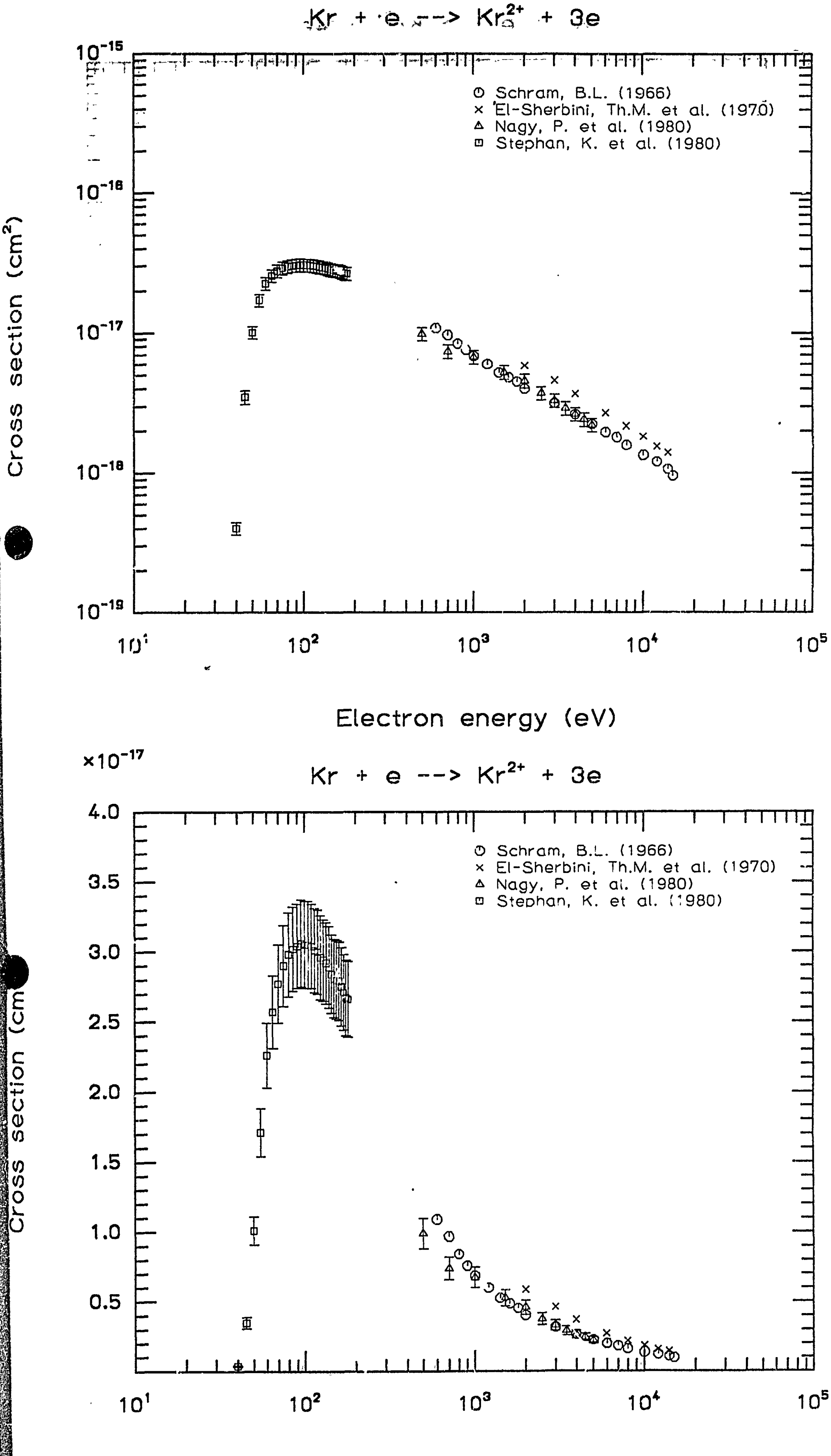
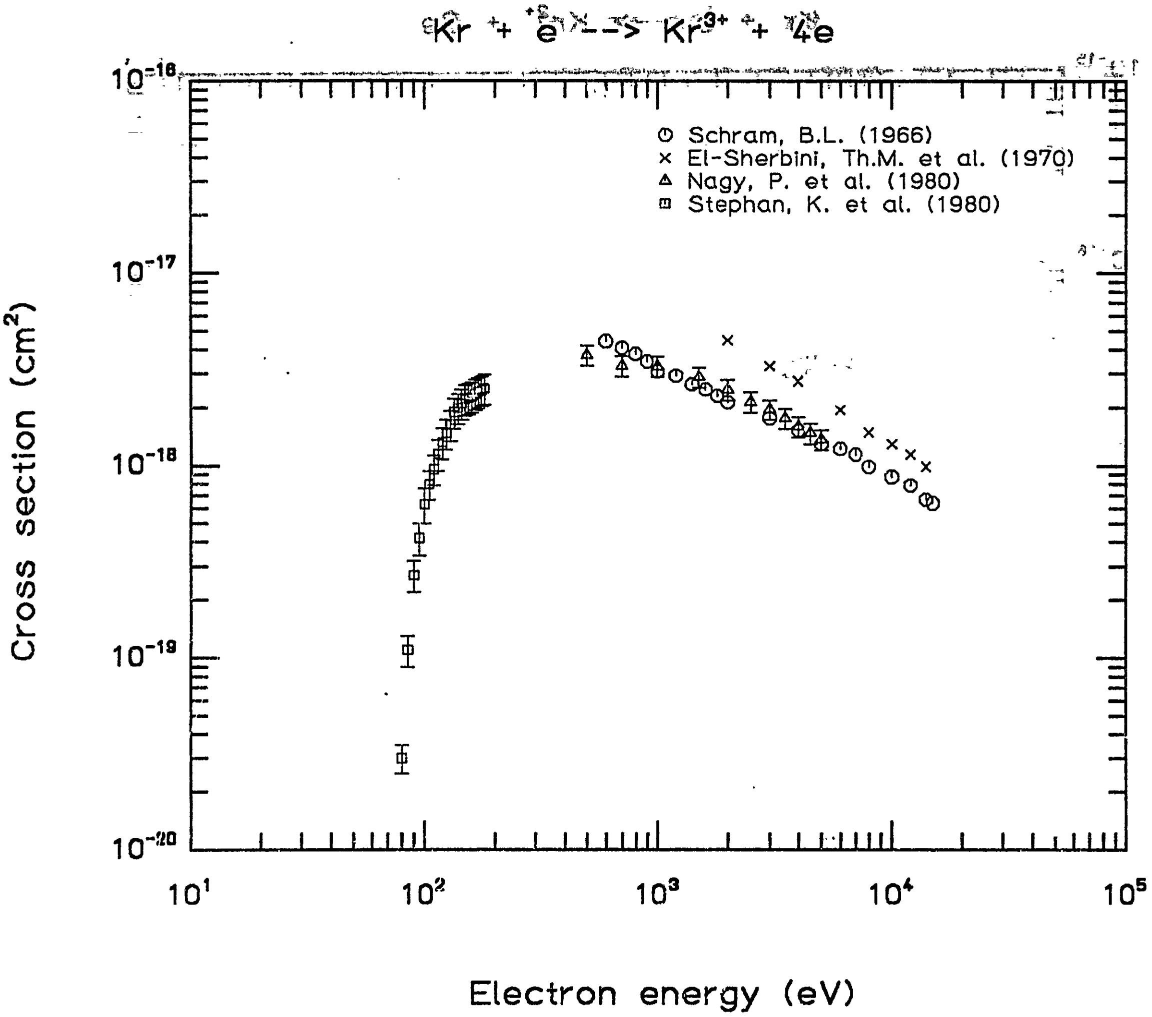

Kr + e --> Kr^{2+} + 3e
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
Cross section (cm^2)
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)
$\times10^{-17}$
Kr + e --> Kr^{2+} + 3e
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
Cross section (cm
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 187


Kr + e --> Kr3+ + 4e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
Cross section (cm2)
10-16
10-17
10-18
10-19
10-20
101
102
103
104
105
Electron energy (eV)

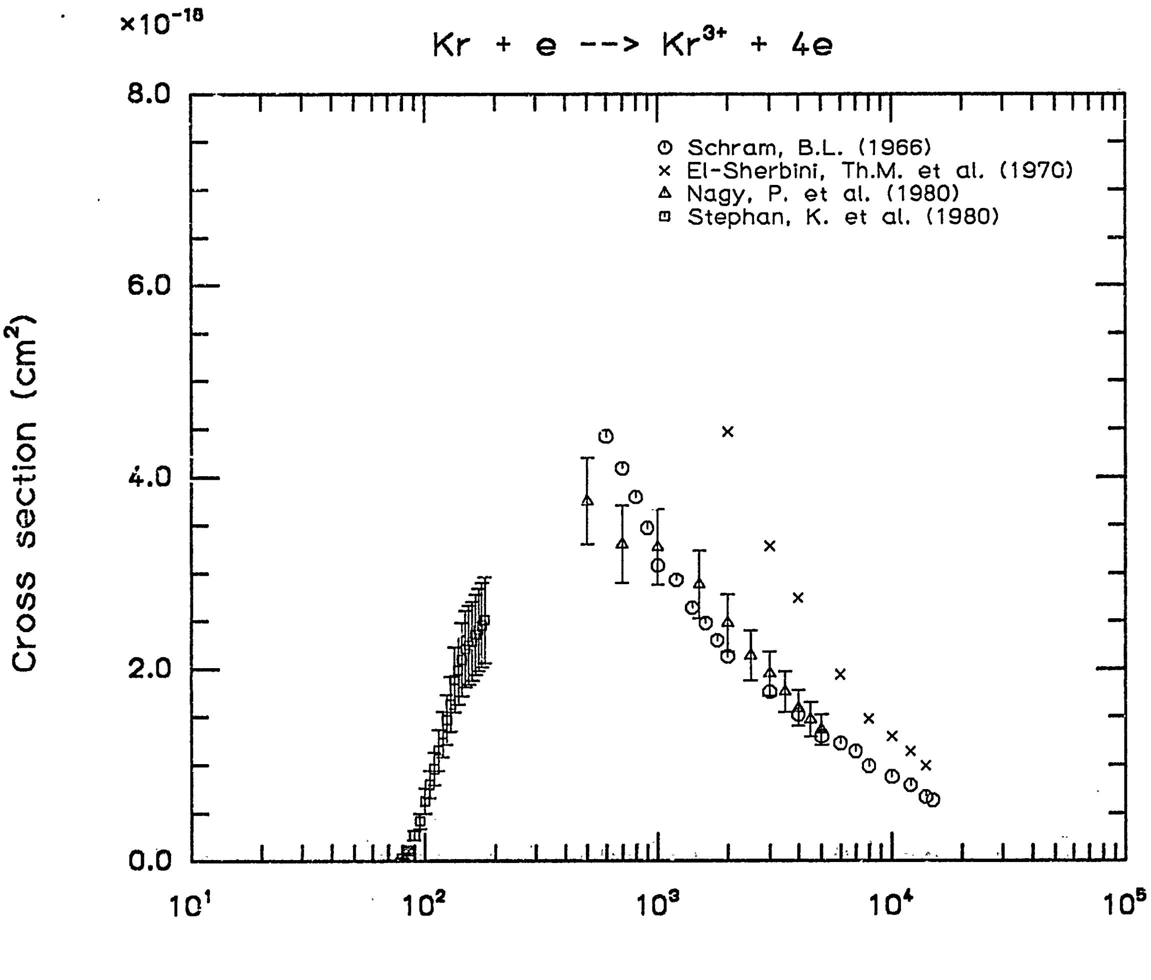
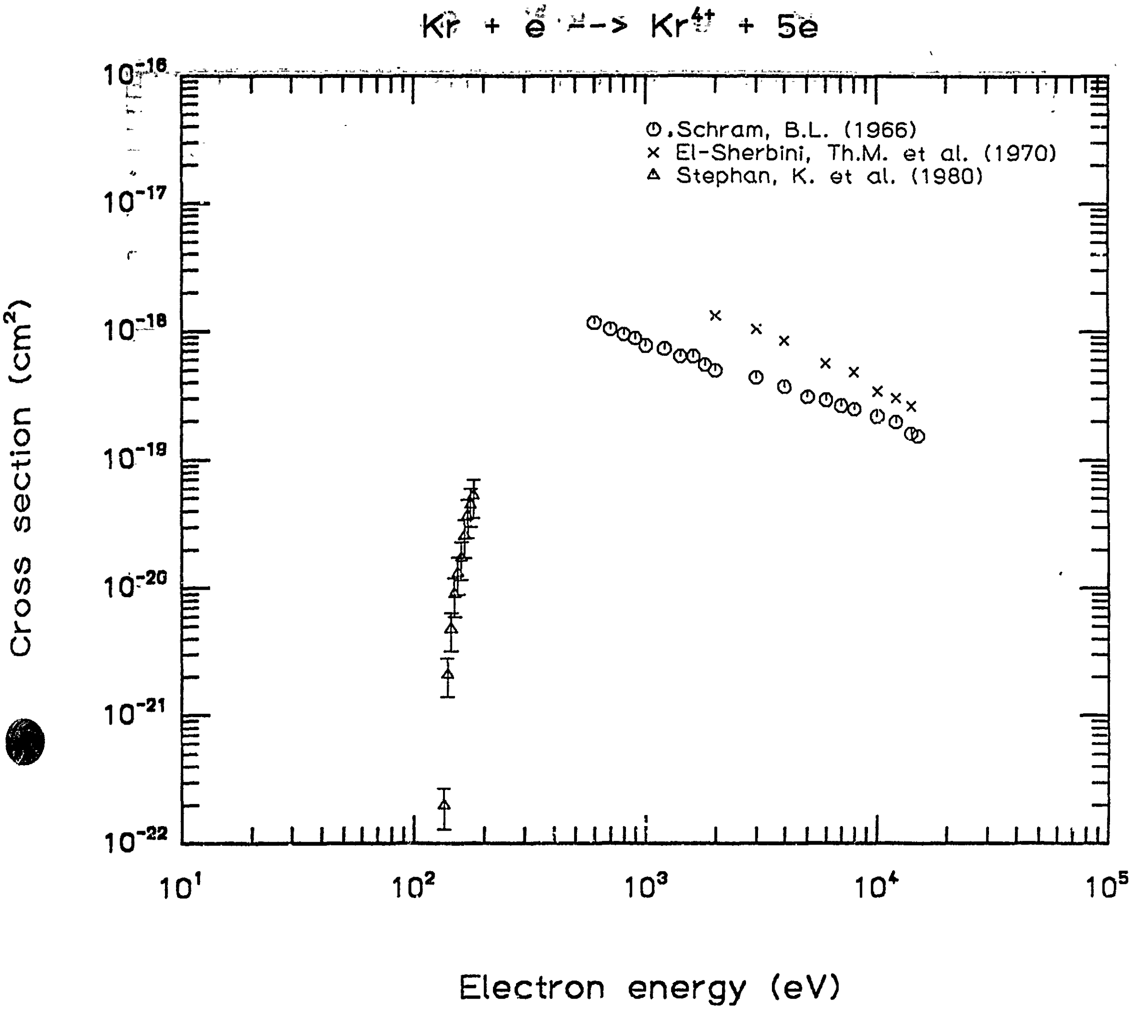

×10-18
Kr + e --> Kr3+ + 4e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Nagy, P. et al. (1980)
Stephan, K. et al. (1980)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
101
102
103
104
105
Electron energy (eV)

Fig. 188


Kr + e --> Kr^{4+} + 5e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Stephan, K. et al. (1980)
Cross section (cm^2)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^{-22}
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

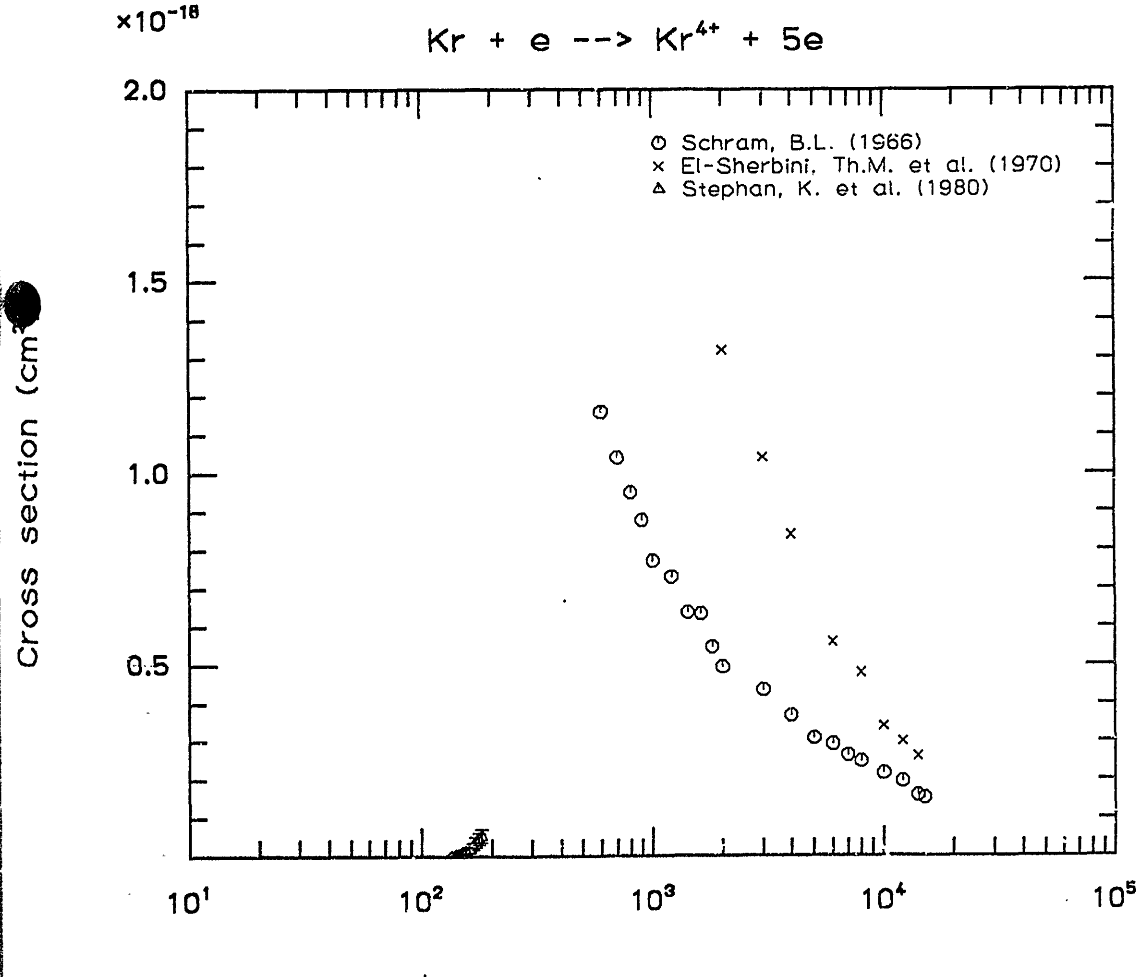
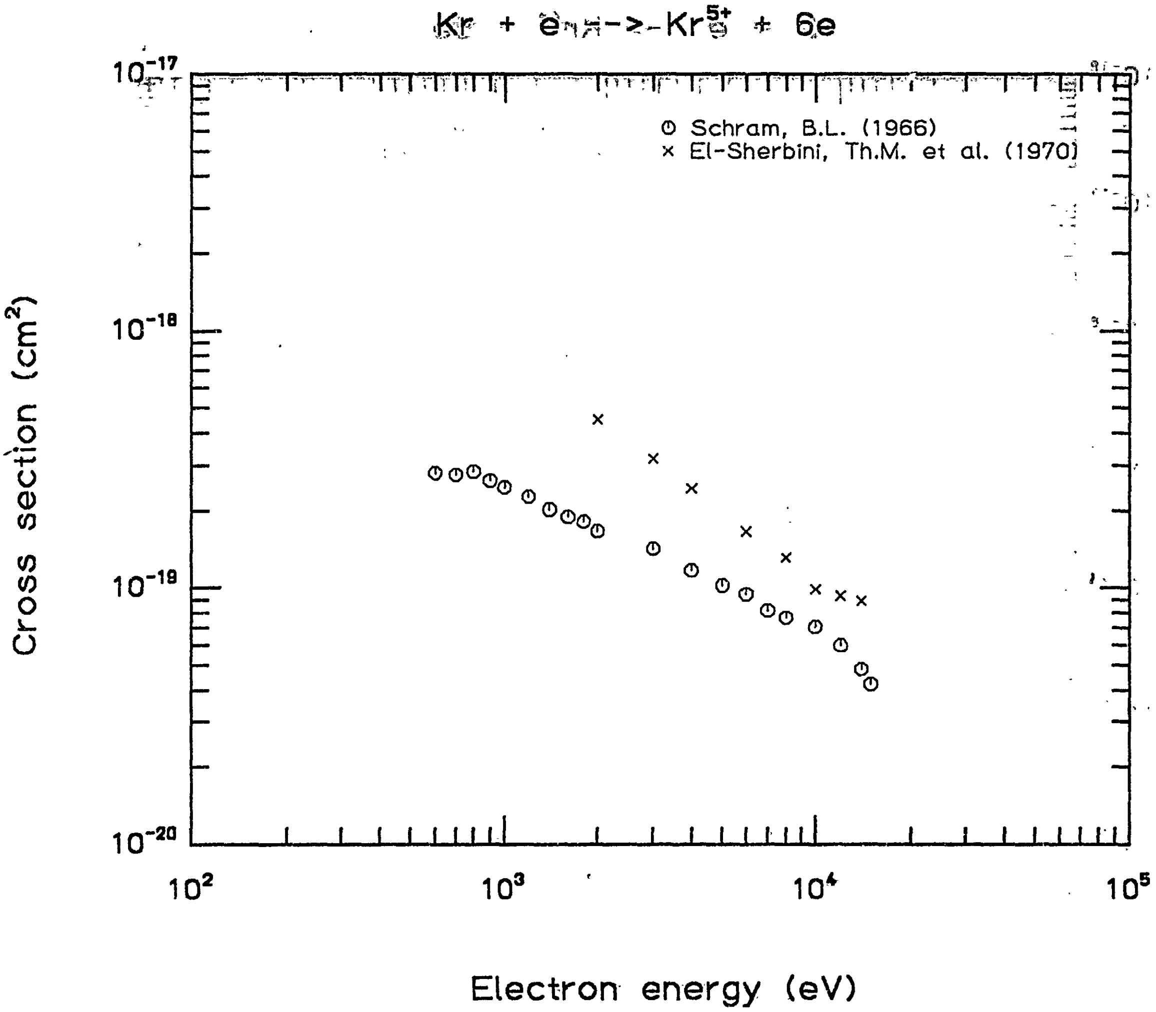
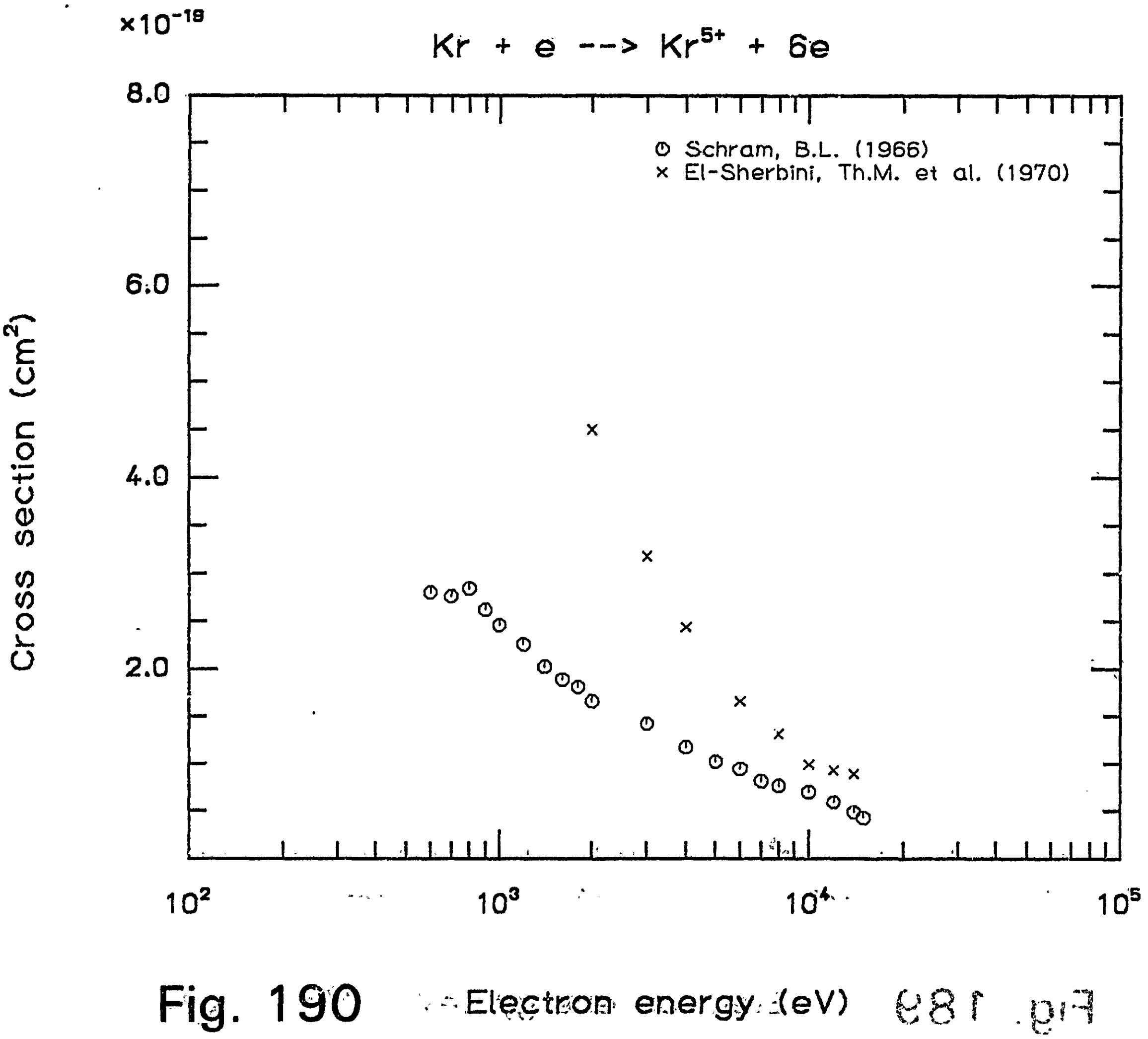

$\times 10^{-18}$
Kr + e --> Kr^{4+} + 5e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Stephan, K. et al. (1980)
Cross section (cm^2)
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 189



Kr + e --> Kr^{5+} + 6e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Cross section (cm^2)
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^2
10^3
10^4
10^5
Electron energy (eV)



$\times 10^{-19}$
Kr + e --> Kr^{5+} + 6e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Cross section (cm^2)
8.0
6.0
4.0
2.0
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 190

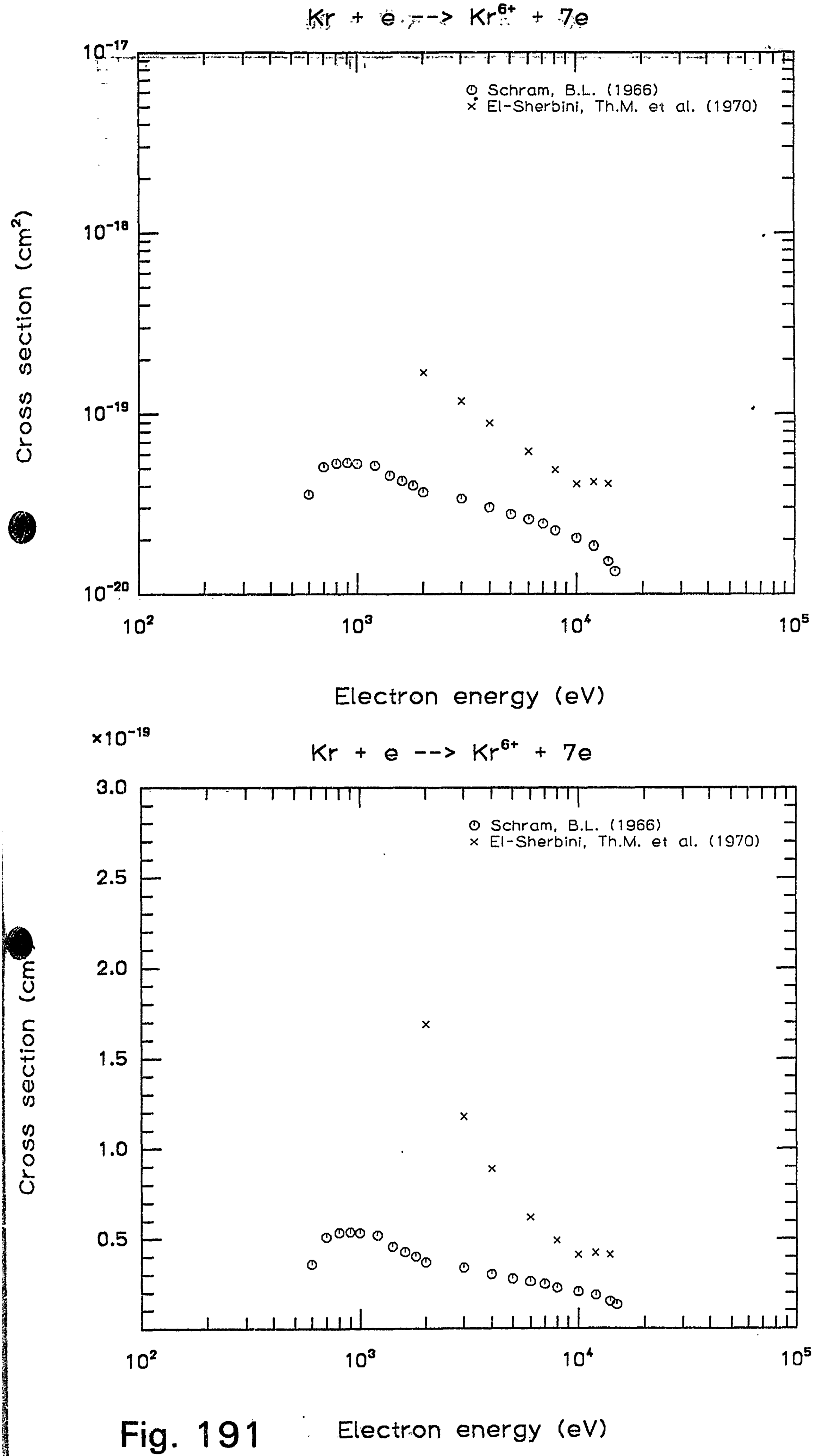
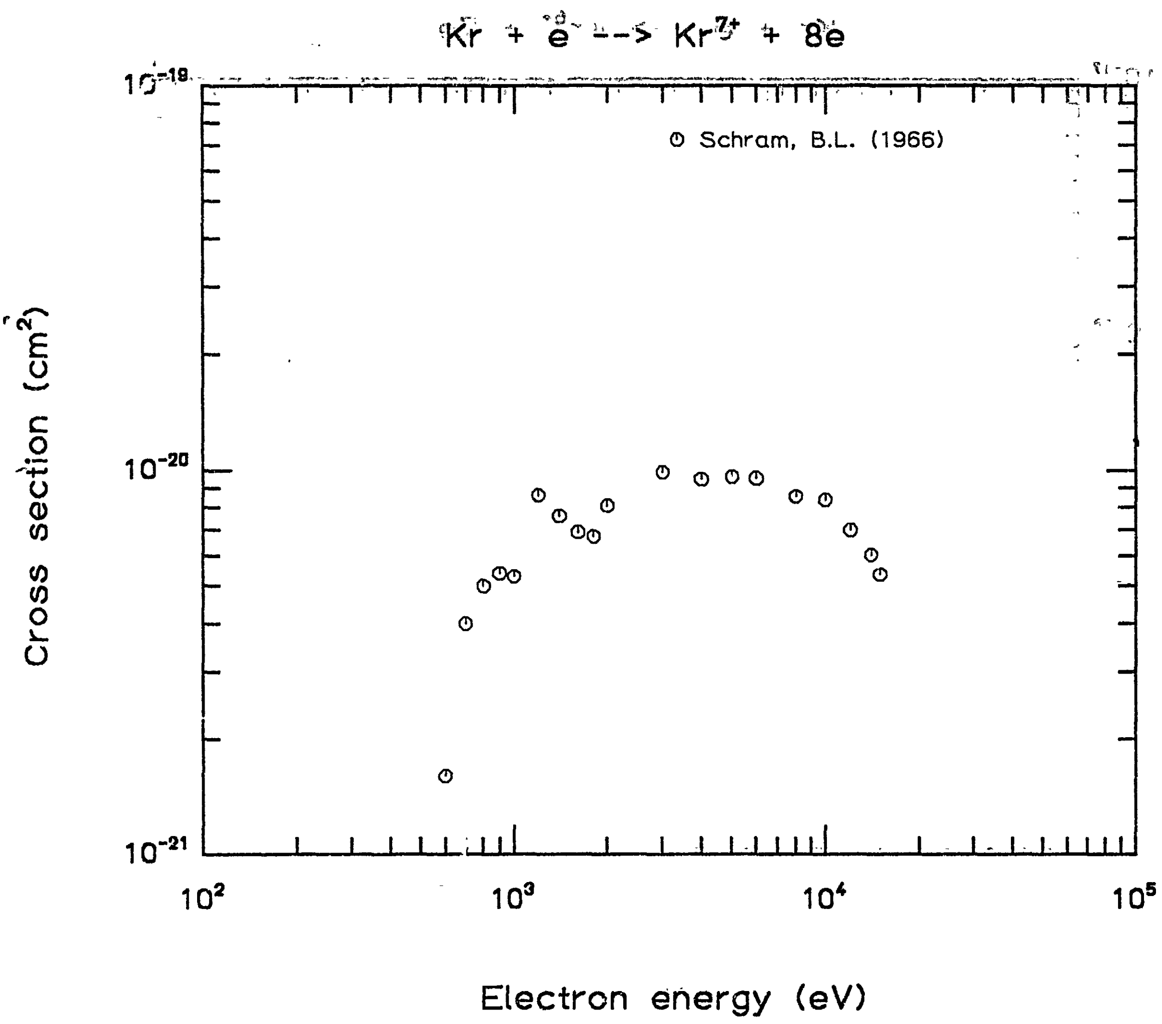

Kr + e --> Kr^{6+} + 7e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Cross section (cm^2)
Electron energy (eV)
×10^{-19}
Kr + e --> Kr^{6+} + 7e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Cross section (cm
Electron energy (eV)

Fig. 191


Kr + e --> Kr7+ + 8e
Schram, B.L. (1966)
Cross section (cm2)
10-19
10-20
10-21
102
103
104
105
Electron energy (eV)

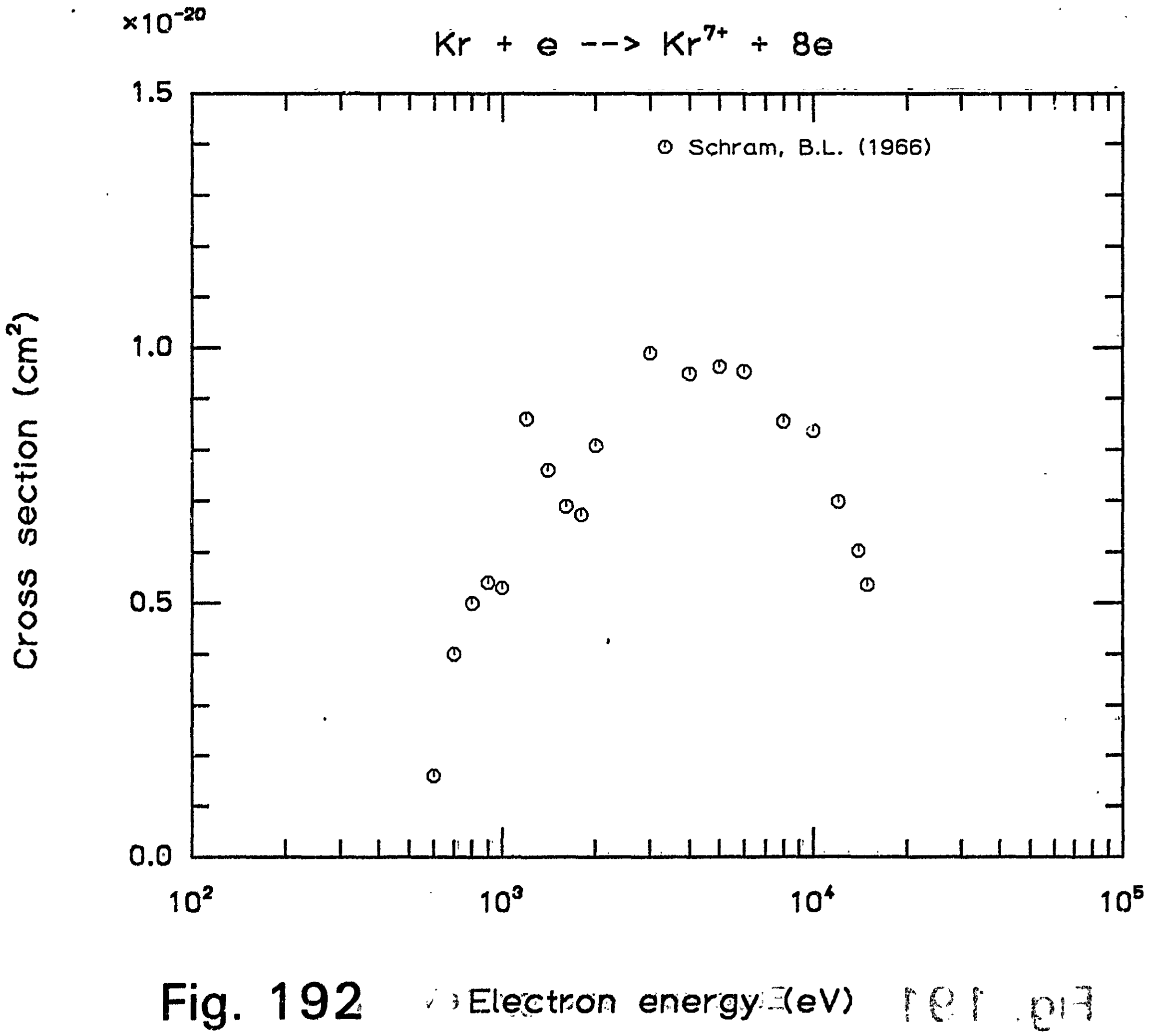
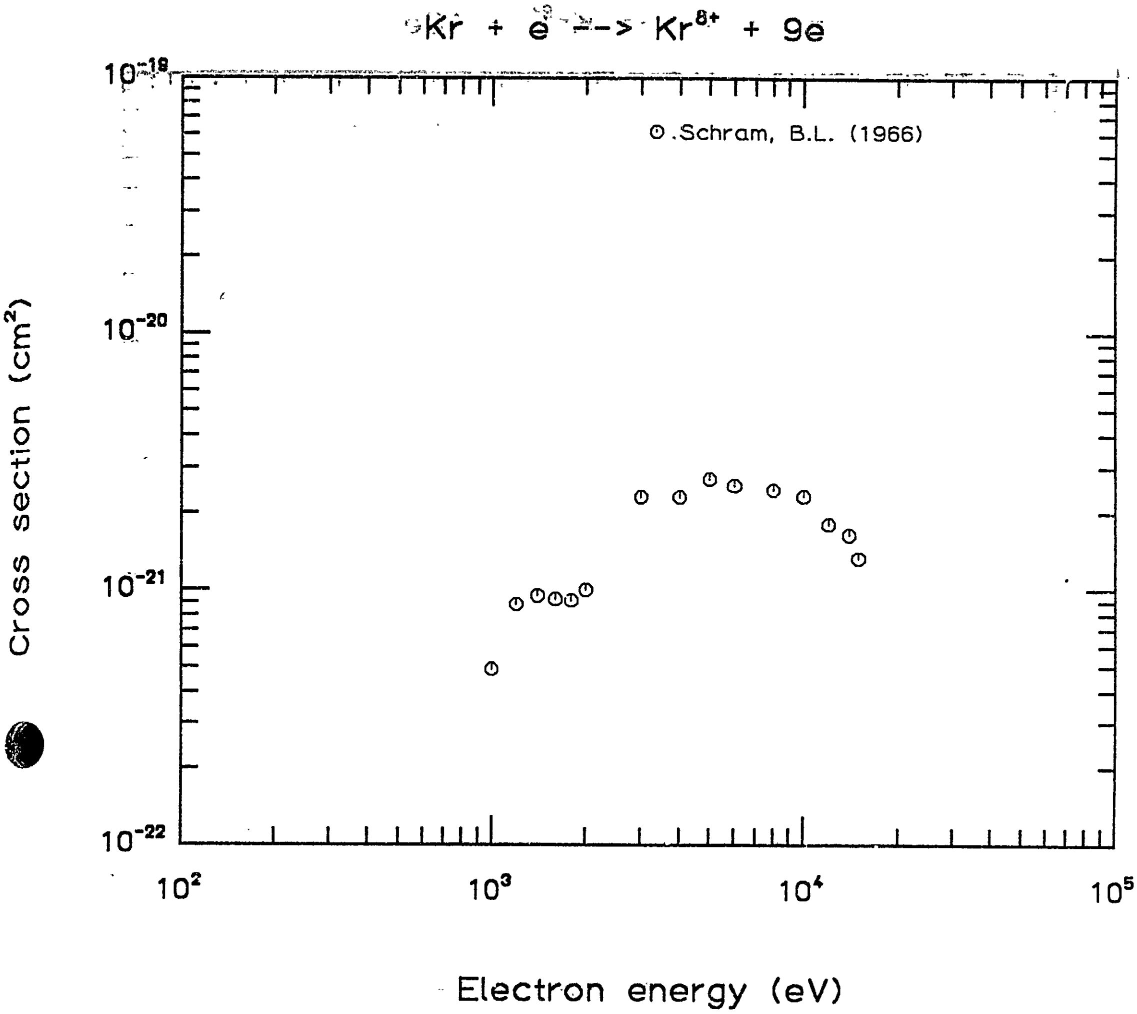

×10-20
Kr + e --> Kr7+ + 8e
Schram, B.L. (1966)
Cross section (cm2)
1.5
1.0
0.5
0.0
102
103
104
105
Electron energy (eV)

Fig. 192


Kr + e --> Kr8+ + 9e
Schram, B.L. (1966)
Cross section (cm2)
10-19
10-20
10-21
10-22
102
103
104
105
Electron energy (eV)

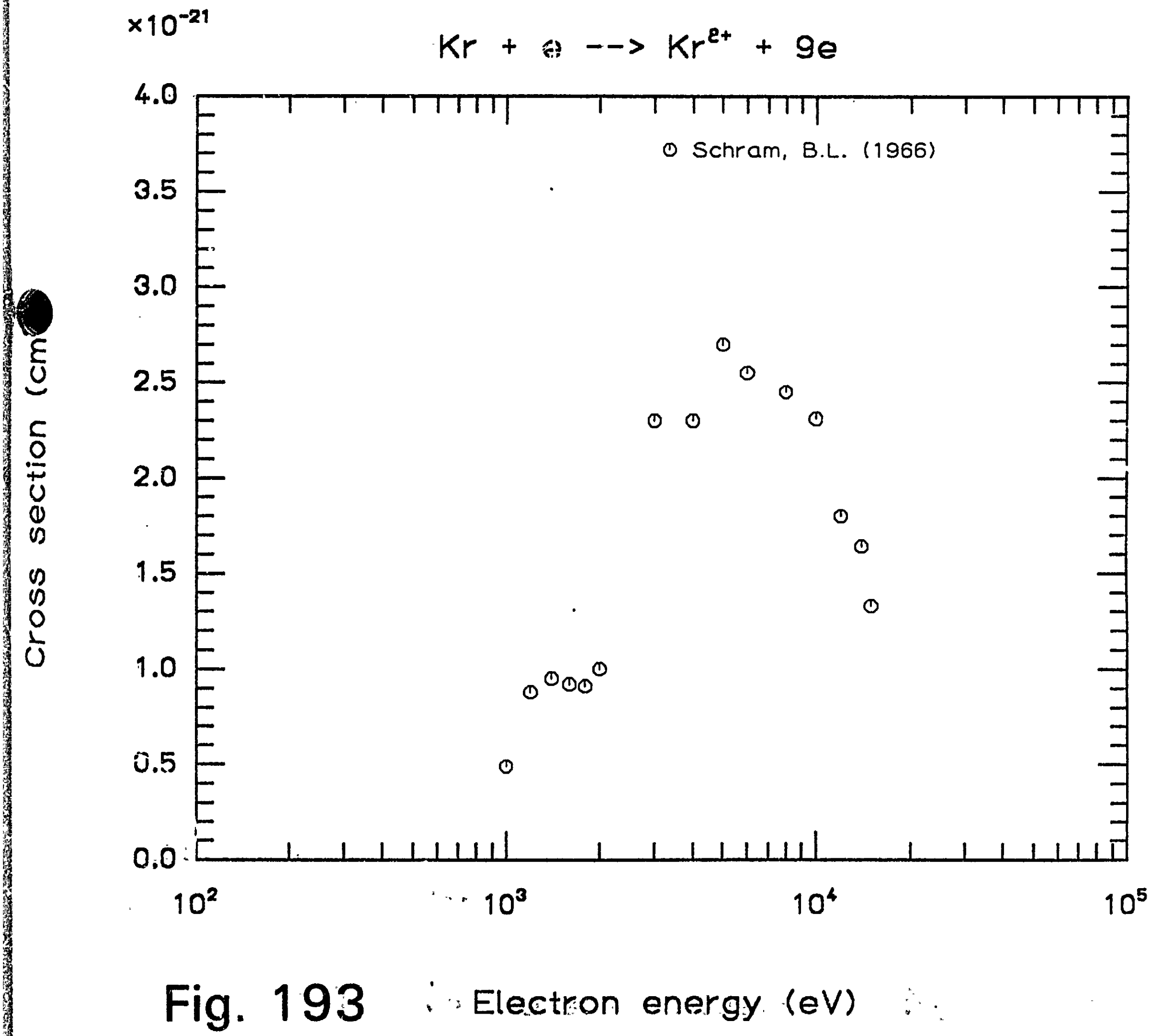
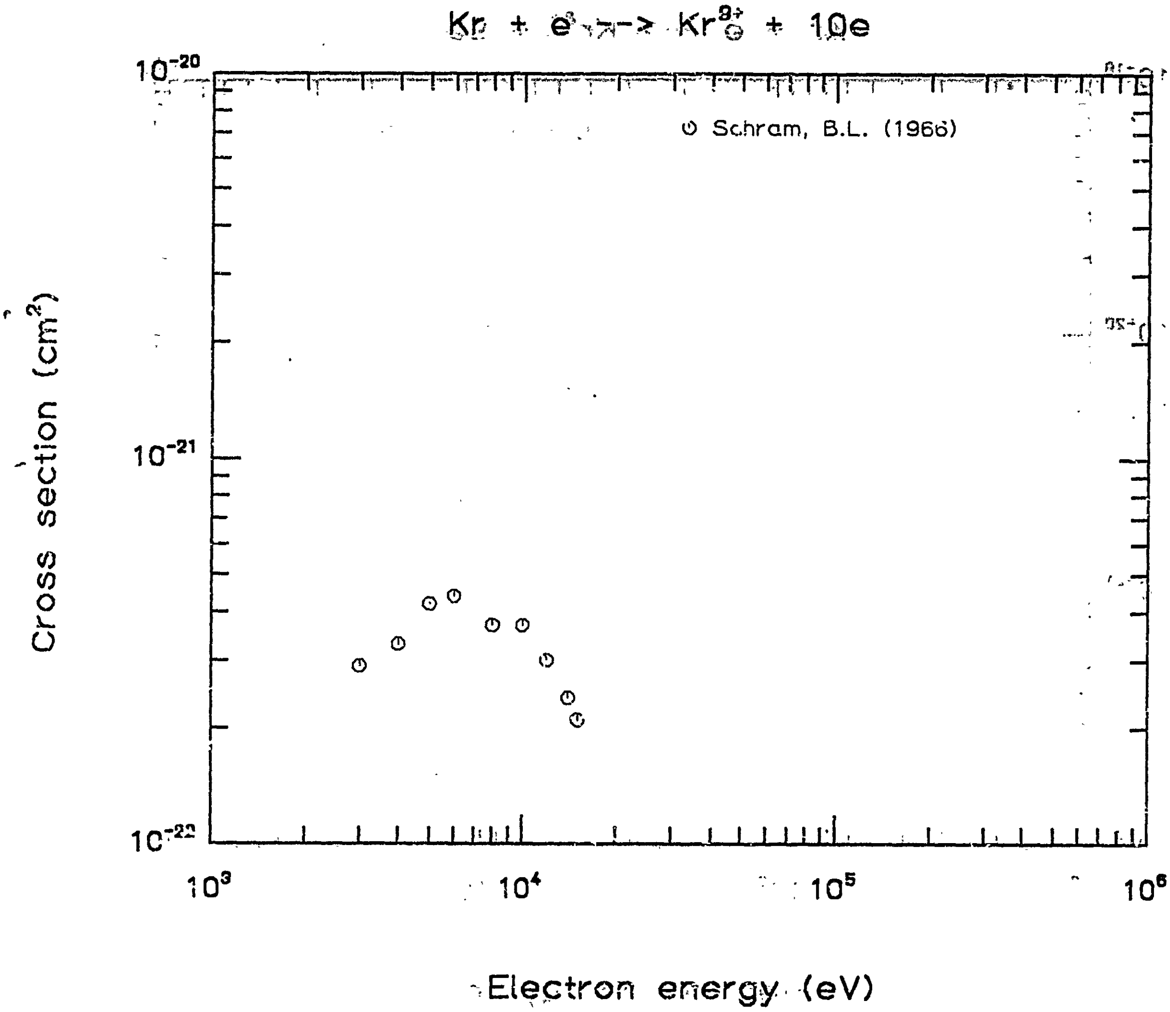

×10-21
Kr + e --> Kr8+ + 9e
Schram, B.L. (1966)
Cross section (cm2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
102
103
104
105
Electron energy (eV)

Fig. 193


Kr + e ---> Kr9+ + 10e
Schram, B.L. (1966)
Cross section (cm2)
10-20
10-21
10-22
103
104
105
106
Electron energy (eV)

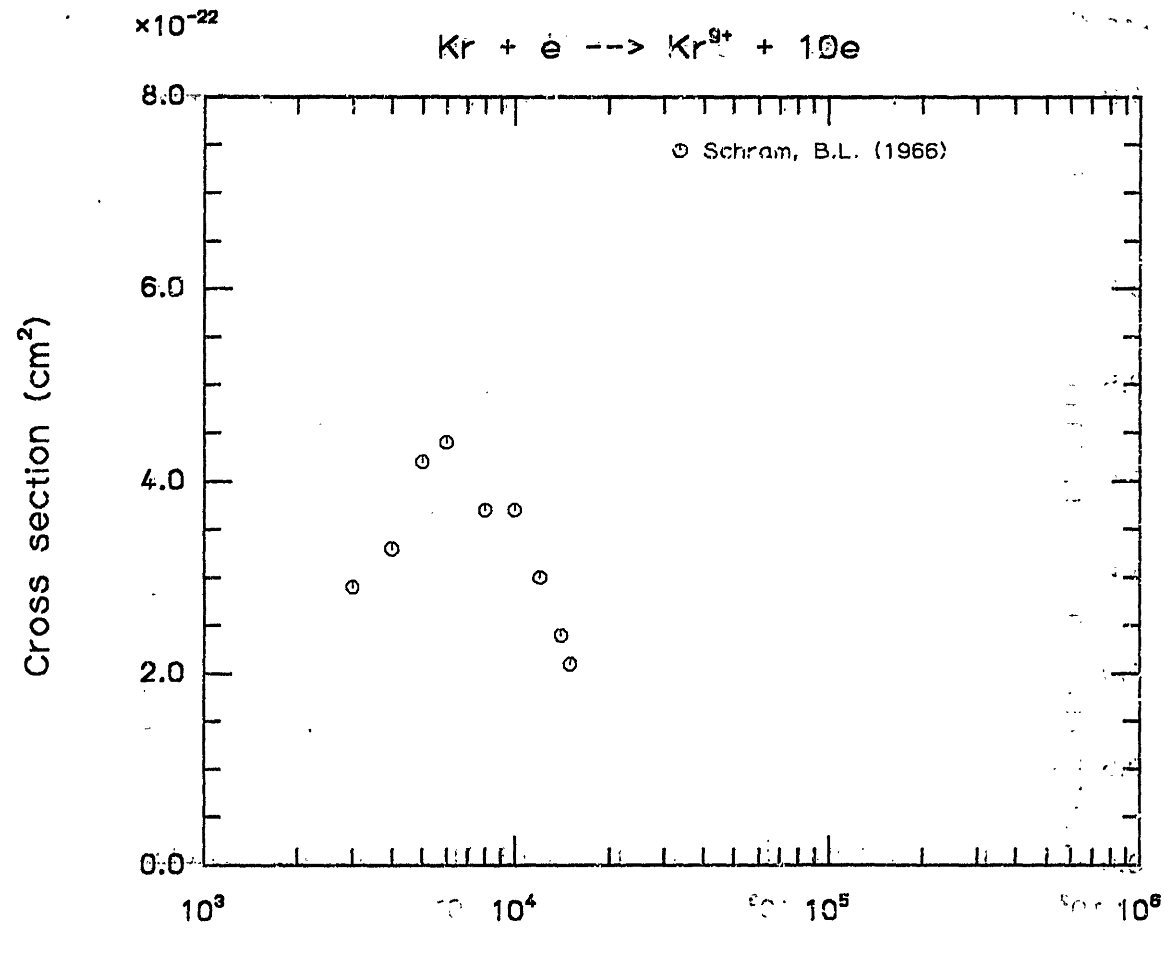
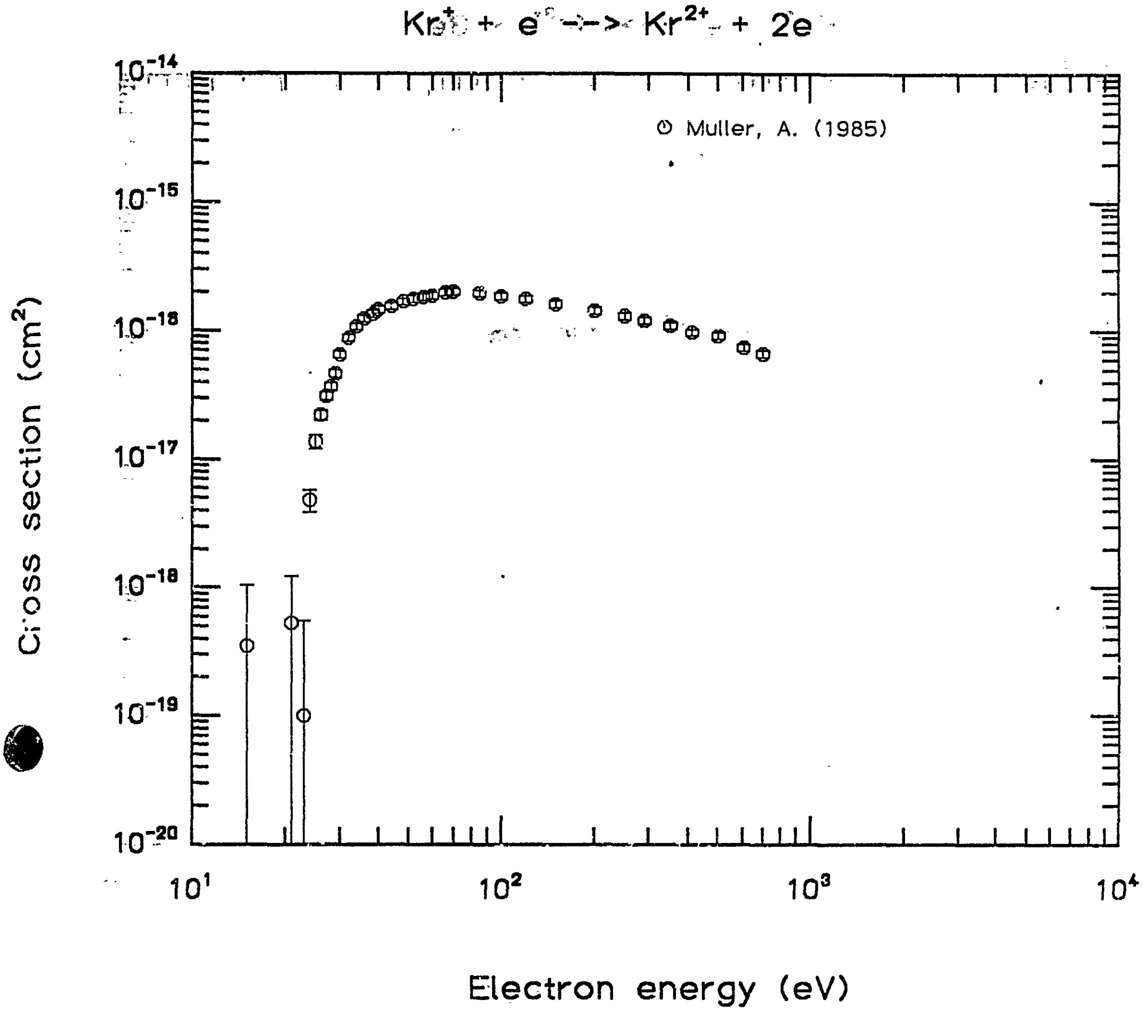

×10-22
Kr + e ---> Kr9+ + 10e
Schram, B.L. (1966)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
103
104
105
106
Electron energy (eV)

Fig. 194



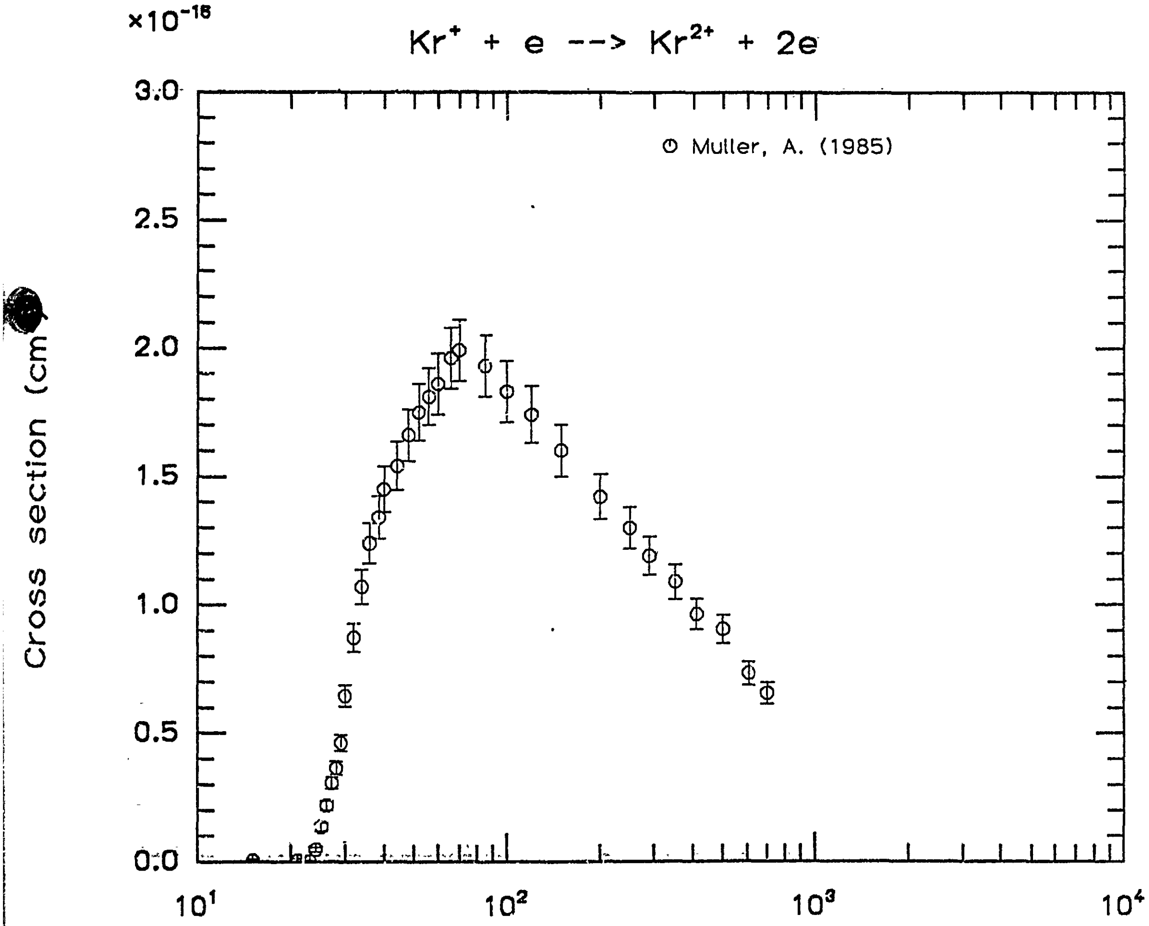


Fig. 195 Electron energy (eV)

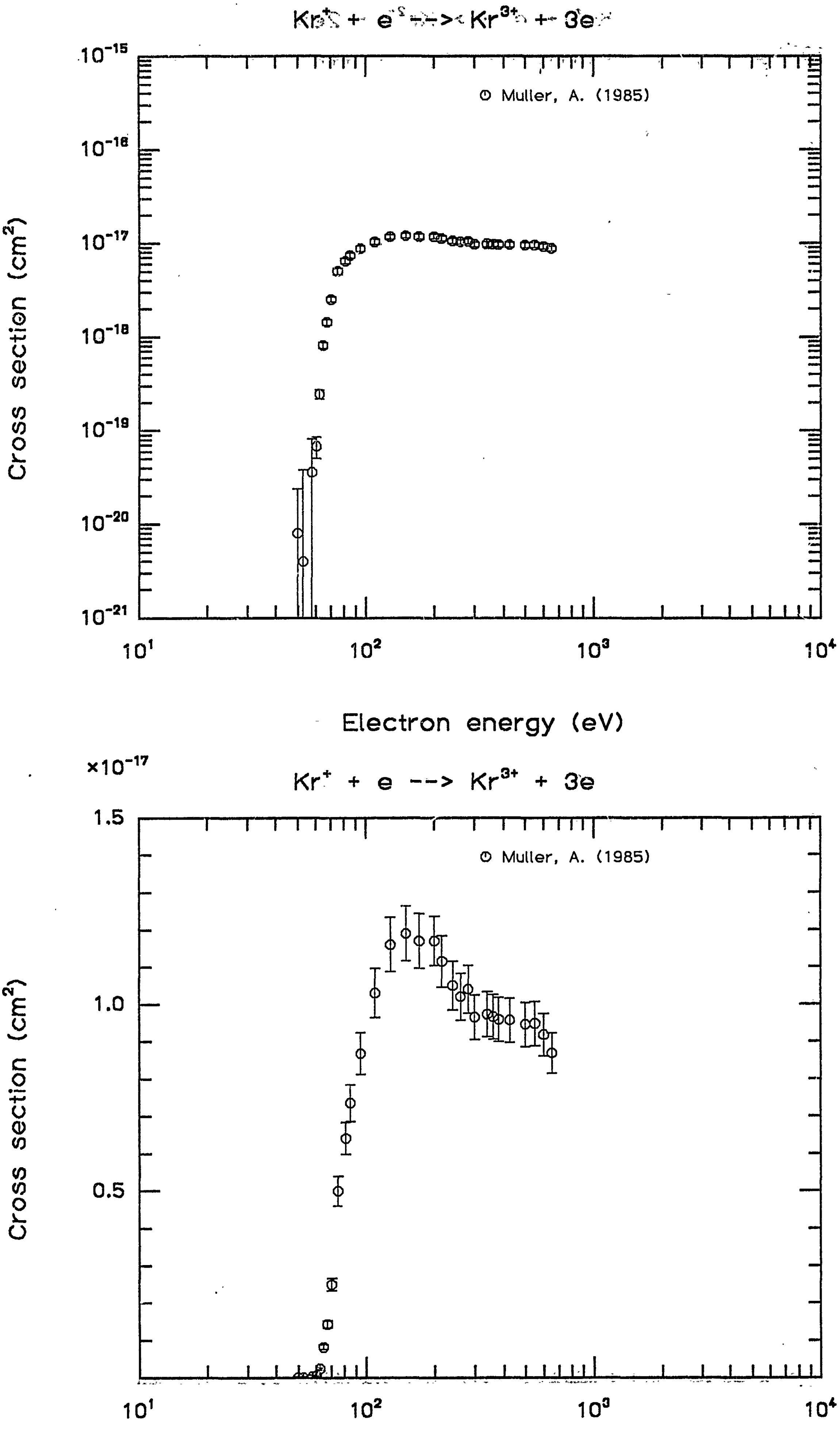
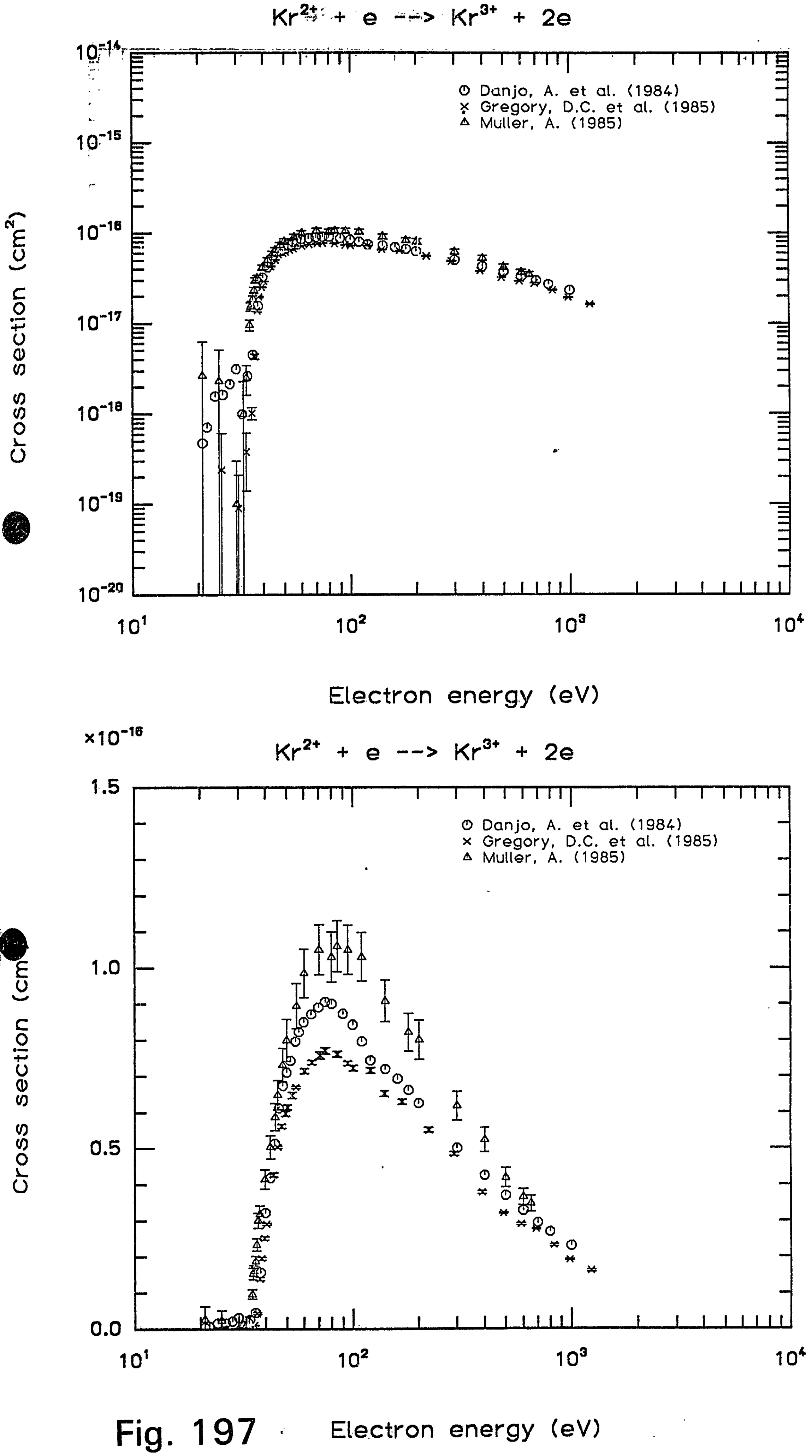
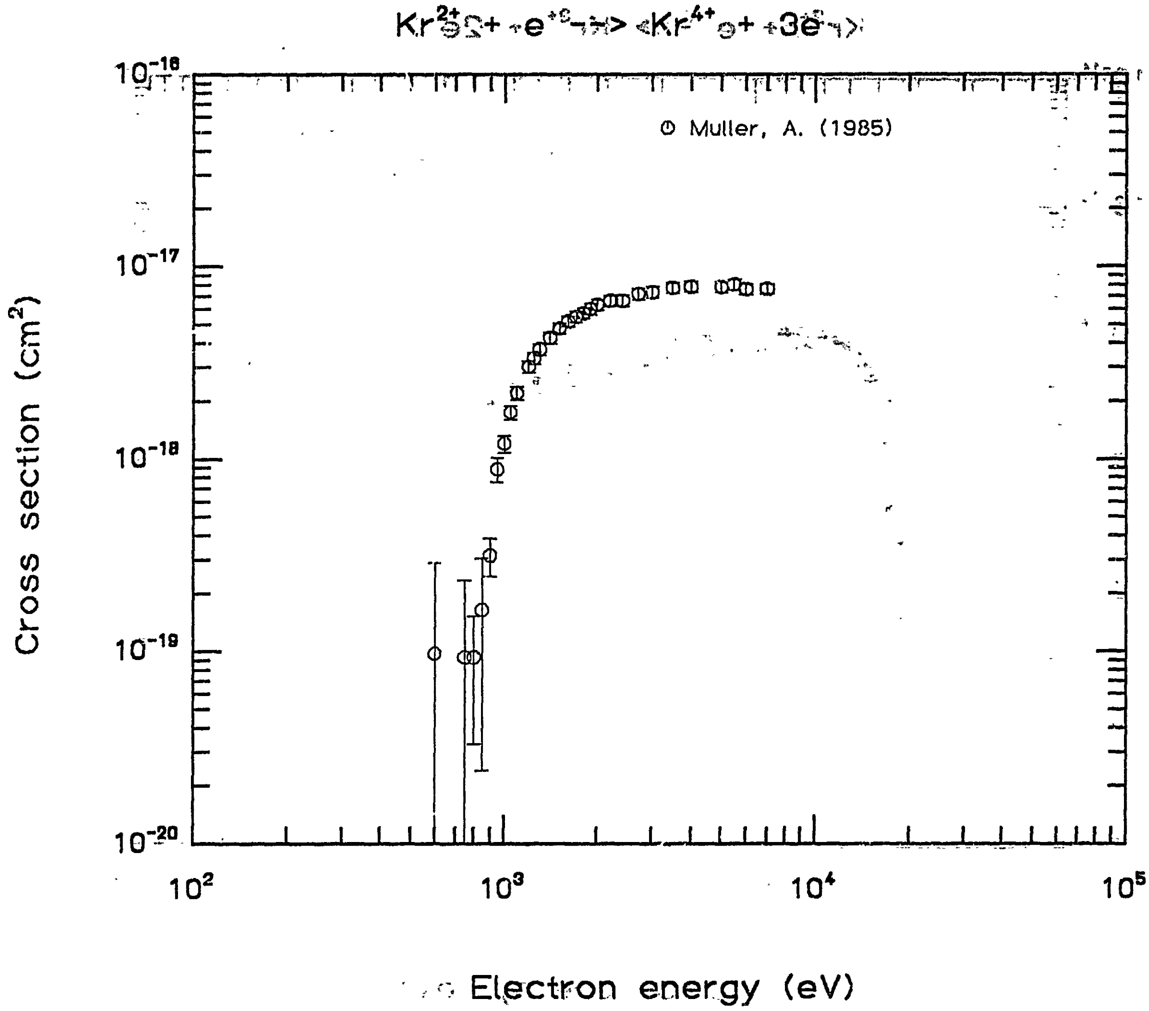

Kr+ + e --> Kr3+ + 3e
Muller, A. (1985)
Cross section (cm2)
10-15
10-16
10-17
10-18
10-19
10-20
10-21
101
102
103
104
Electron energy (eV)
×10-17
Kr+ + e --> Kr3+ + 3e
Muller, A. (1985)
Cross section (cm2)
1.5
1.0
0.5
101
102
103
104
Electron energy (eV)

Fig. 196



Kr2+ + e --> Kr3+ + 2e
Danjo, A. et al. (1984)
Gregory, D.C. et al. (1985)
Muller, A. (1985)
Cross section (cm2)
10-14
10-15
10-16
10-17
10-18
10-19
10-20
10^1
10^2
10^3
10^4
Electron energy (eV)
×10-16
Kr2+ + e --> Kr3+ + 2e
Danjo, A. et al. (1984)
Gregory, D.C. et al. (1985)
Muller, A. (1985)
Cross section (cm2)
1.5
1.0
0.5
0.0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 197


Kr2+ + e --> Kr4+ + 3e
Muller, A. (1985)
Cross section (cm2)
10-16
10-17
10-18
10-19
10-20
102
103
104
105
Electron energy (eV)

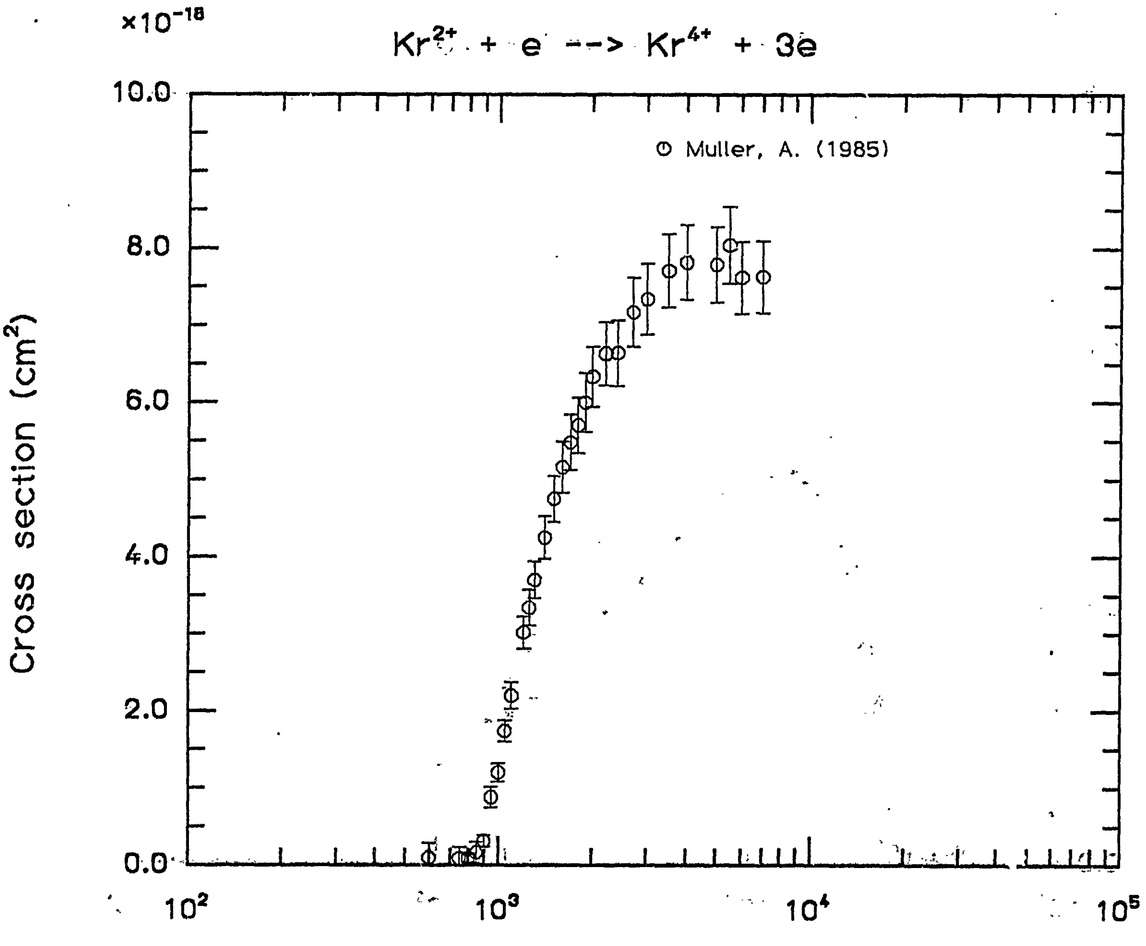
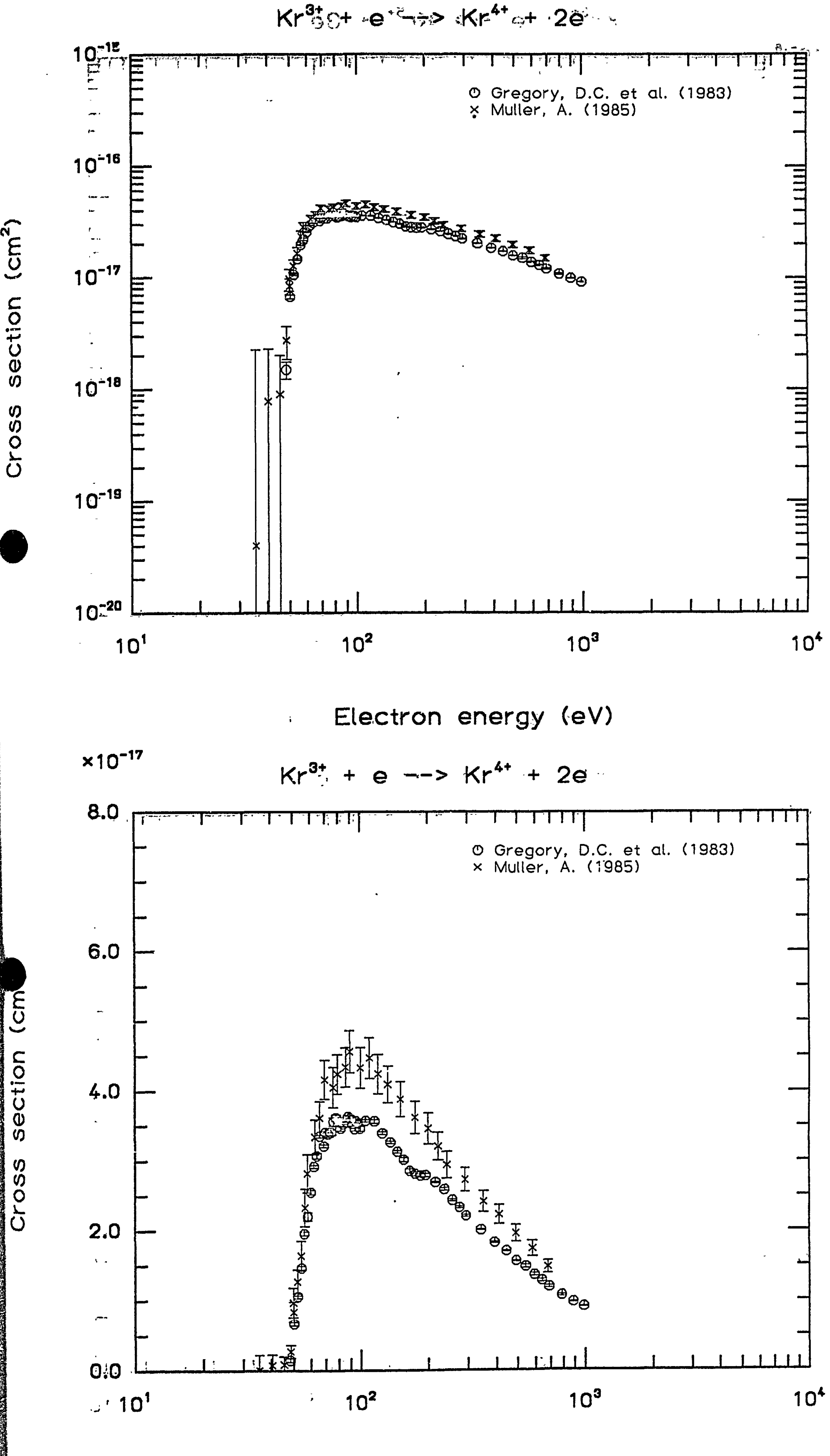

×10-18
Kr2+ + e --> Kr4+ + 3e
Muller, A. (1985)
Cross section (cm2)
10.0
8.0
6.0
4.0
2.0
0.0
102
103
104
105
Electron energy (eV)

Fig. 198



Kr^{3+} + e --> Kr^{4+} + 2e
Gregory, D.C. et al. (1983)
Muller, A. (1985)
Cross section (cm^2)
Electron energy (eV)
Kr^{3+} + e --> Kr^{4+} + 2e
×10^{-17}
Gregory, D.C. et al. (1983)
Muller, A. (1985)
Cross section (cm
Electron energy (eV)

Fig. 199

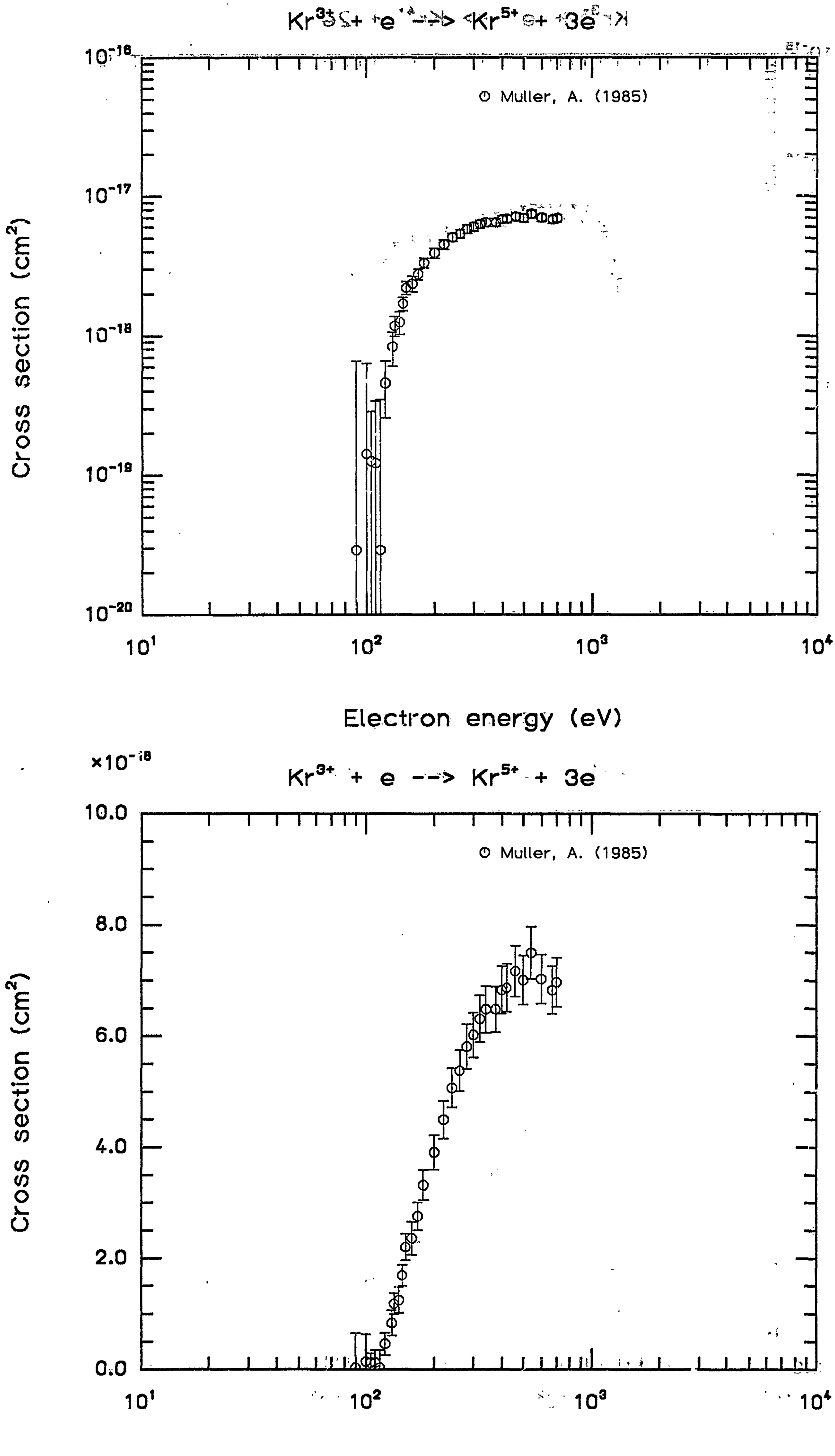
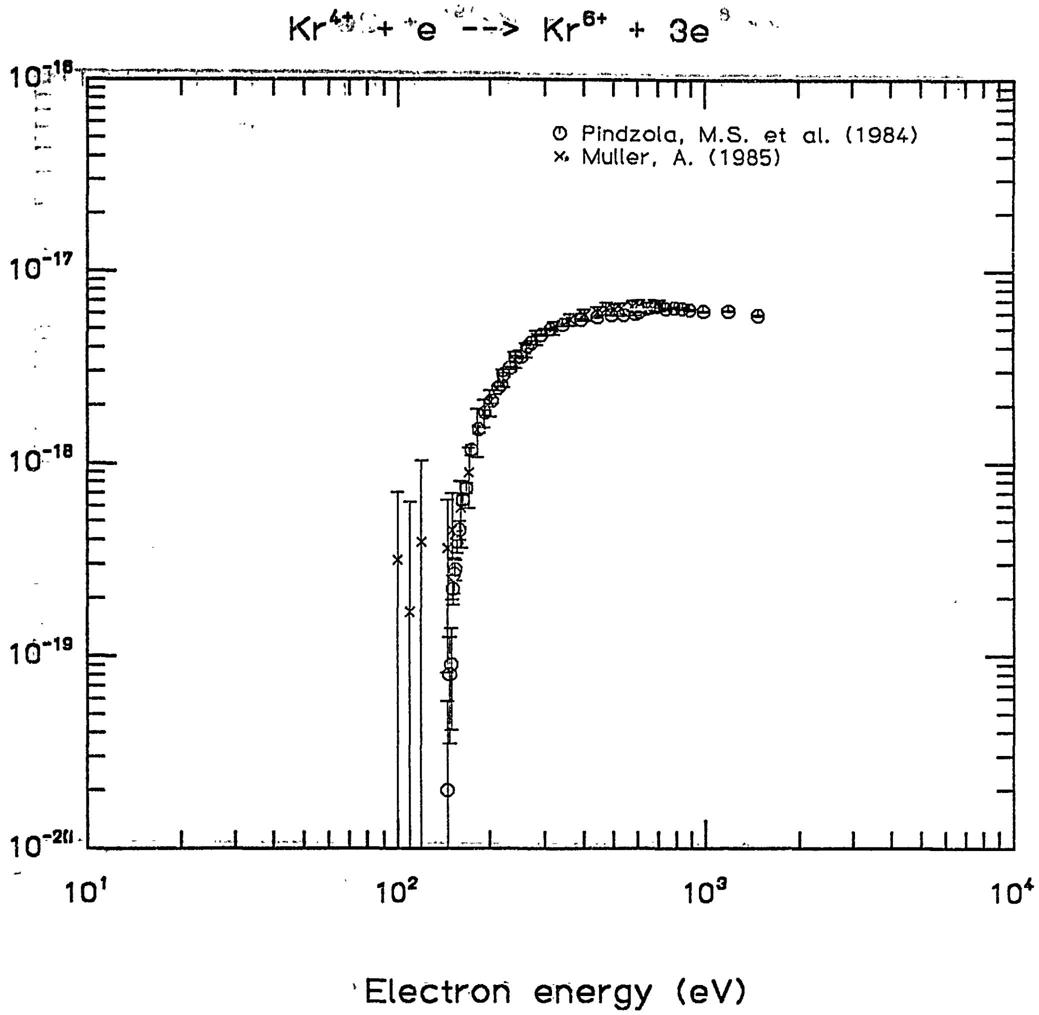
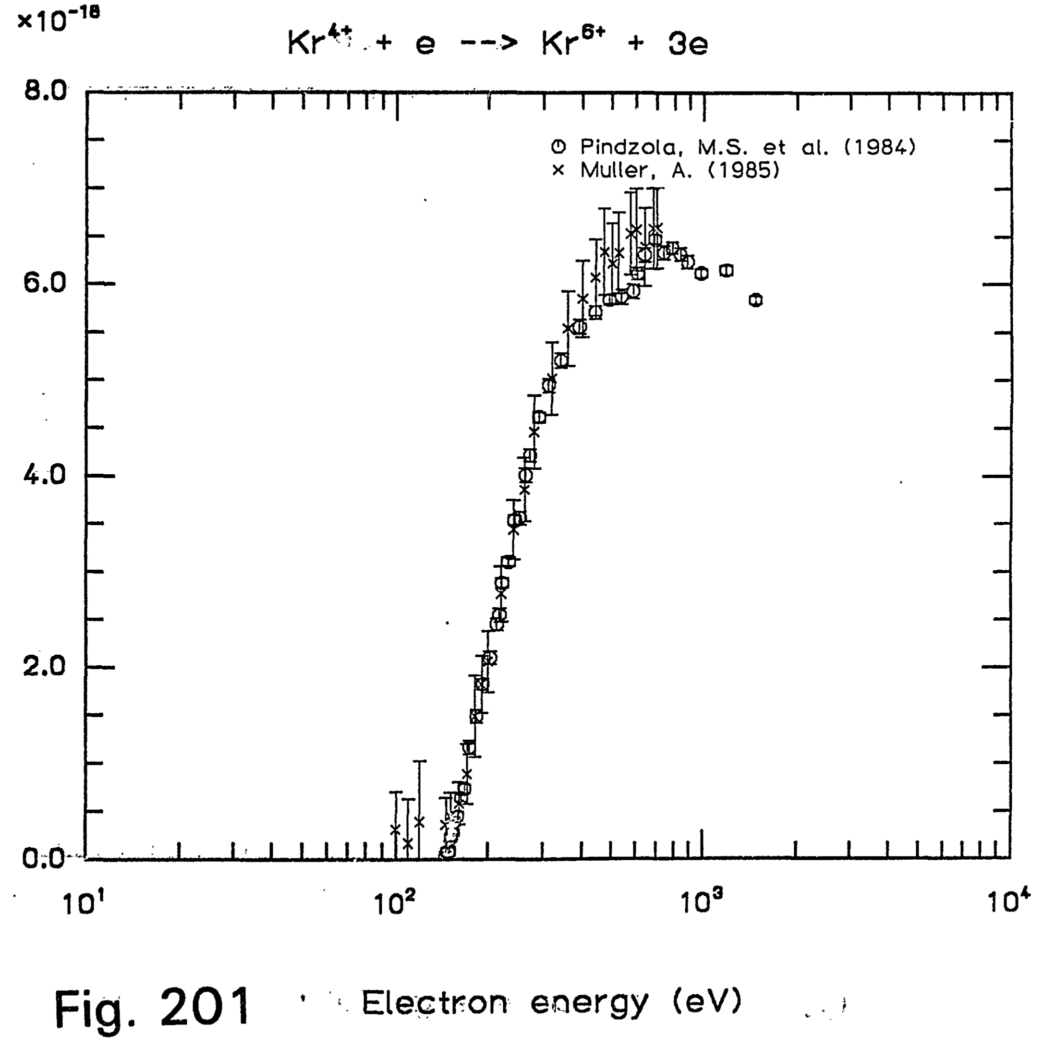


Fig. 200 Electron energy (eV)

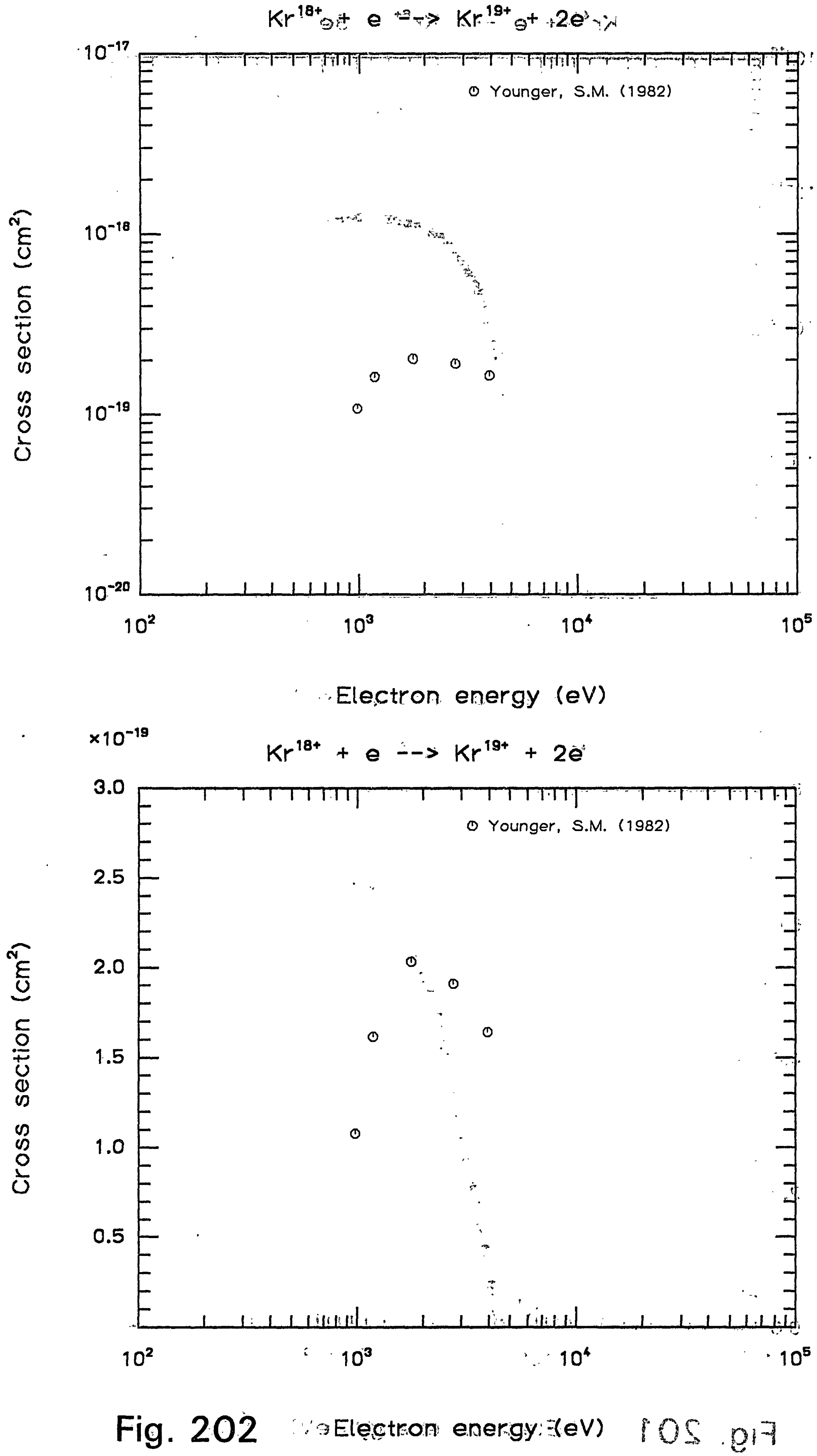


Kr4+ + e --> Kr6+ + 3e
O Pindzola, M.S. et al. (1984)
× Muller, A. (1985)
Cross section (cm2)
10-16
10-17
10-18
10-19
10-20
101
102
103
104
Electron energy (eV)



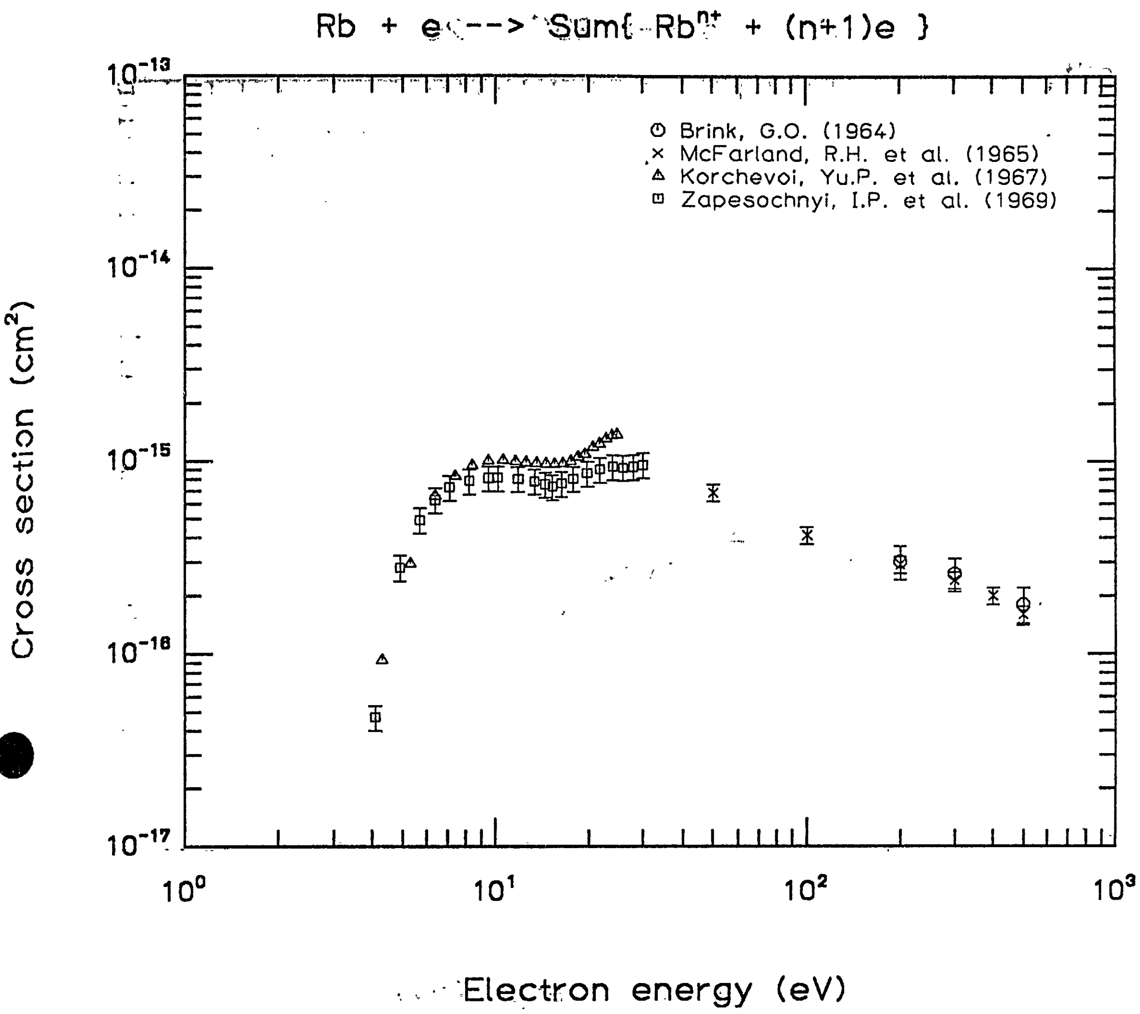
×10-18
Kr4+ + e --> Kr6+ + 3e
O Pindzola, M.S. et al. (1984)
× Muller, A. (1985)
Cross section (cm
8.0
6.0
4.0
2.0
0.0
101
102
103
104
Electron energy (eV)

Fig. 201

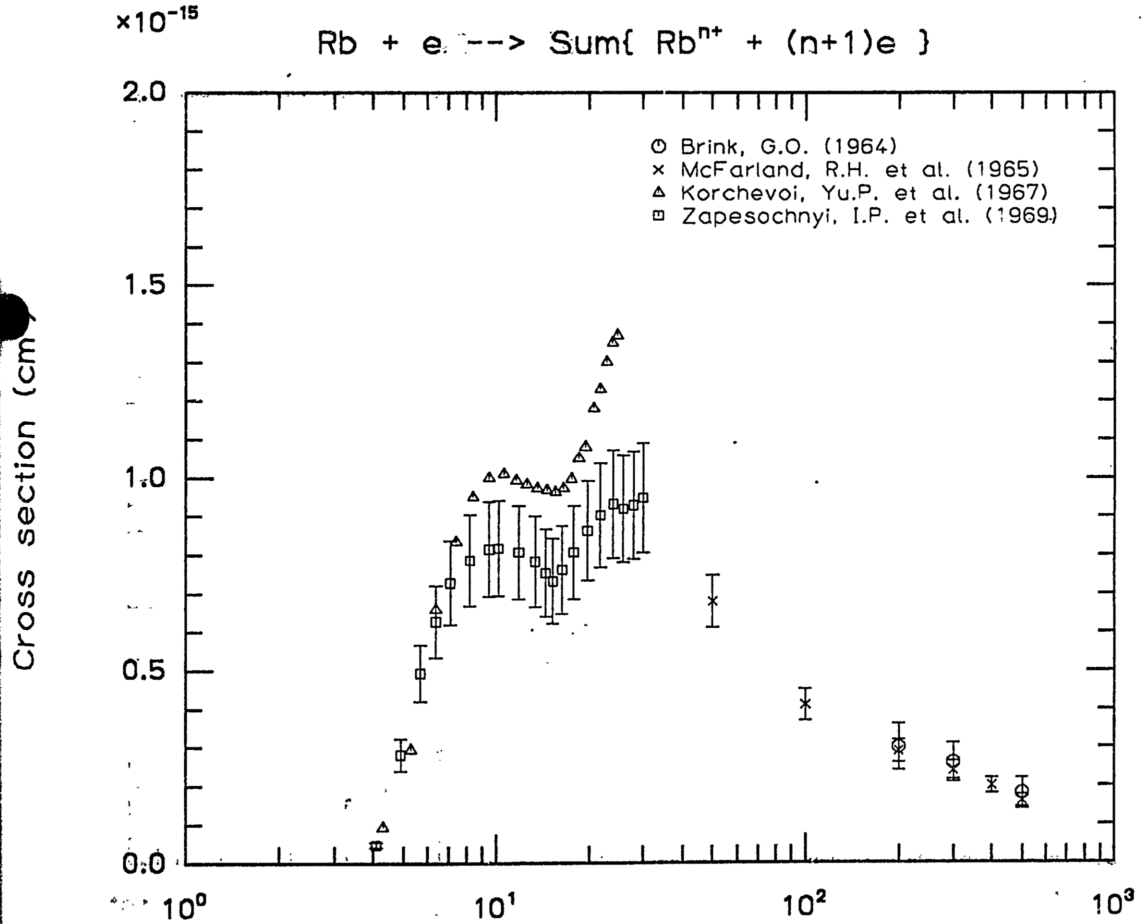


Kr18+ + e --> Kr19+ + 2e
Younger, S.M. (1982)
10-17
10-18
10-19
10-20
Cross section (cm2)
10^2
10^3
10^4
10^5
Electron energy (eV)
×10-19
Kr18+ + e --> Kr19+ + 2e
Younger, S.M. (1982)
3.0
2.5
2.0
1.5
1.0
0.5
Cross section (cm2)
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 202



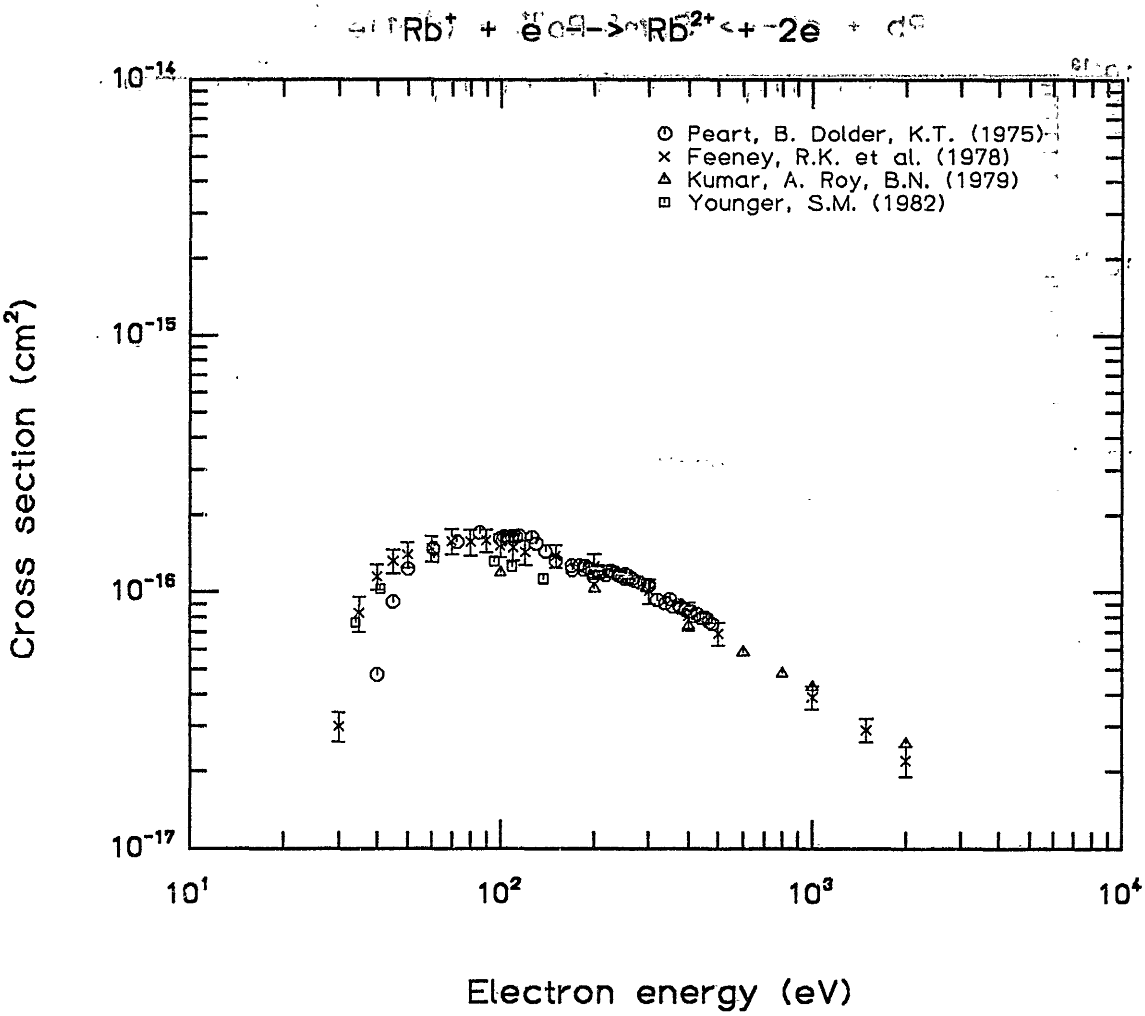
Rb + e --> Sum{ Rb^{n+} + (n+1)e }
Brink, G.O. (1964)
McFarland, R.H. et al. (1965)
Korchevoi, Yu.P. et al. (1967)
Zapesochnyi, I.P. et al. (1969)
Cross section (cm^2)
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^0
10^1
10^2
10^3
Electron energy (eV)



$\times 10^{-15}$
Rb + e --> Sum{ Rb^{n+} + (n+1)e }
Brink, G.O. (1964)
McFarland, R.H. et al. (1965)
Korchevoi, Yu.P. et al. (1967)
Zapesochnyi, I.P. et al. (1969)
Cross section (cm
2.0
1.5
1.0
0.5
0.0
10^0
10^1
10^2
10^3

Fig. 203

Electron energy (eV)


Rb⁺ + e --> Rb²⁺ + 2e
Peart, B. Dolder, K.T. (1975)
Feeney, R.K. et al. (1978)
Kumar, A. Roy, B.N. (1979)
Younger, S.M. (1982)
Cross section (cm²)
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10¹
10²
10³
10⁴
Electron energy (eV)

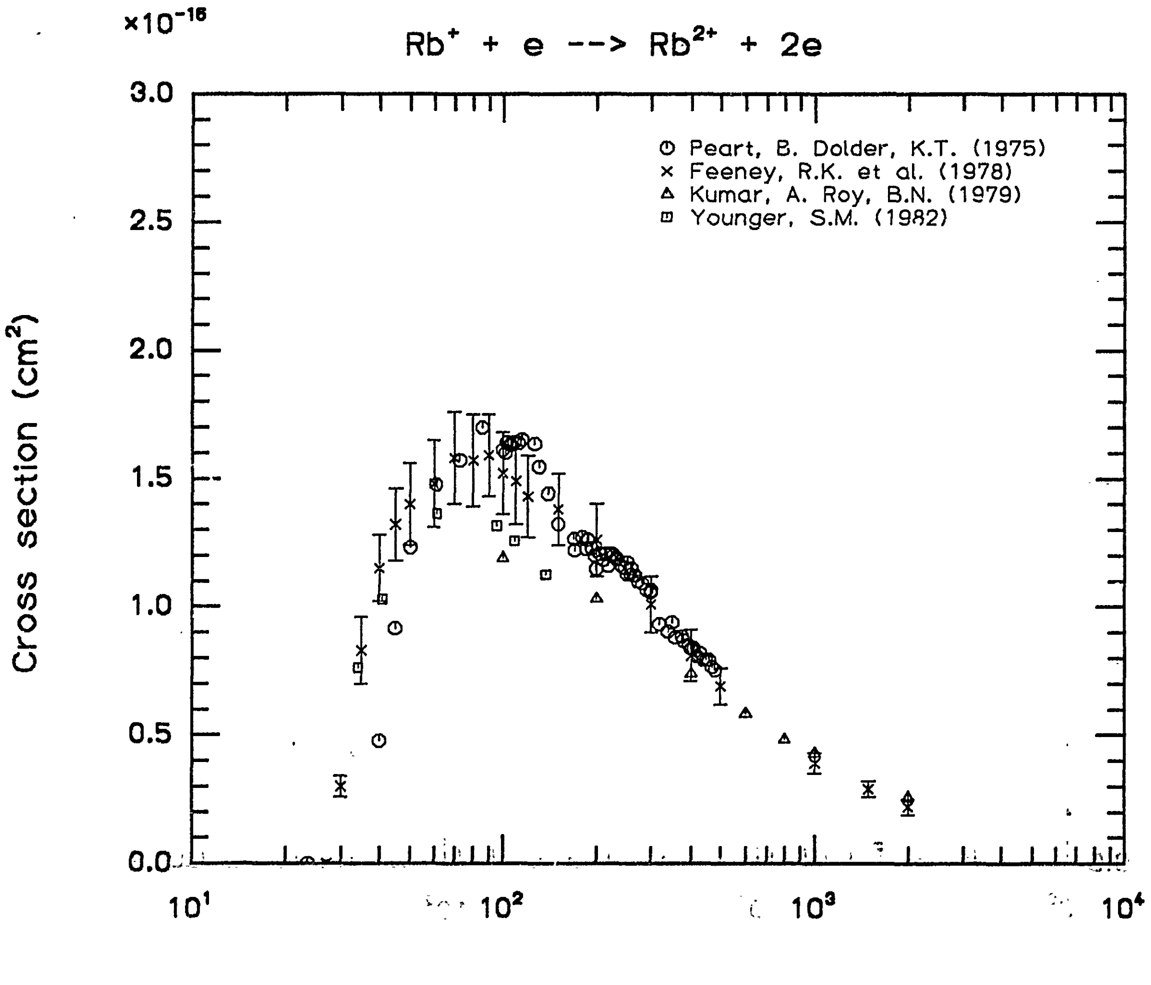
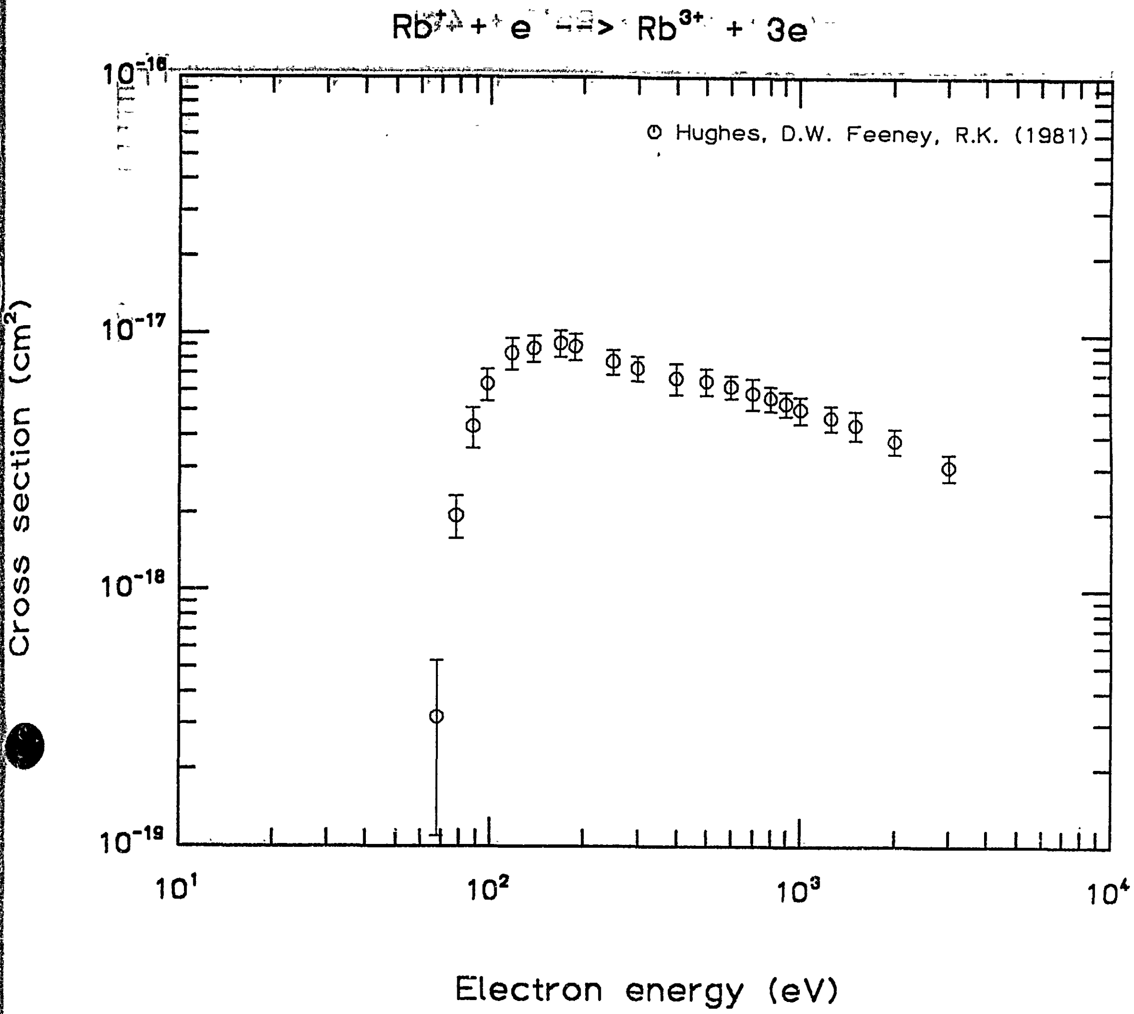

×10⁻¹⁶
Rb⁺ + e --> Rb²⁺ + 2e
Peart, B. Dolder, K.T. (1975)
Feeney, R.K. et al. (1978)
Kumar, A. Roy, B.N. (1979)
Younger, S.M. (1982)
Cross section (cm²)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 204



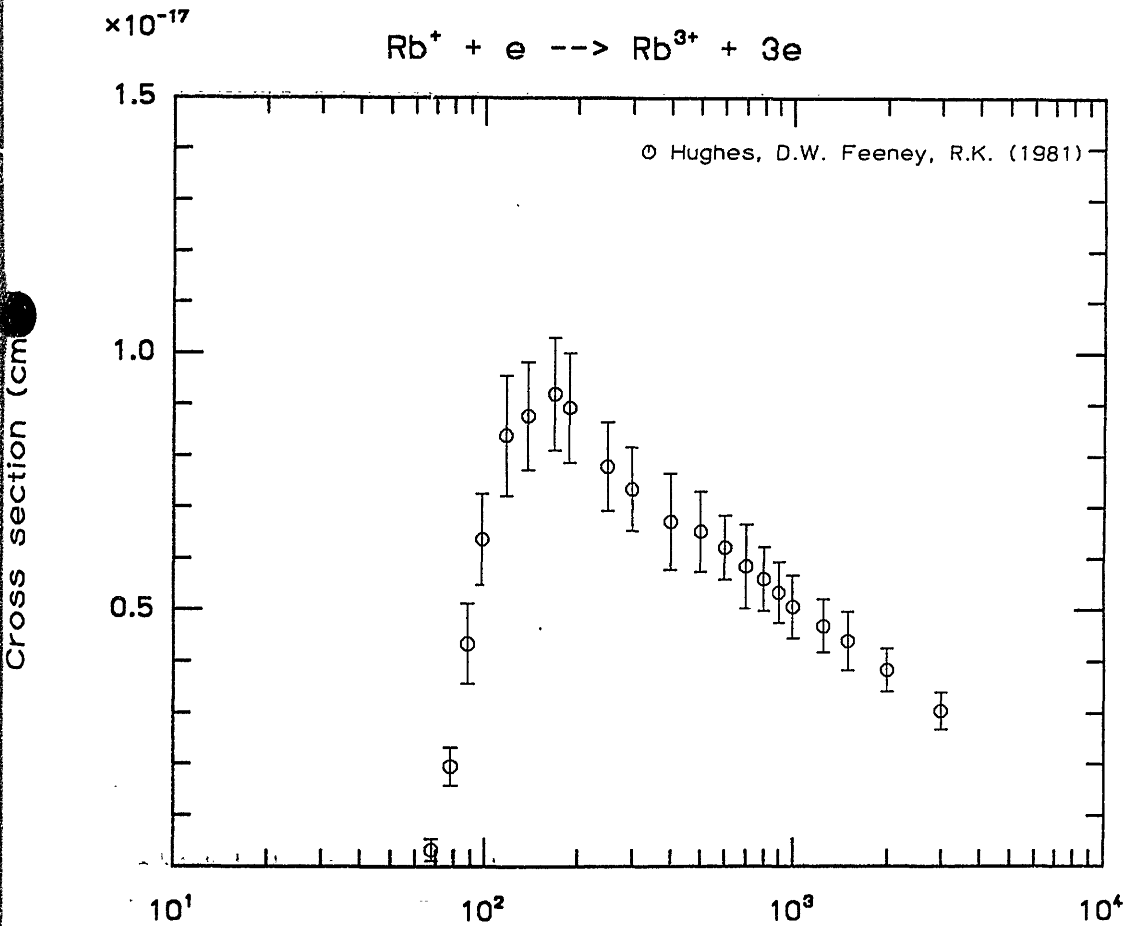
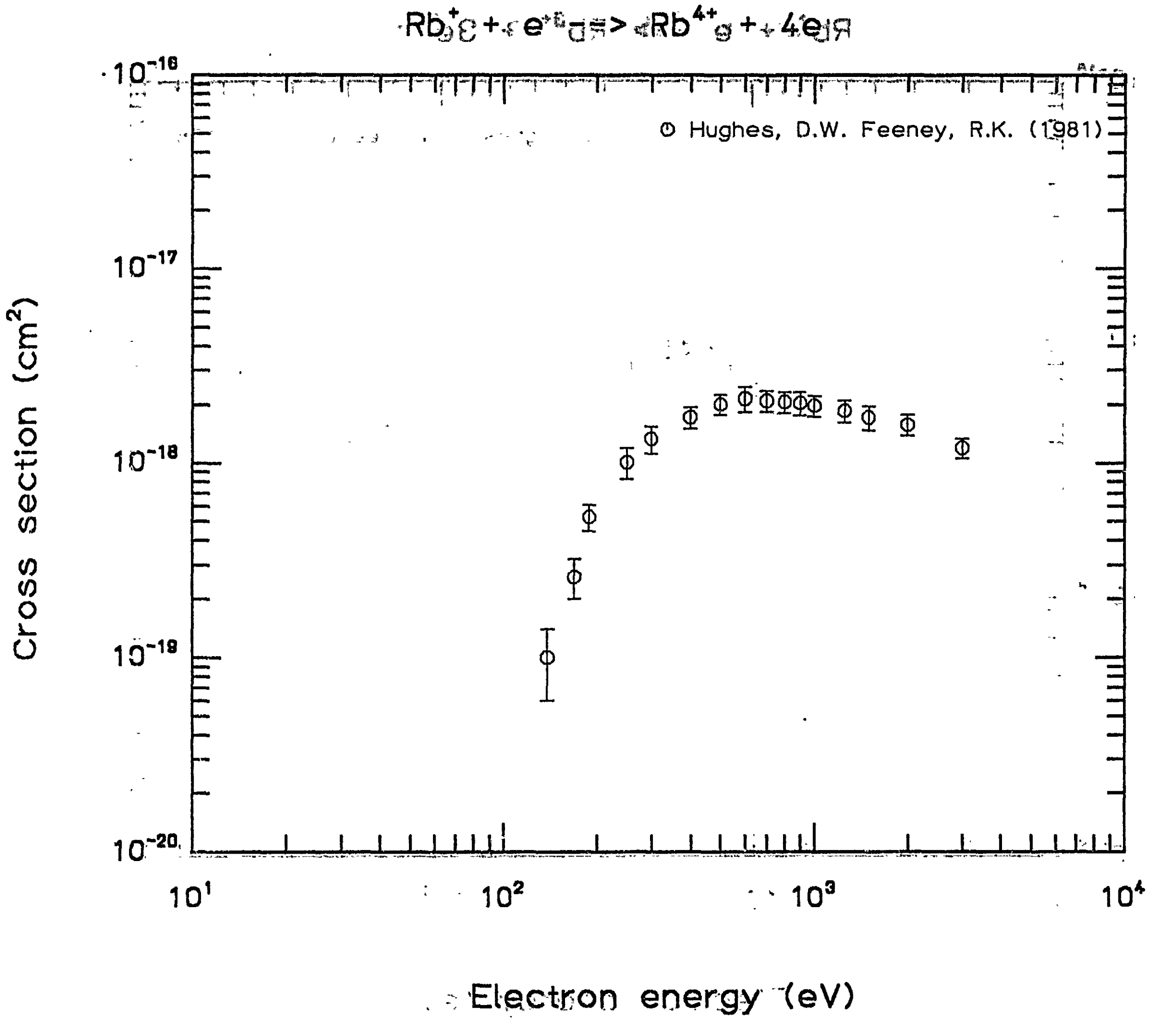
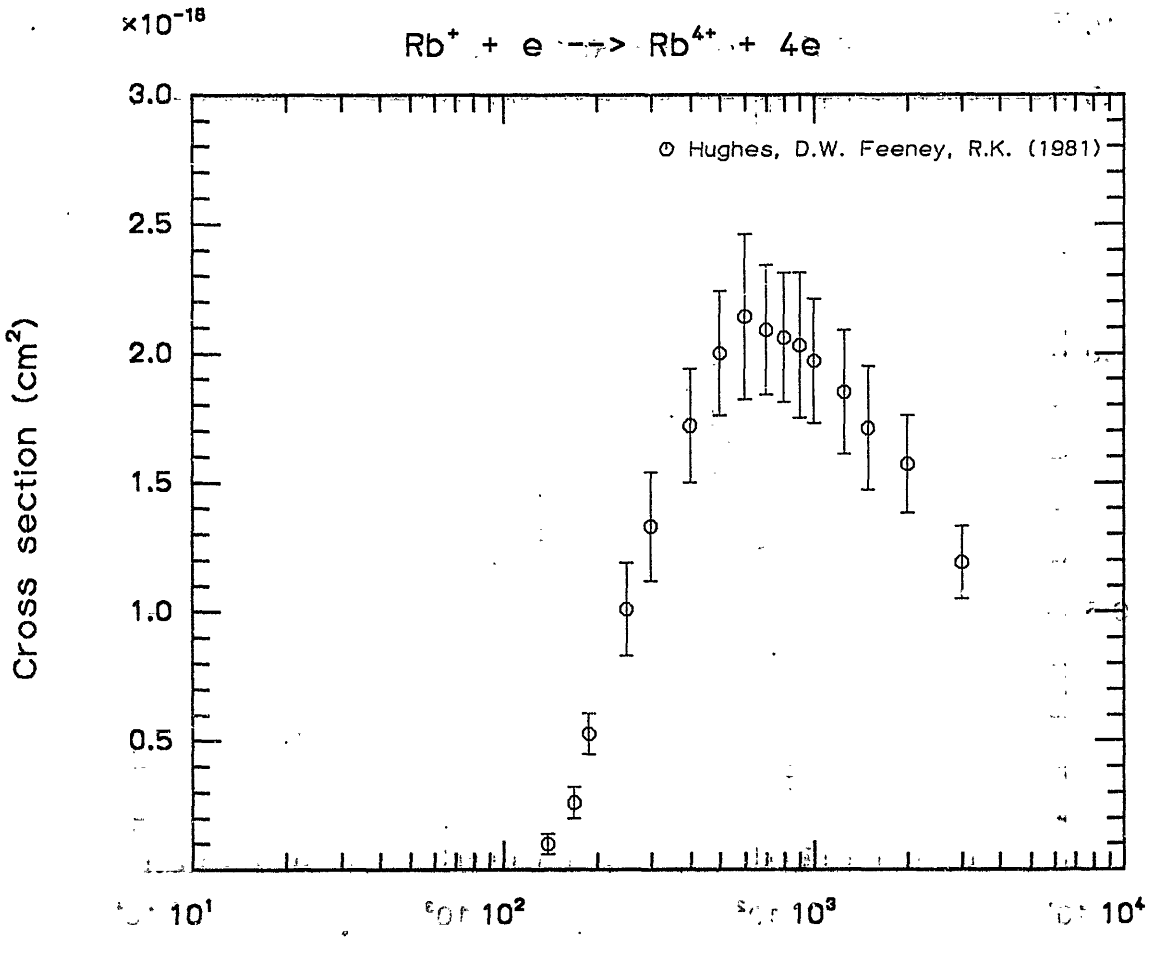


Fig. 205 Electron energy (eV)

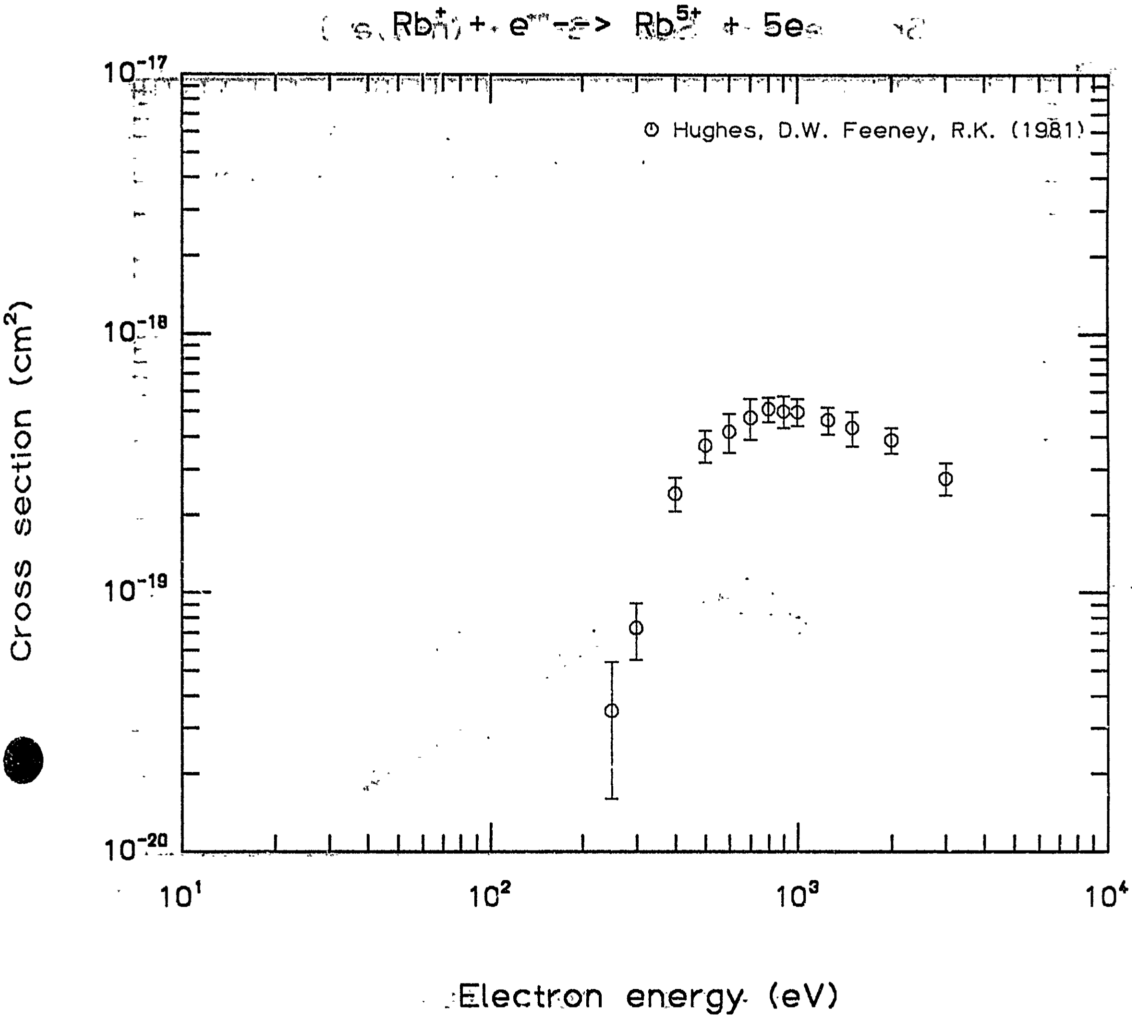


Rb⁺ + e ==> Rb⁴⁺ + 4e
Hughes, D.W. Feeney, R.K. (1981)
Cross section (cm²)
Electron energy (eV)

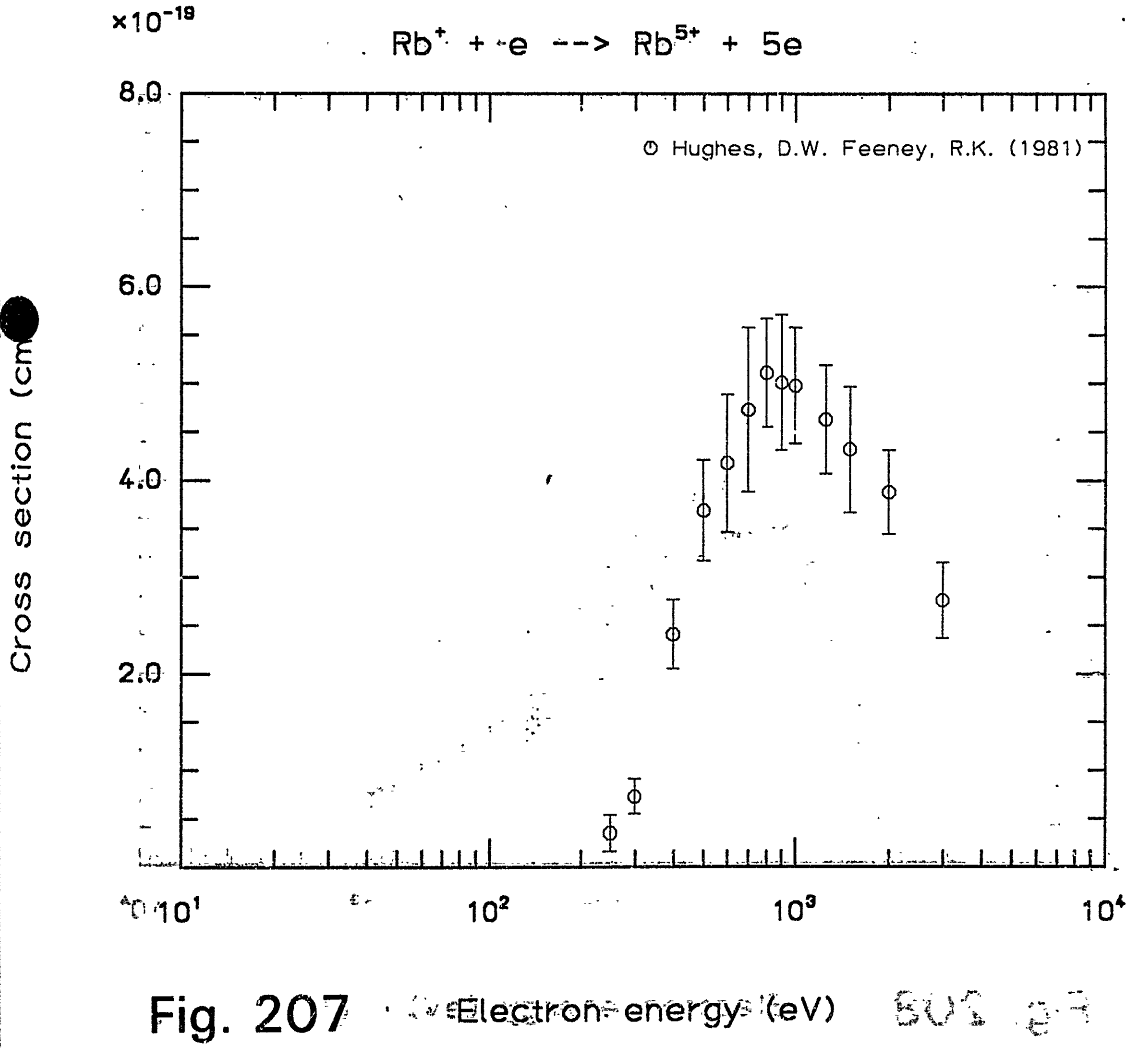


Rb⁺ + e ==> Rb⁴⁺ + 4e
Hughes, D.W. Feeney, R.K. (1981)
Cross section (cm²)
Electron energy (eV)

Fig. 206

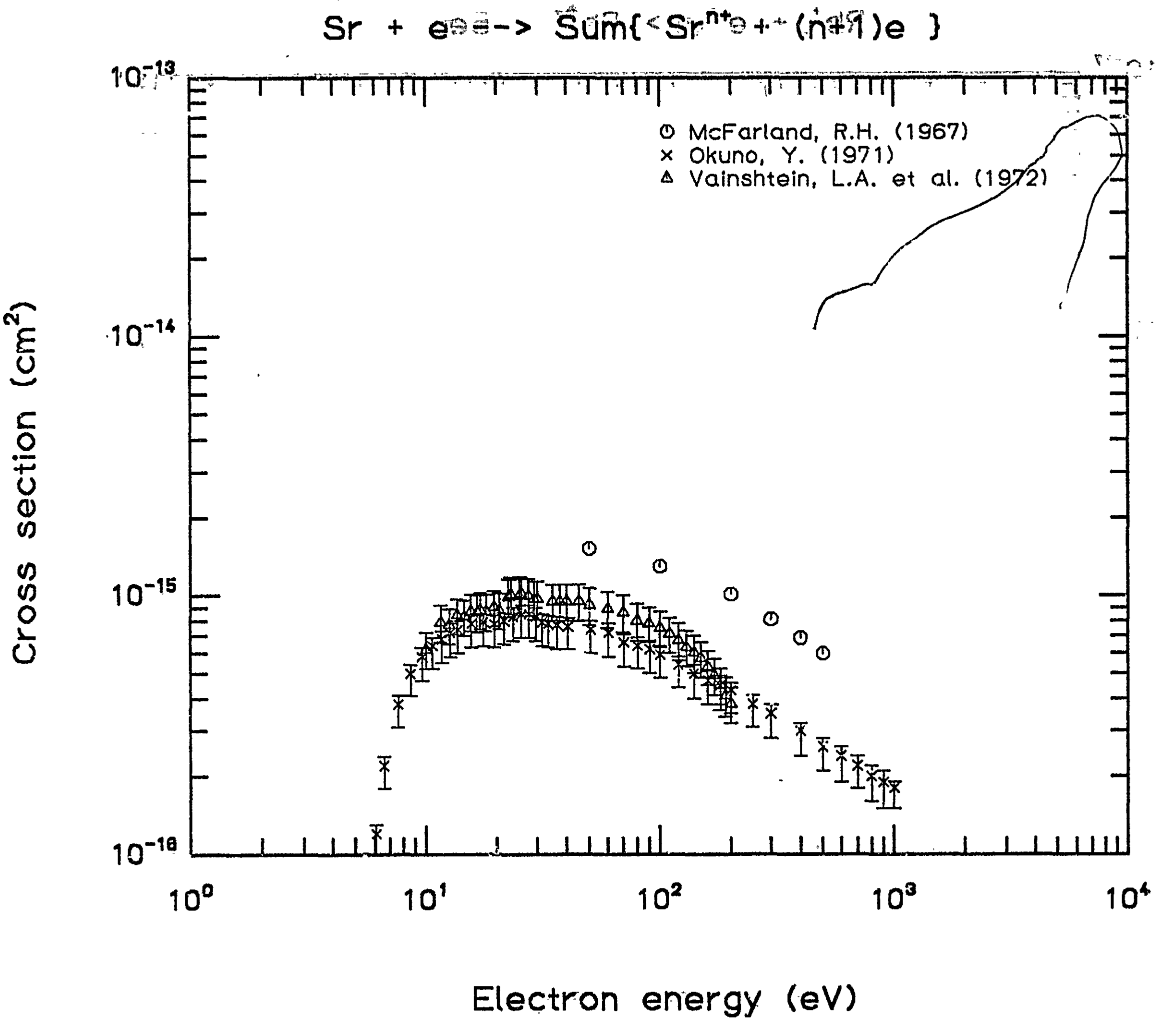


Rb⁺ + e --> Rb⁵⁺ + 5e
Hughes, D.W. Feeney, R.K. (1981)
Cross section (cm²)
10⁻¹⁷
10⁻¹⁸
10⁻¹⁹
10⁻²⁰
10¹
10²
10³
10⁴
Electron energy (eV)

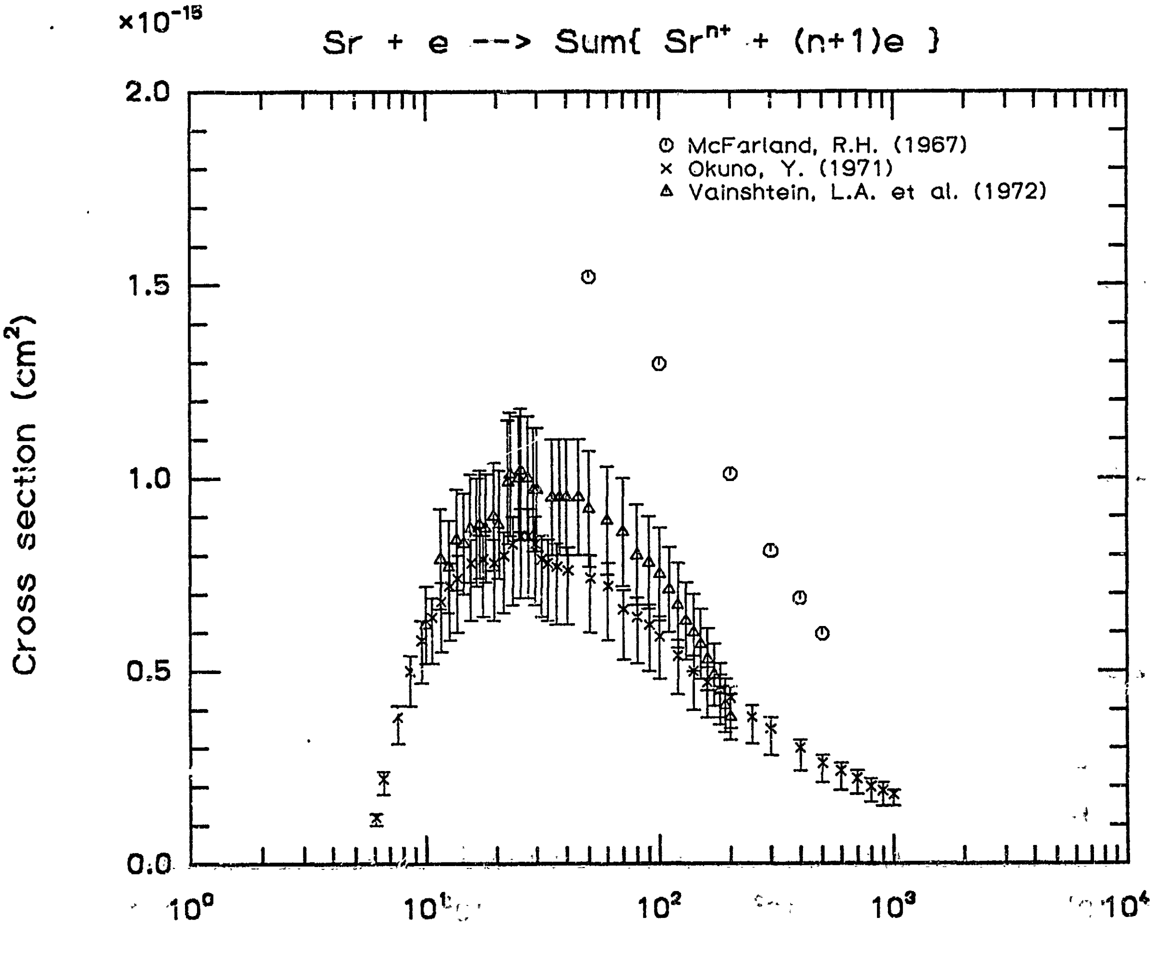


×10⁻¹⁹
Rb⁺ + e --> Rb⁵⁺ + 5e
Hughes, D.W. Feeney, R.K. (1981)
Cross section (cm²)
8.0
6.0
4.0
2.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 207

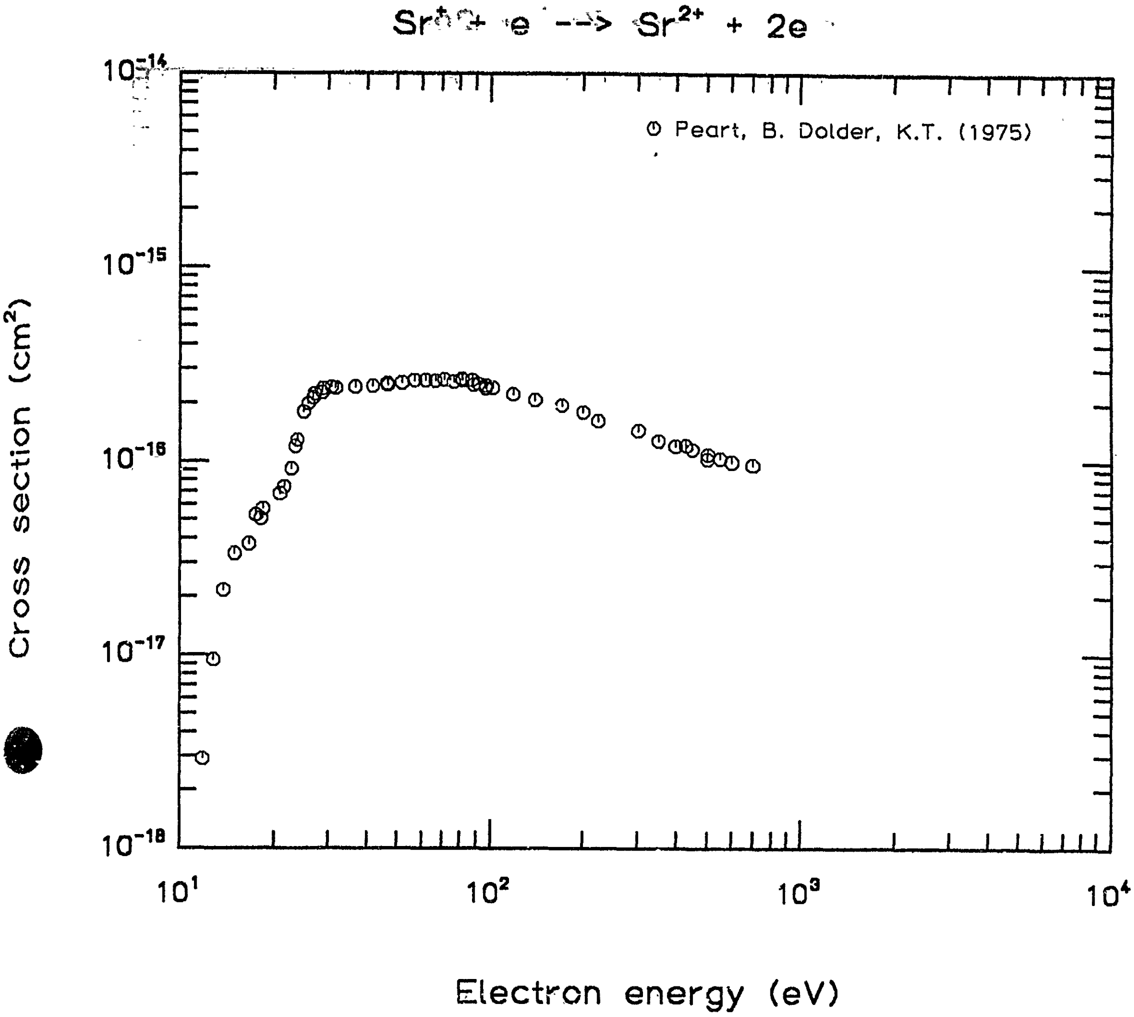


Sr + e --> Sum{ Sr^n+ + (n+1)e }
McFarland, R.H. (1967)
Okuno, Y. (1971)
Vainshtein, L.A. et al. (1972)
Cross section (cm²)
10⁻¹³
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁰
10¹
10²
10³
10⁴
Electron energy (eV)



×10⁻¹⁵
Sr + e --> Sum{ Sr^n+ + (n+1)e }
McFarland, R.H. (1967)
Okuno, Y. (1971)
Vainshtein, L.A. et al. (1972)
Cross section (cm²)
2.0
1.5
1.0
0.5
0.0
10⁰
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 208



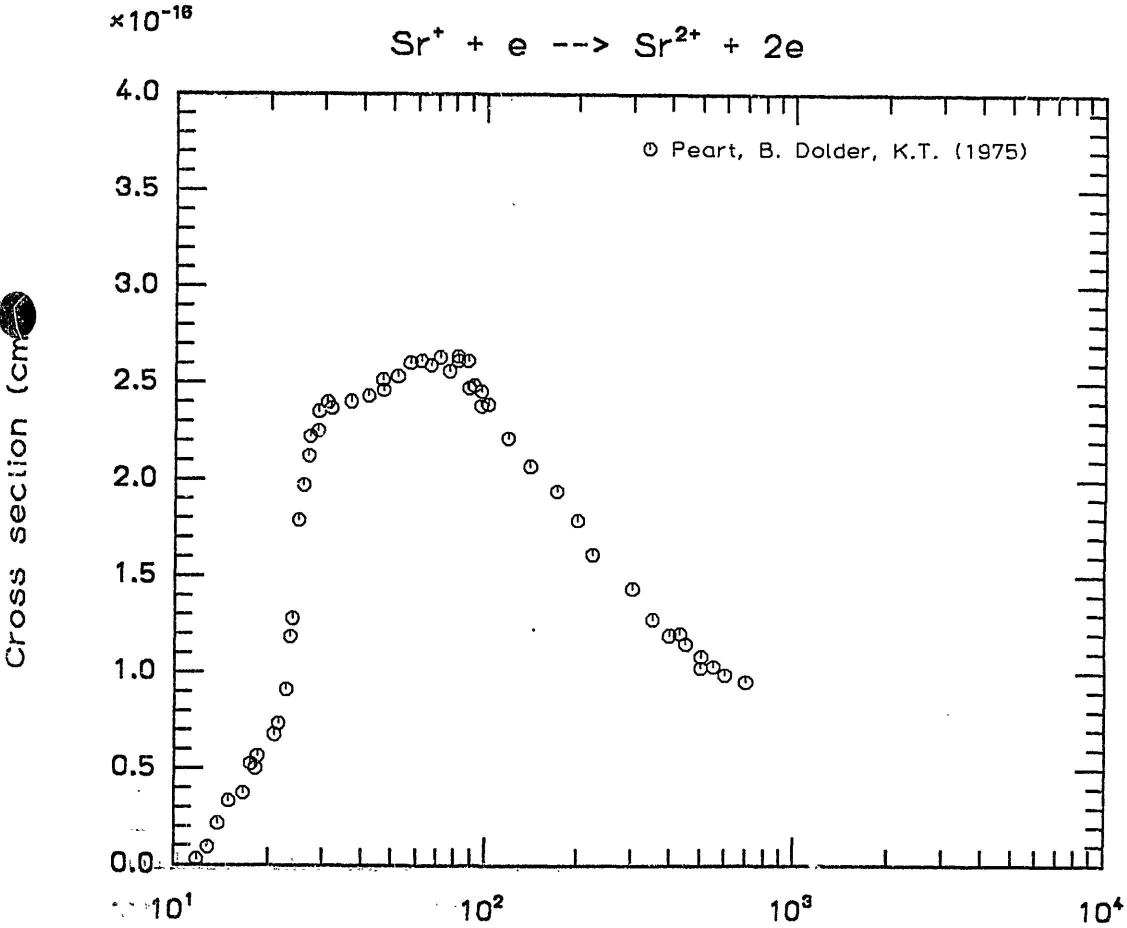
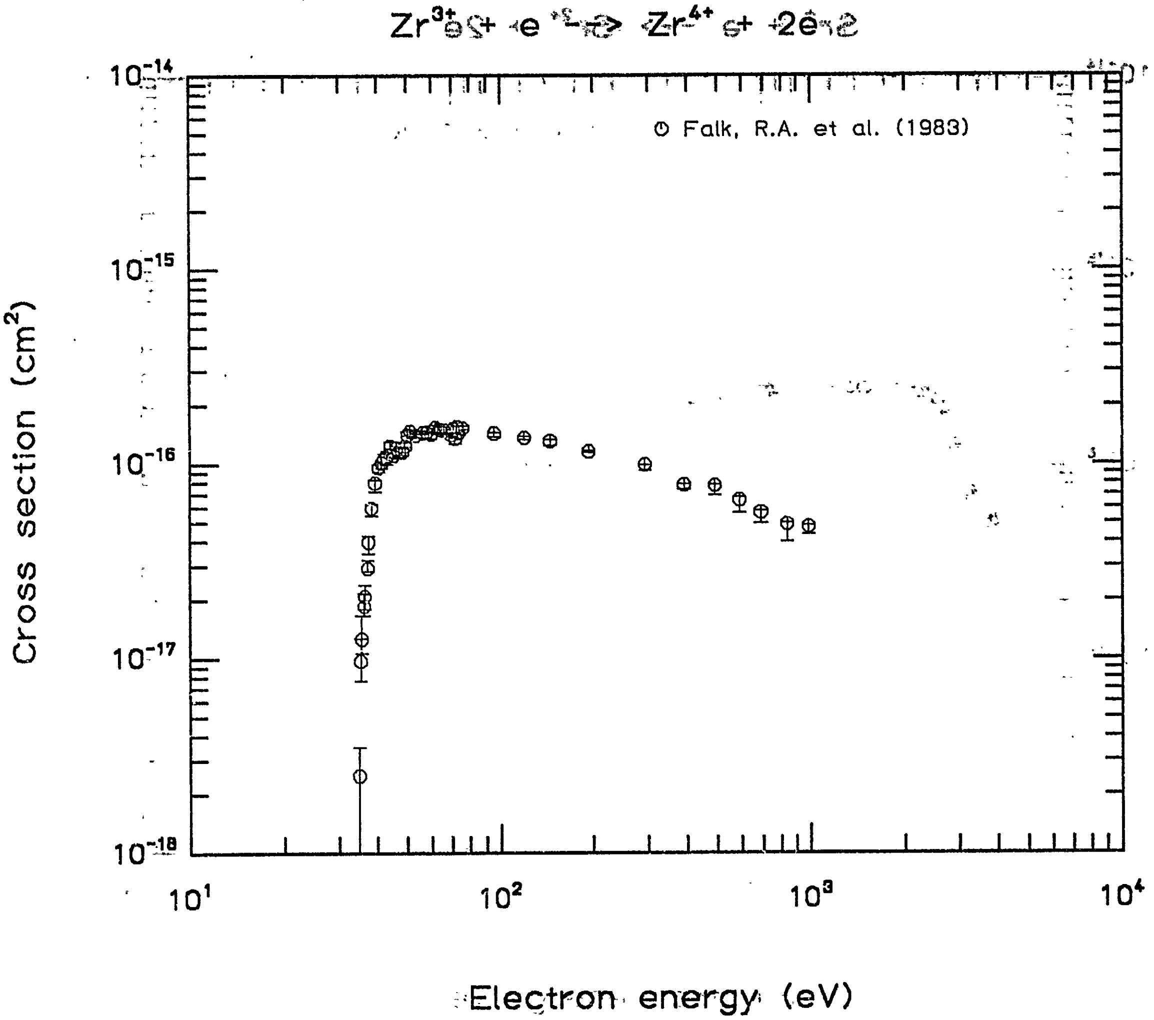
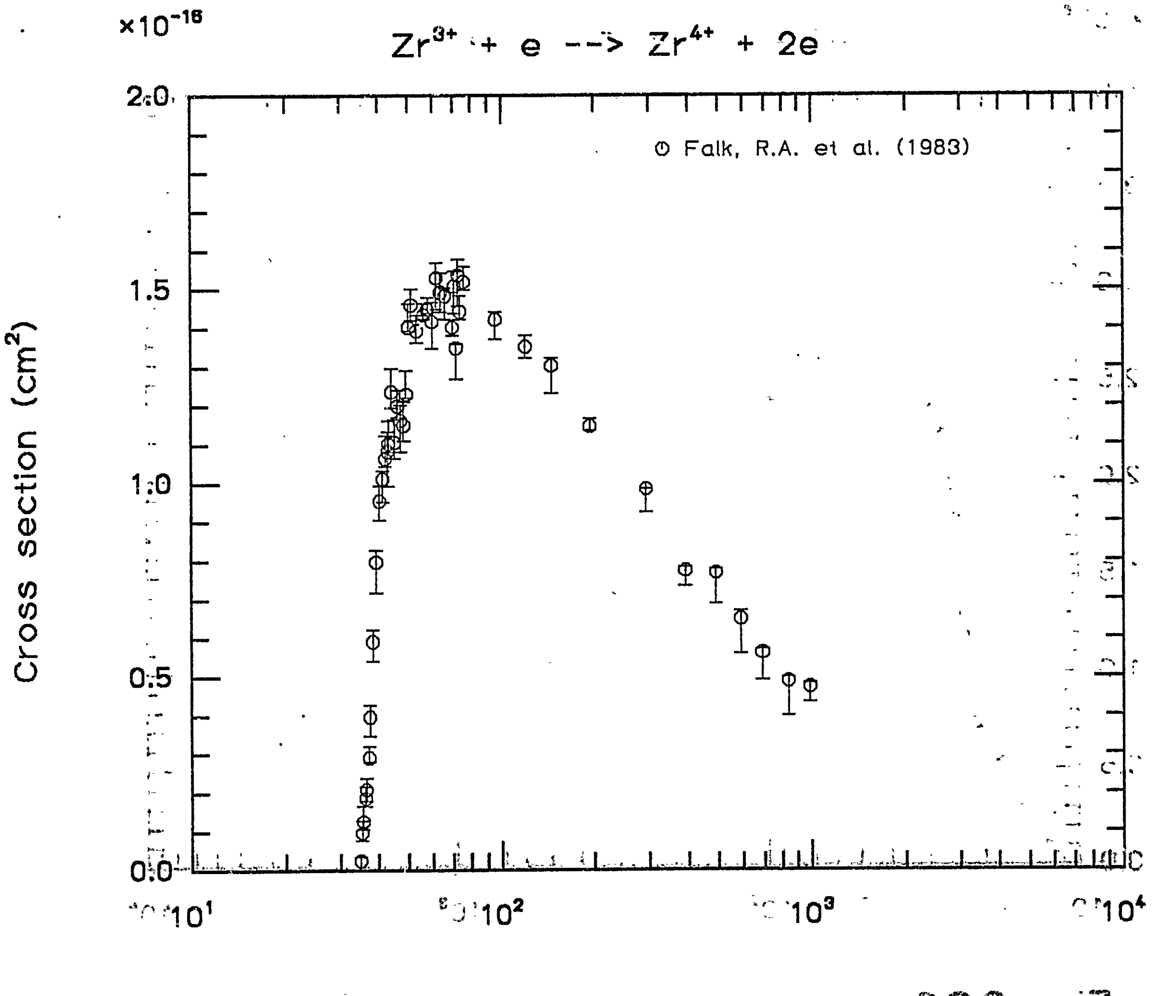


Fig. 209 Electron energy (eV)

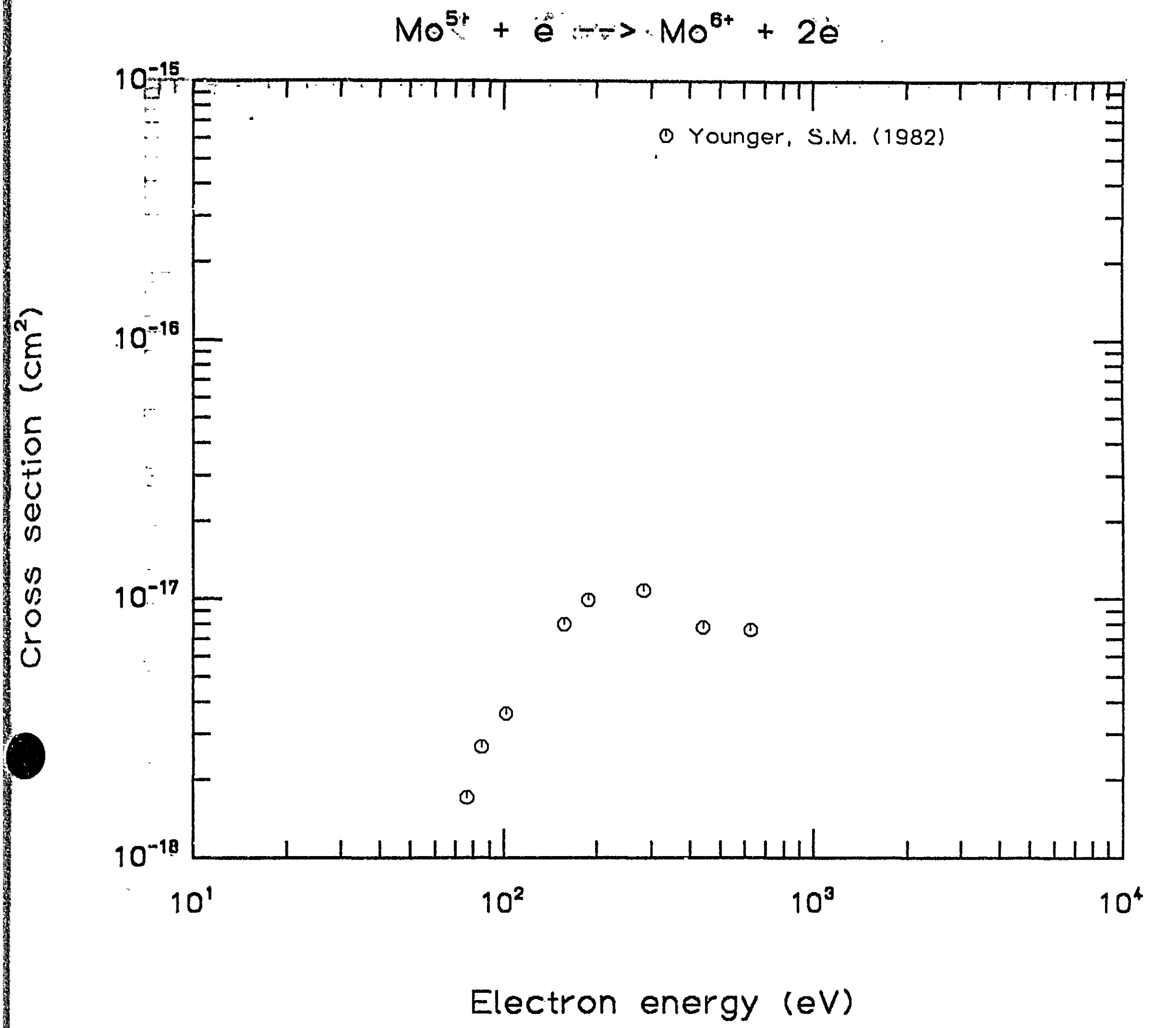


Zr3+ + e --> Zr4+ + 2e
Falk, R.A. et al. (1983)
Cross section (cm2)
10-14
10-15
10-16
10-17
10-18
101
102
103
104
Electron energy (eV)



×10-16
Zr3+ + e --> Zr4+ + 2e
Falk, R.A. et al. (1983)
Cross section (cm2)
2.0
1.5
1.0
0.5
0.0
101
102
103
104
Electron energy (eV)

Fig. 210



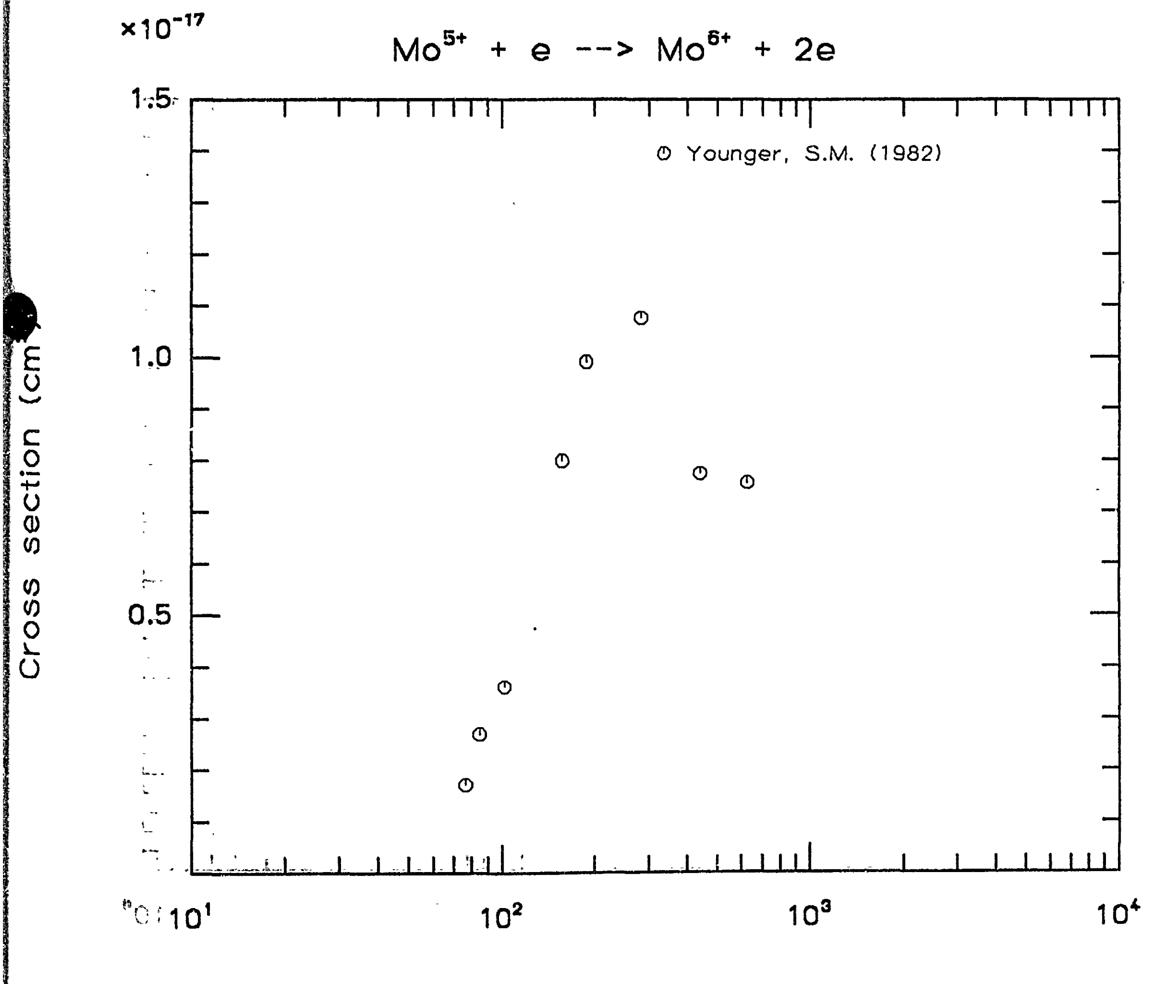
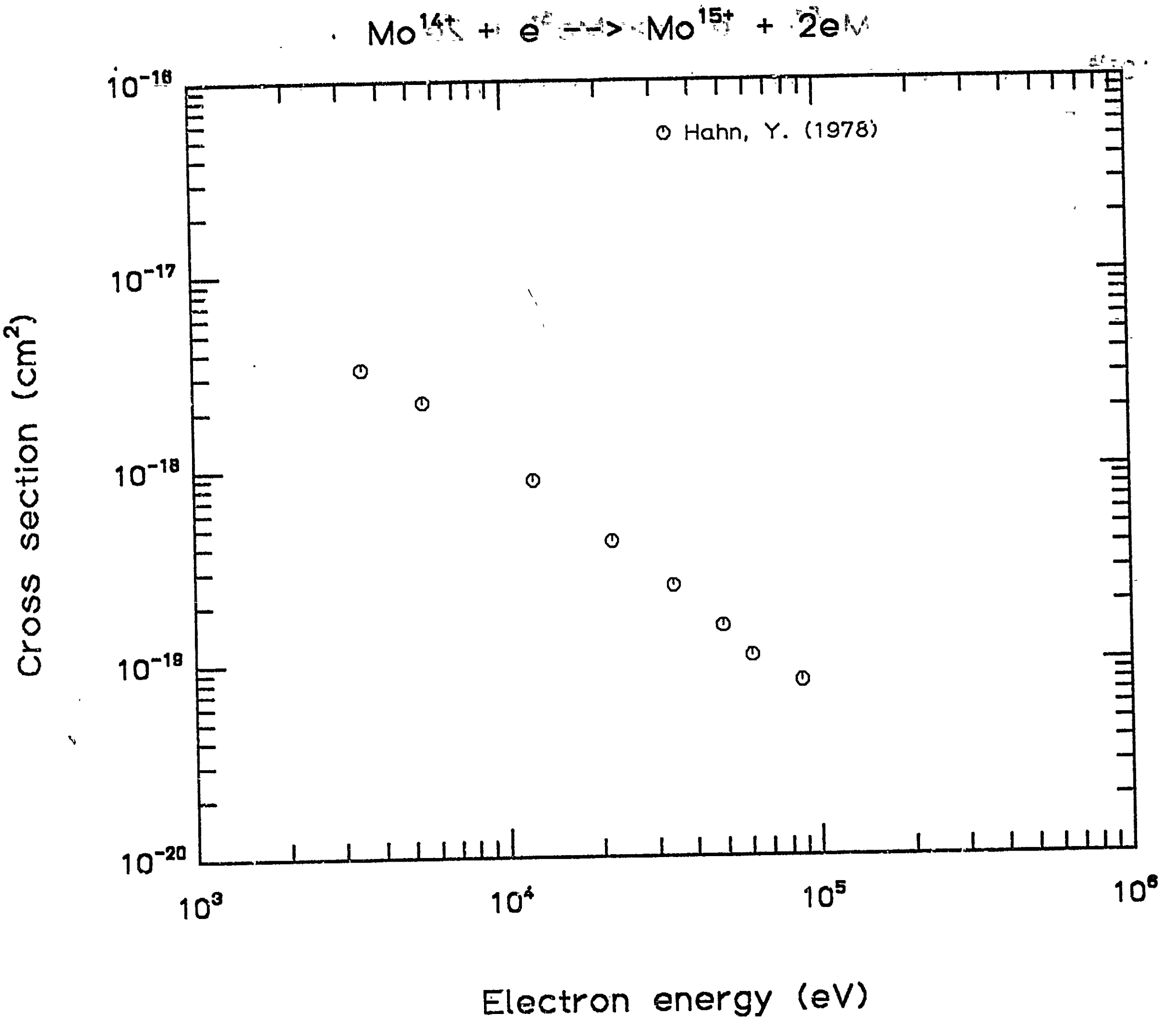
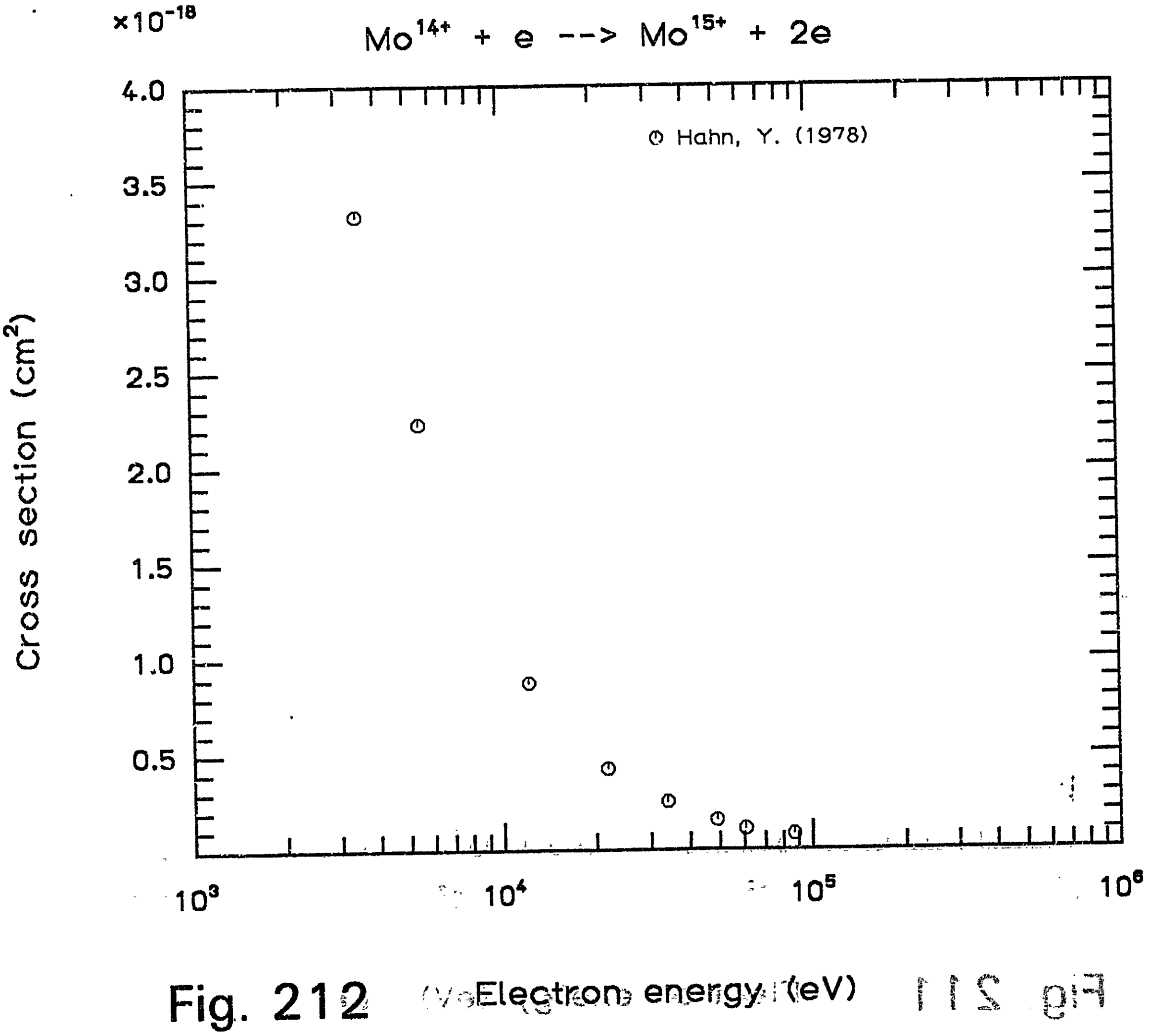


Fig. 211 Electron energy (eV)

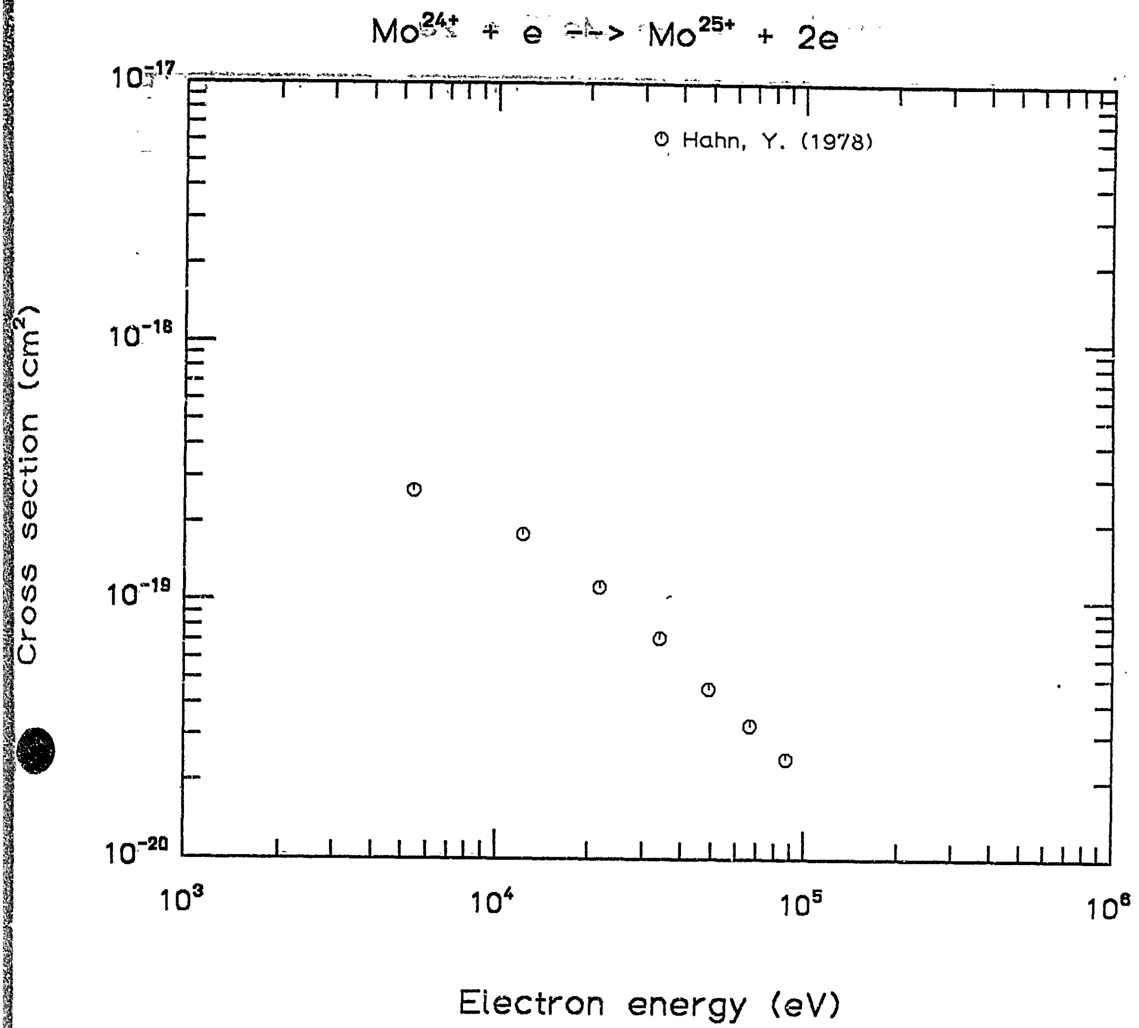


Mo14+ + e --> Mo15+ + 2e
Hahn, Y. (1978)
Cross section (cm2)
10-16
10-17
10-18
10-19
10-20
103
104
105
106
Electron energy (eV)

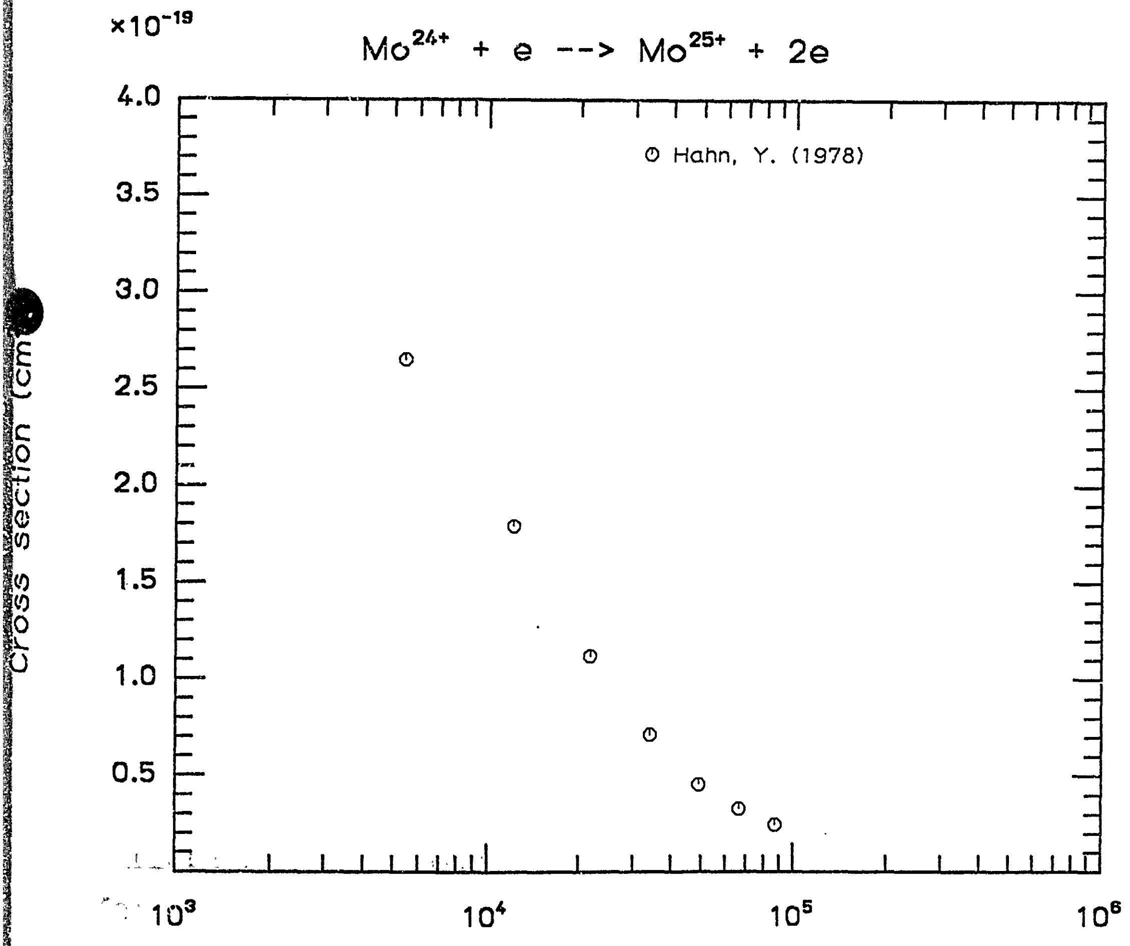


×10-18
Mo14+ + e --> Mo15+ + 2e
Hahn, Y. (1978)
Cross section (cm2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
103
104
105
106
Electron energy (eV)

Fig. 212

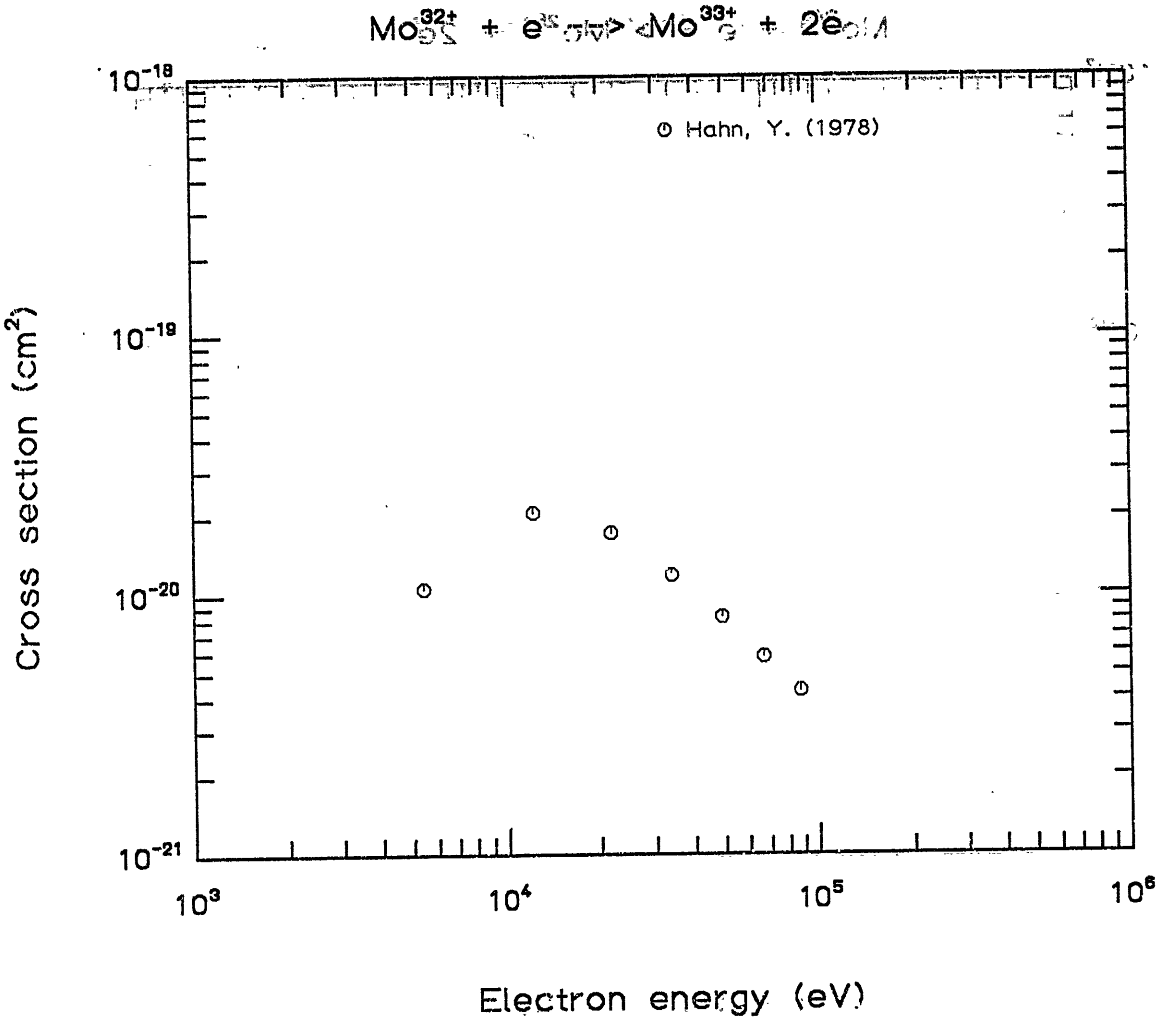


Mo^{24+} + e --> Mo^{25+} + 2e
Hahn, Y. (1978)
Cross section (cm^2)
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^3
10^4
10^5
10^6
Electron energy (eV)

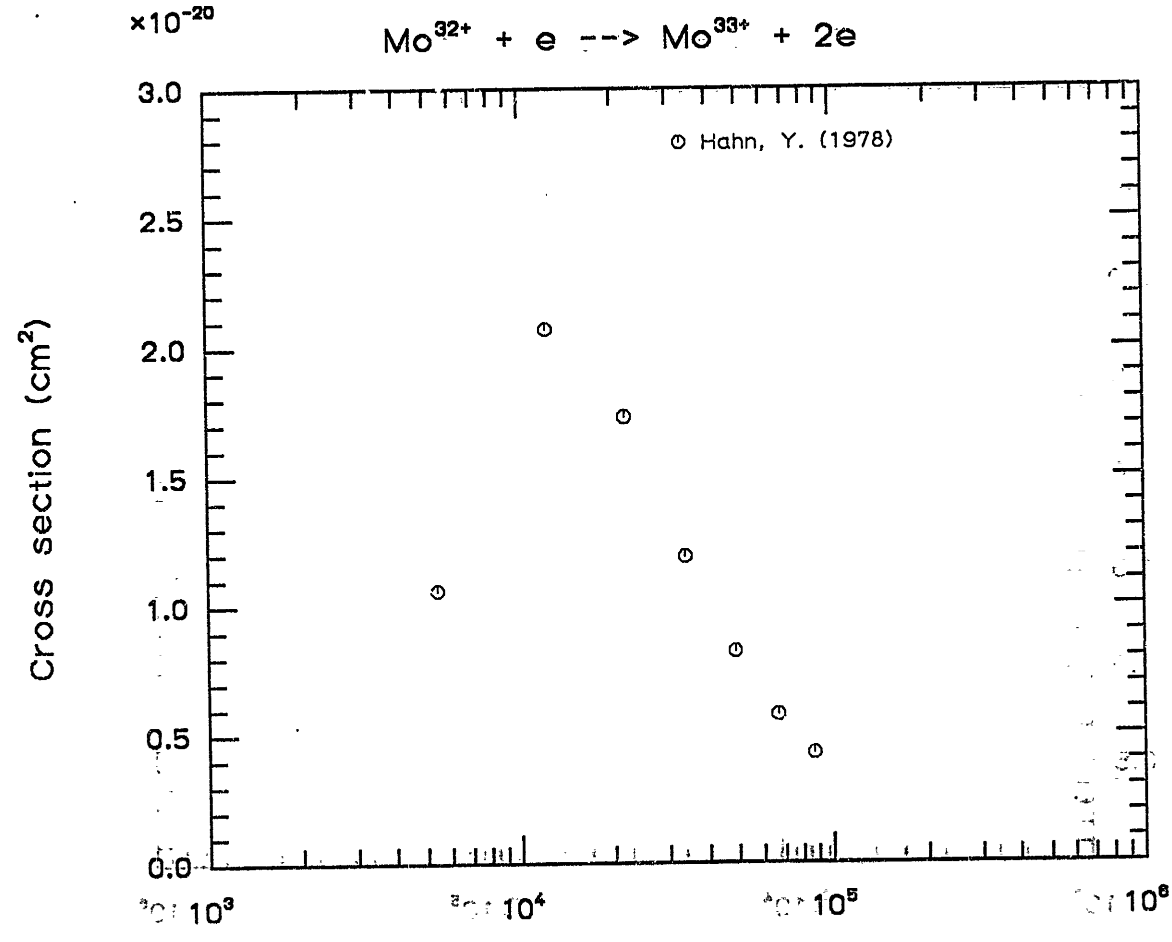


$\times 10^{-19}$
Mo^{24+} + e --> Mo^{25+} + 2e
Hahn, Y. (1978)
Cross section (cm^2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10^3
10^4
10^5
10^6
Electron energy (eV)

Fig. 213

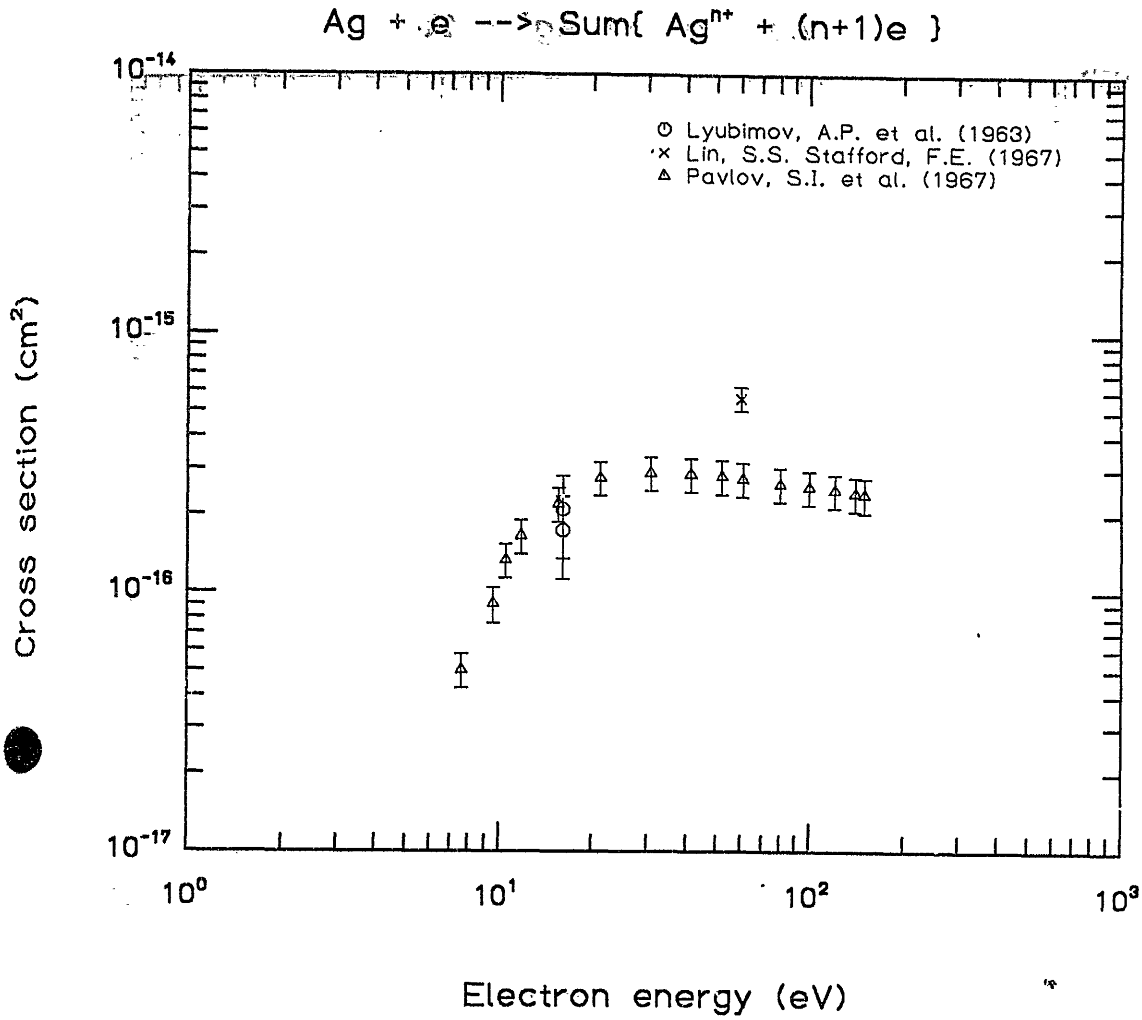


Mo^{32+} + e --> Mo^{33+} + 2e
Hahn, Y. (1978)
Cross section (cm^2)
10^{-18}
10^{-19}
10^{-20}
10^{-21}
10^3
10^4
10^5
10^6
Electron energy (eV)



×10^{-20}
Mo^{32+} + e --> Mo^{33+} + 2e
Hahn, Y. (1978)
Cross section (cm^2)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10^3
10^4
10^5
10^6
Electron energy (eV)

Fig. 214



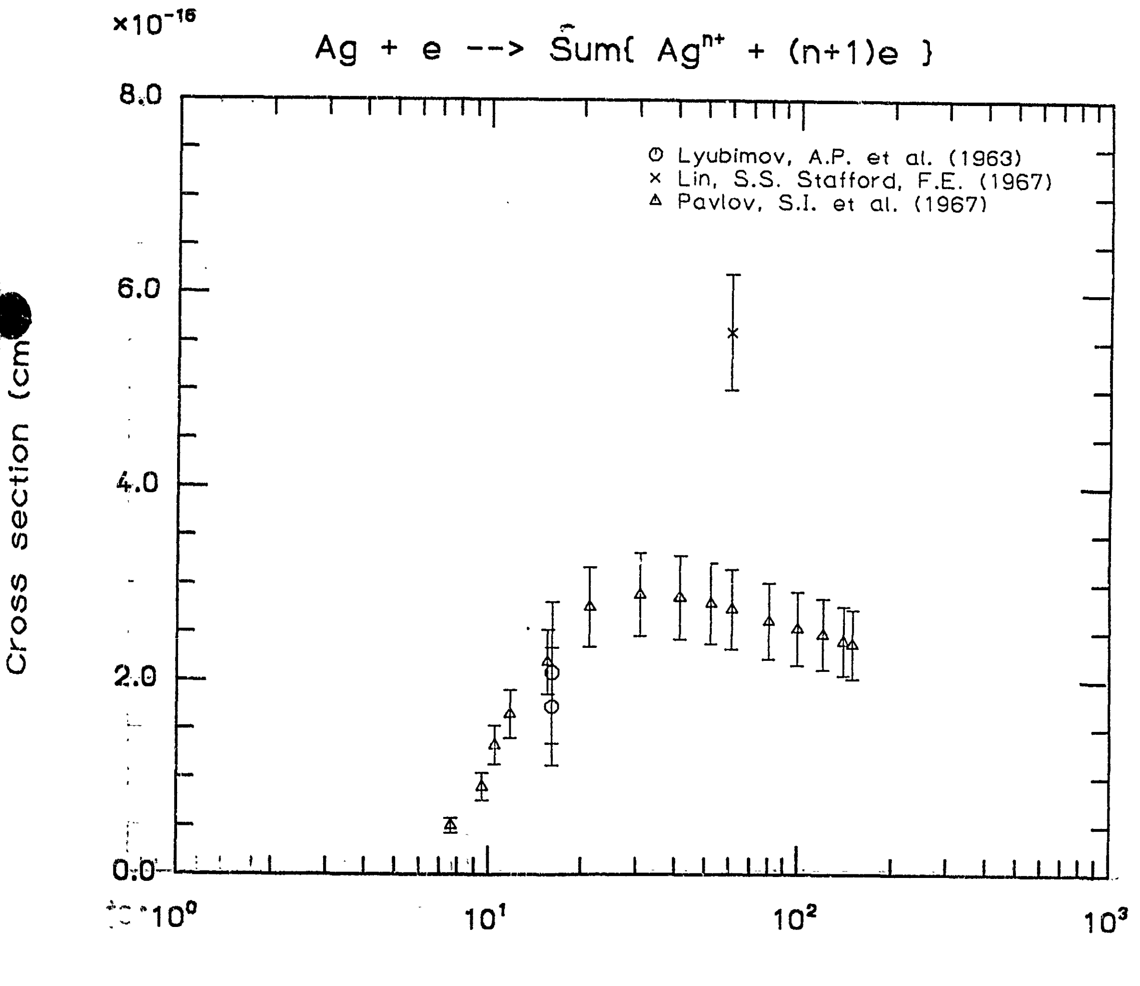


Fig. 215 Electron energy (eV)

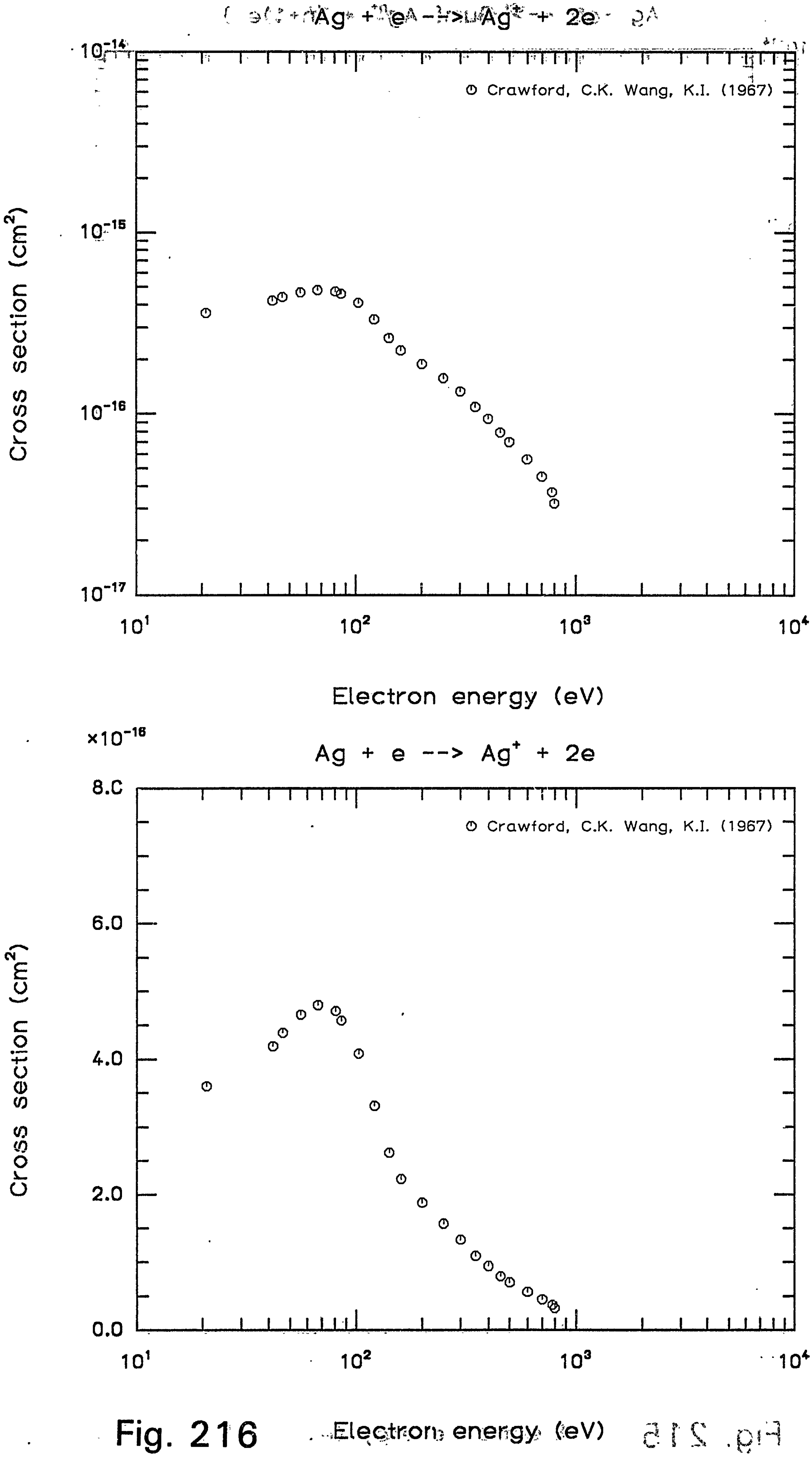

Ag + e --> Ag+ + 2e
Crawford, C.K. Wang, K.I. (1967)
Cross section (cm2)
10-14
10-15
10-16
10-17
101
102
103
104
Electron energy (eV)
×10-16
Ag + e --> Ag+ + 2e
Crawford, C.K. Wang, K.I. (1967)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
101
102
103
104
Electron energy (eV)

Fig. 216

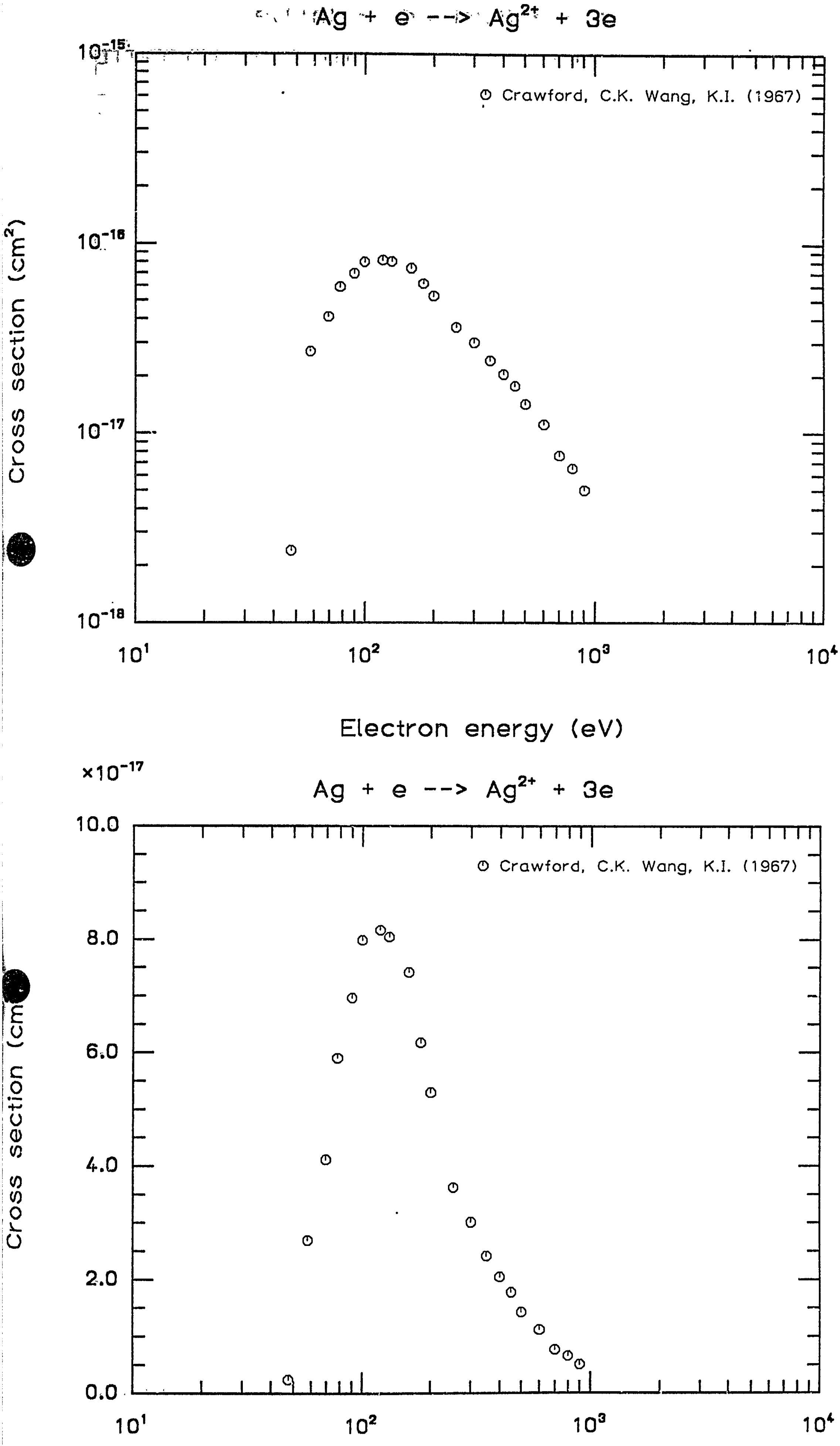
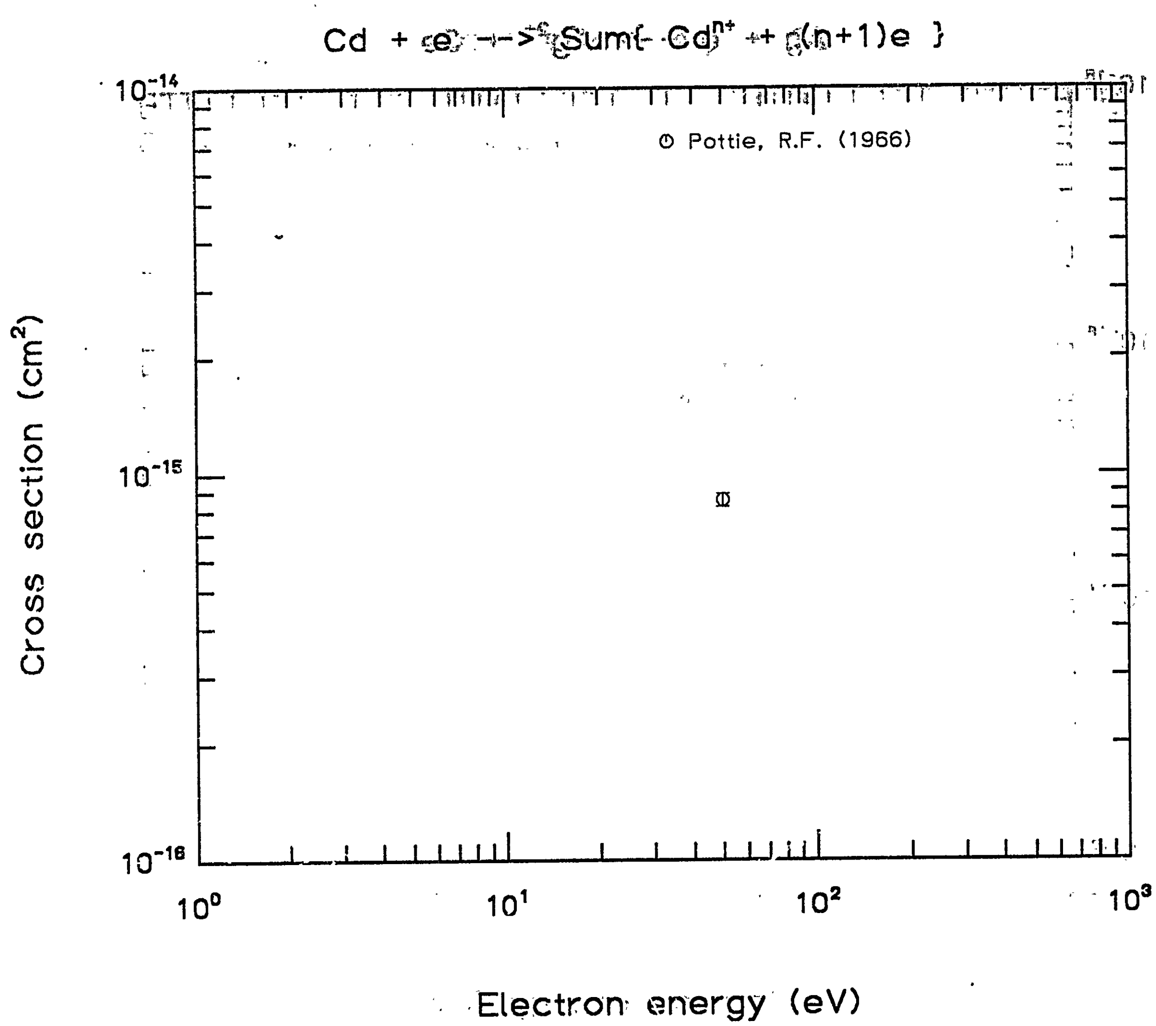


Fig. 217 Electron energy (eV)


Cd + e --> Sum{ Cd^n+ + (n+1)e }
Pottie, R.F. (1966)
Cross section (cm²)
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁰
10¹
10²
10³
Electron energy (eV)

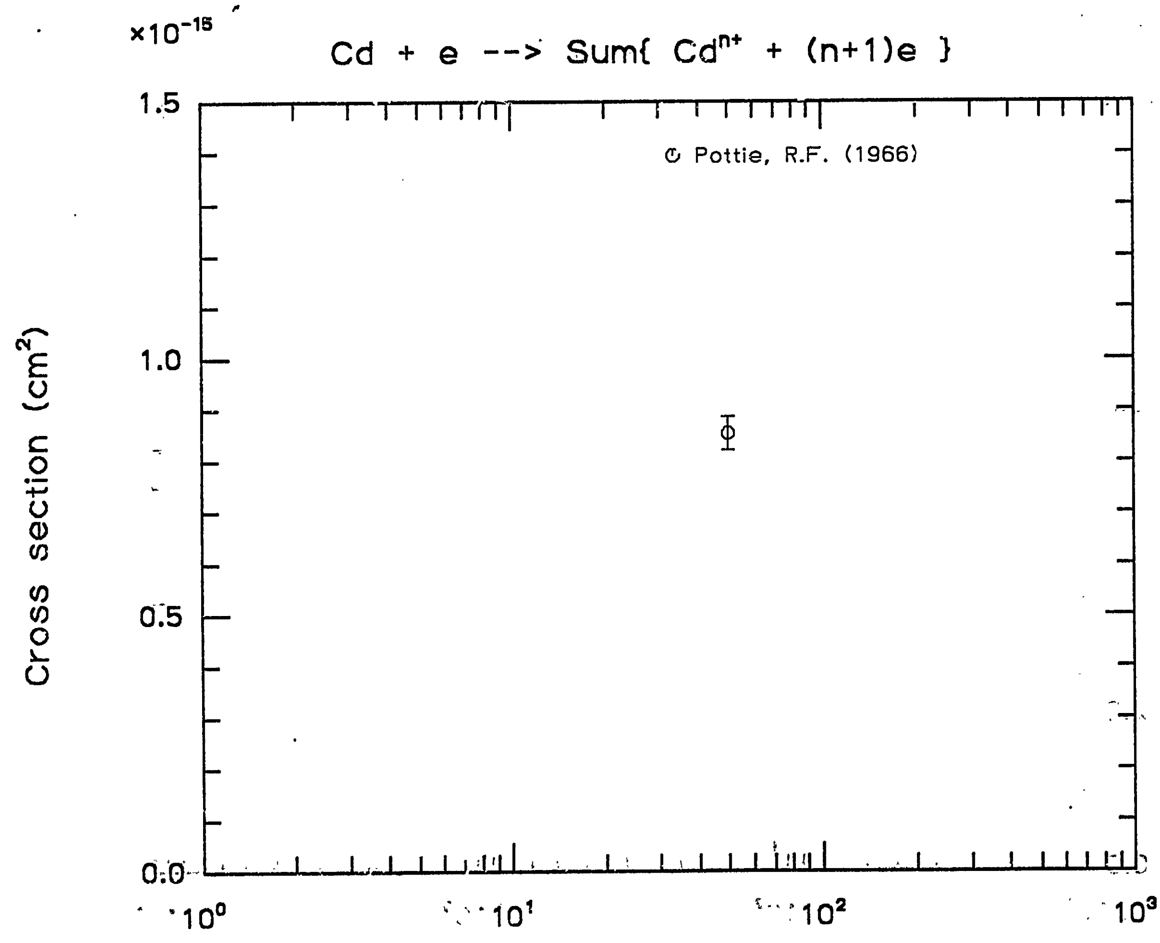

×10⁻¹⁵
Cd + e --> Sum{ Cd^n+ + (n+1)e }
Pottie, R.F. (1966)
Cross section (cm²)
1.5
1.0
0.5
0.0
10⁰
10¹
10²
10³
Electron energy (eV)

Fig. 218

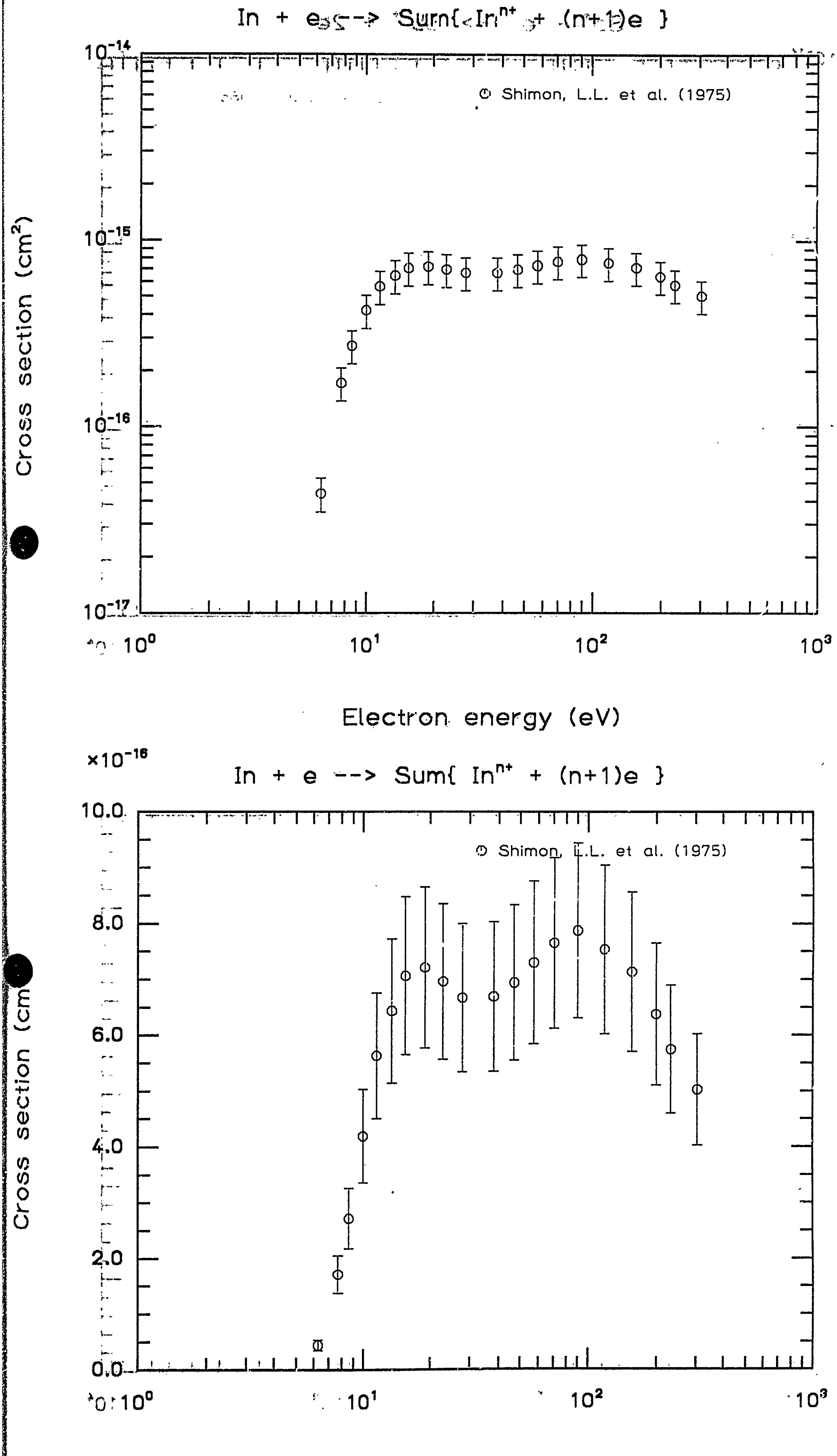
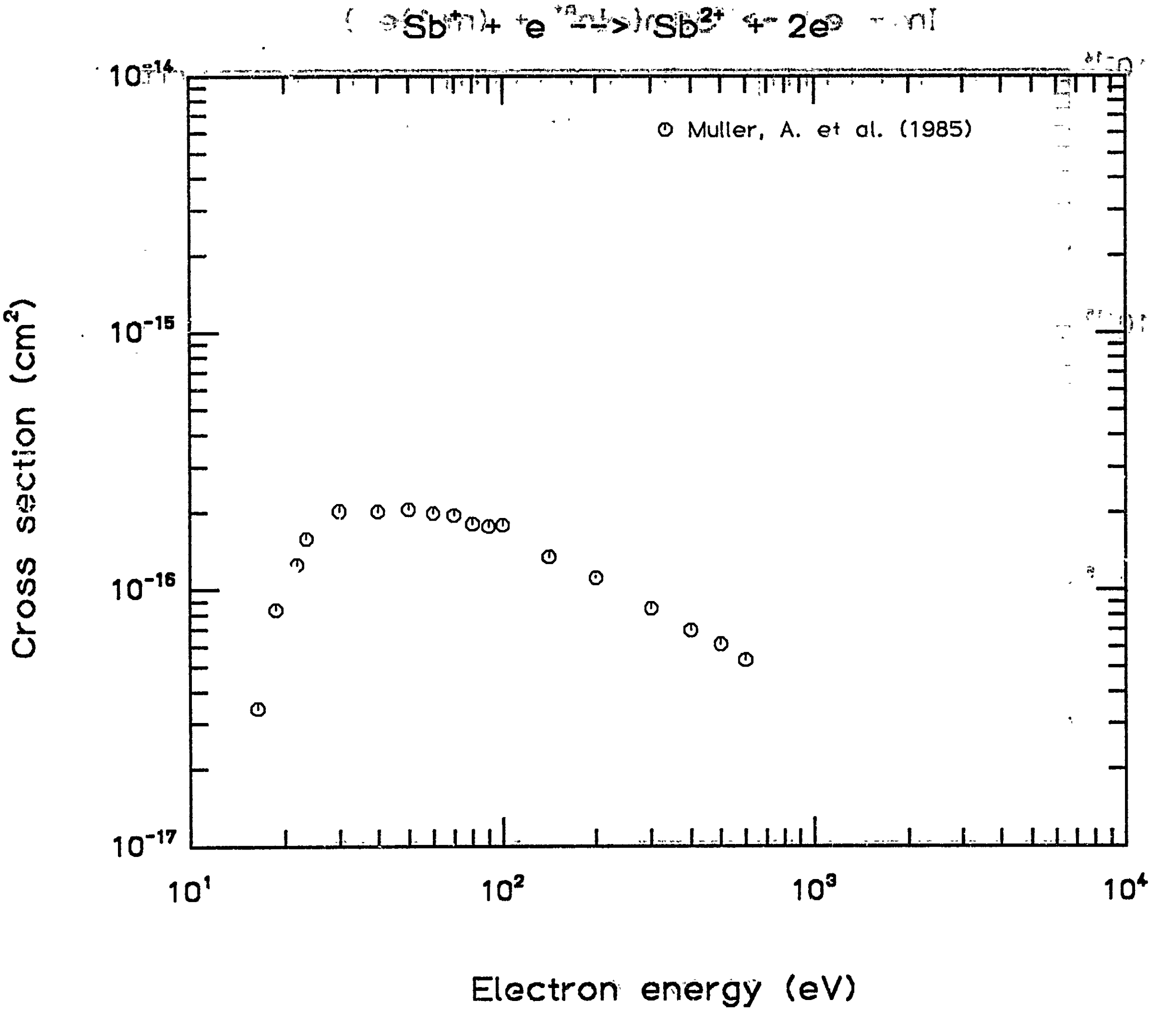

In + e --> Sum{ In^{n+} + (n+1)e }
Shimon, L.L. et al. (1975)
Cross section (cm^2)
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^0
10^1
10^2
10^3
Electron energy (eV)
$\times10^{-16}$
In + e --> Sum{ In^{n+} + (n+1)e }
Shimon, L.L. et al. (1975)
10.0
8.0
6.0
4.0
2.0
0.0
10^0
10^1
10^2
10^3
Cross section (cm
Electron energy (eV)

Fig. 219


$Sb^+ + e \rightarrow Sb^{2+} + 2e$
Muller, A. et al. (1985)
Cross section (cm^2)
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^1
10^2
10^3
10^4
Electron energy (eV)

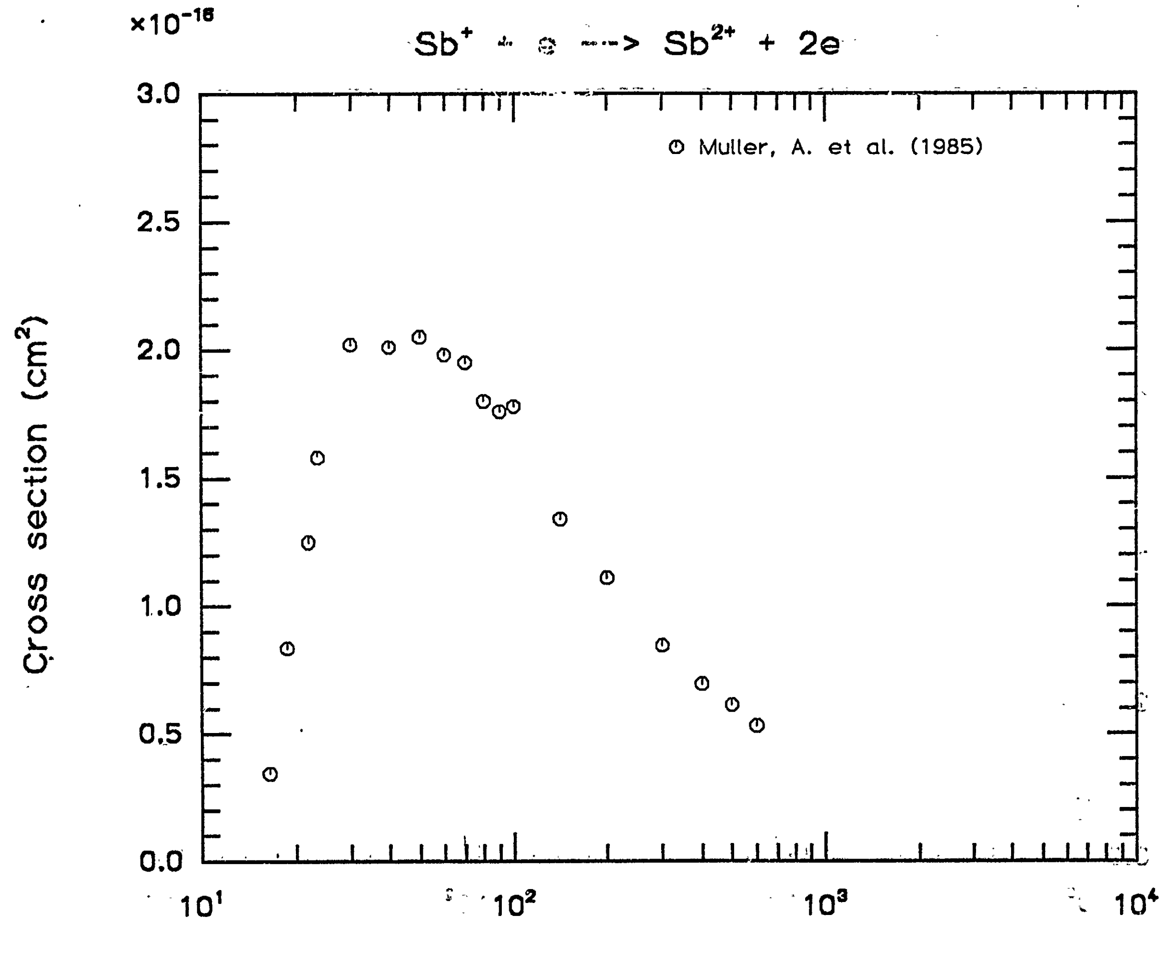
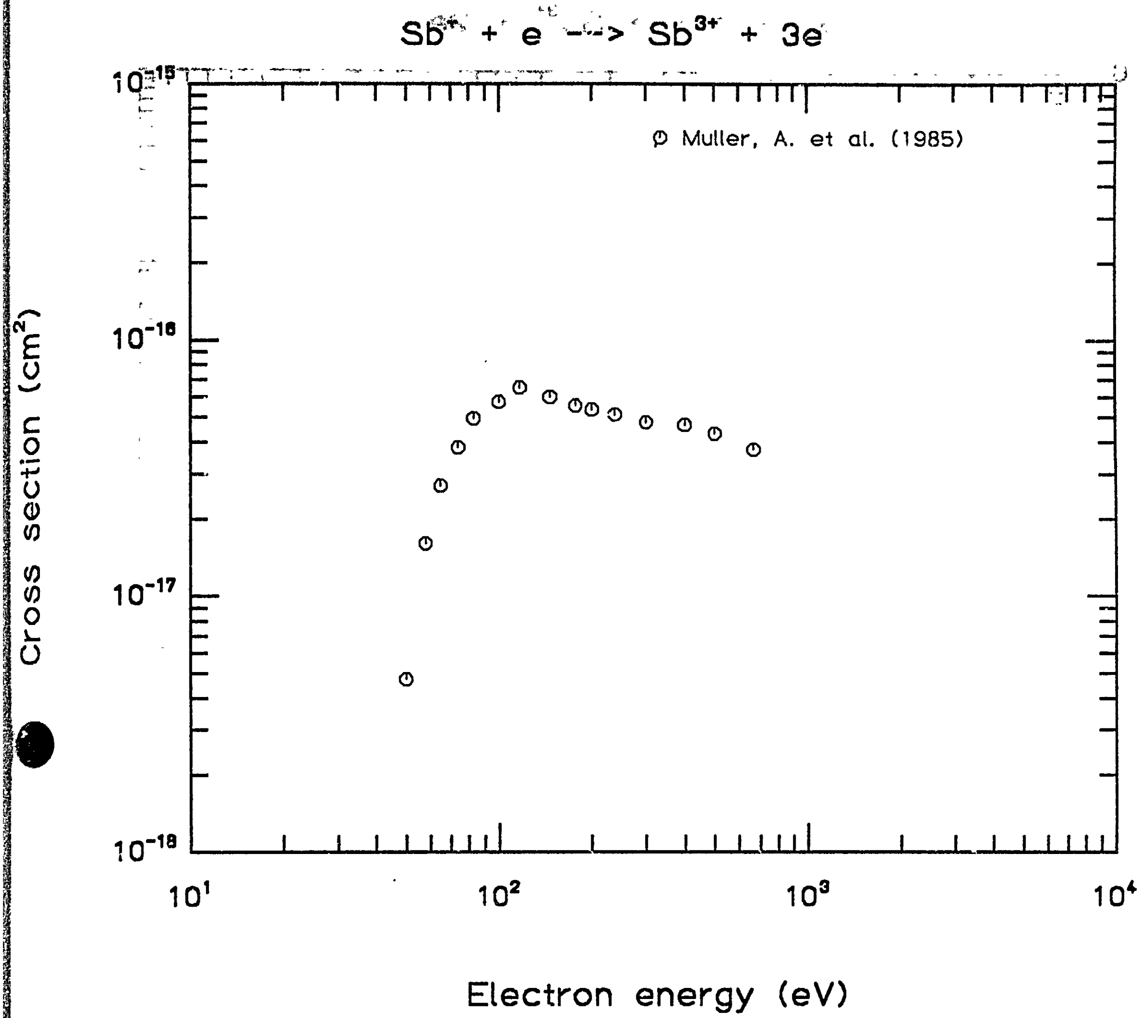

$\times 10^{-16}$
$Sb^+ + e \rightarrow Sb^{2+} + 2e$
Muller, A. et al. (1985)
Cross section (cm^2)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 220


Sb+ + e --> Sb3+ + 3e
Muller, A. et al. (1985)
Cross section (cm2)
10-15
10-16
10-17
10-18
10¹
10²
10³
10⁴
Electron energy (eV)

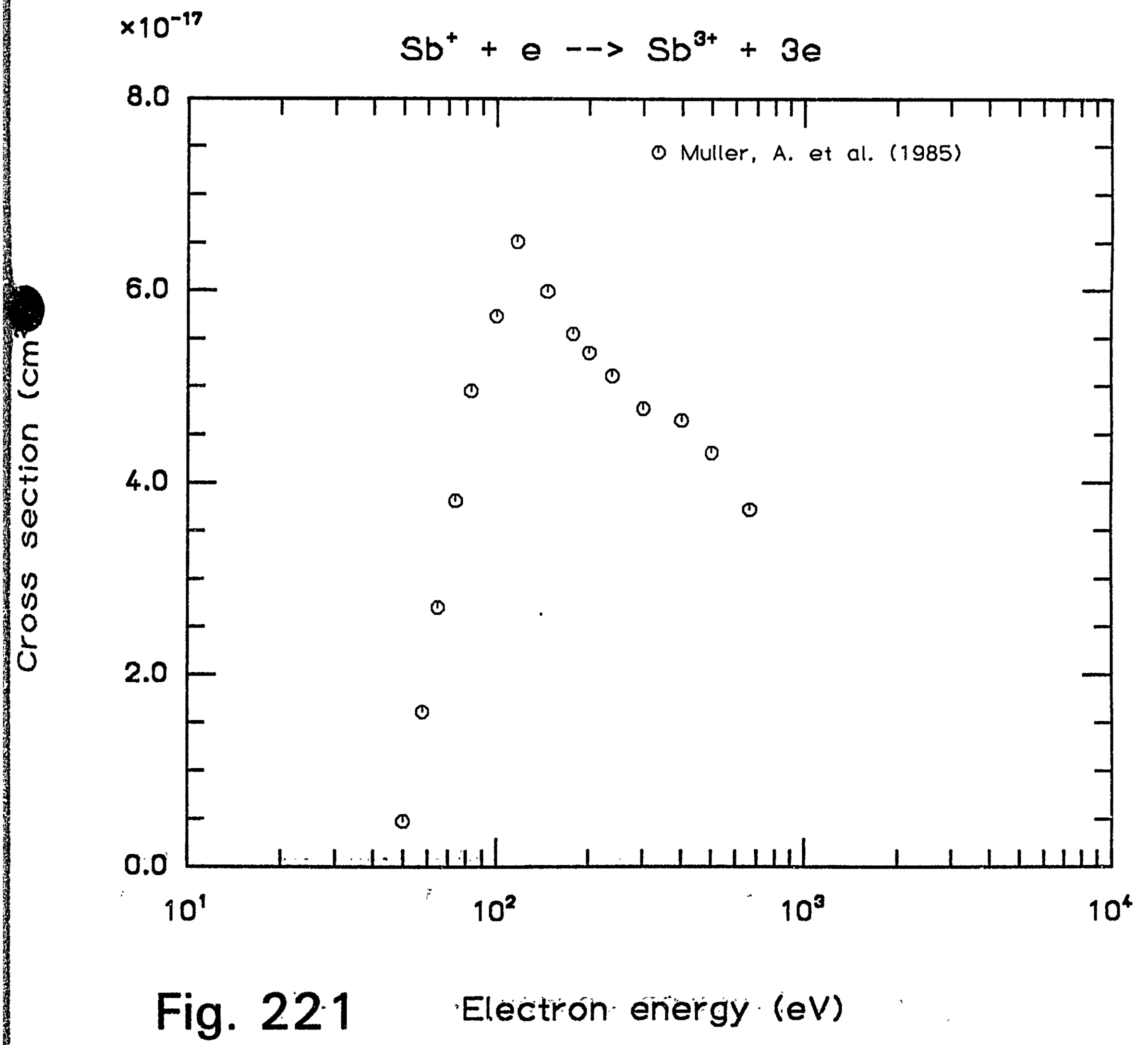
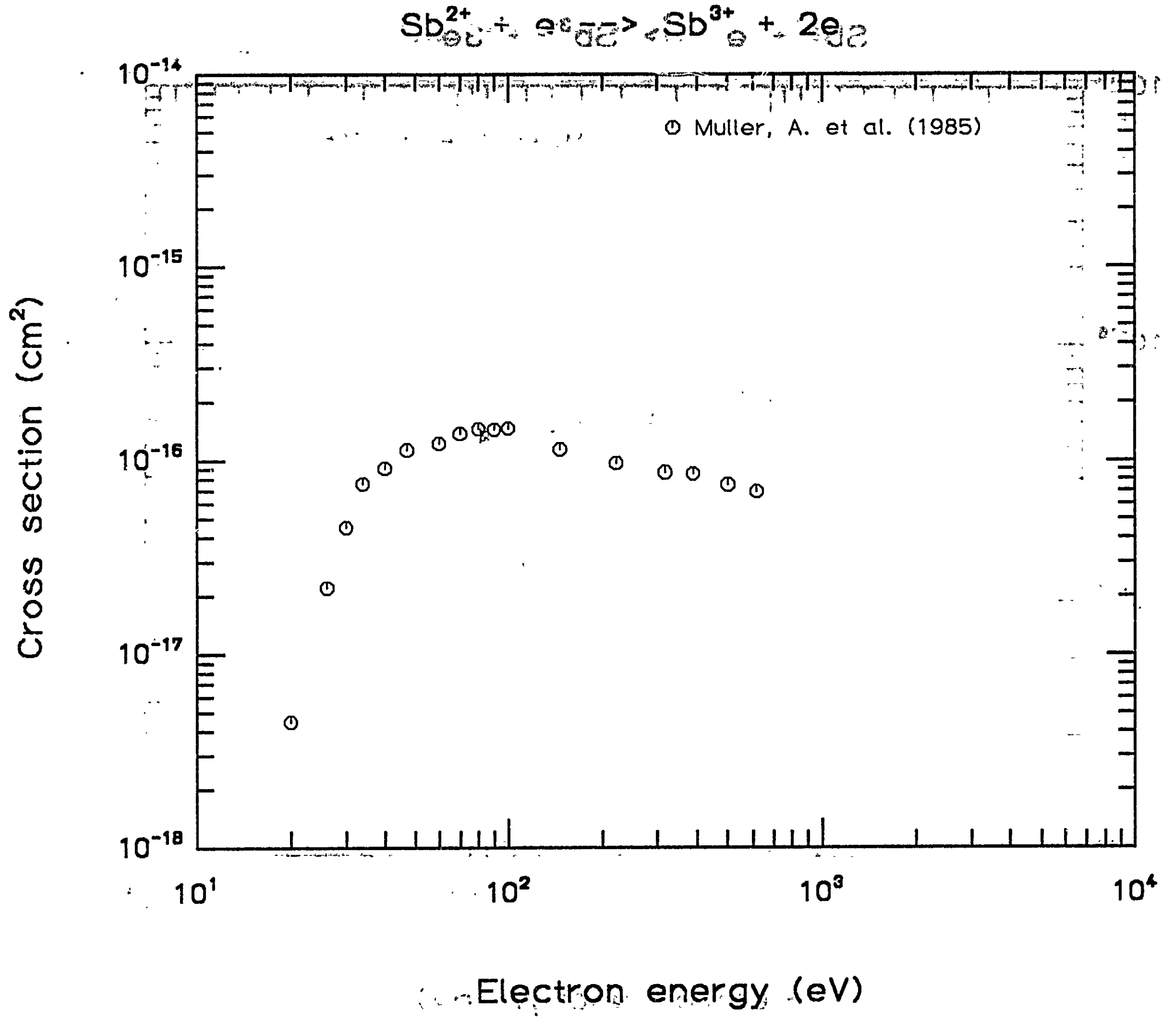
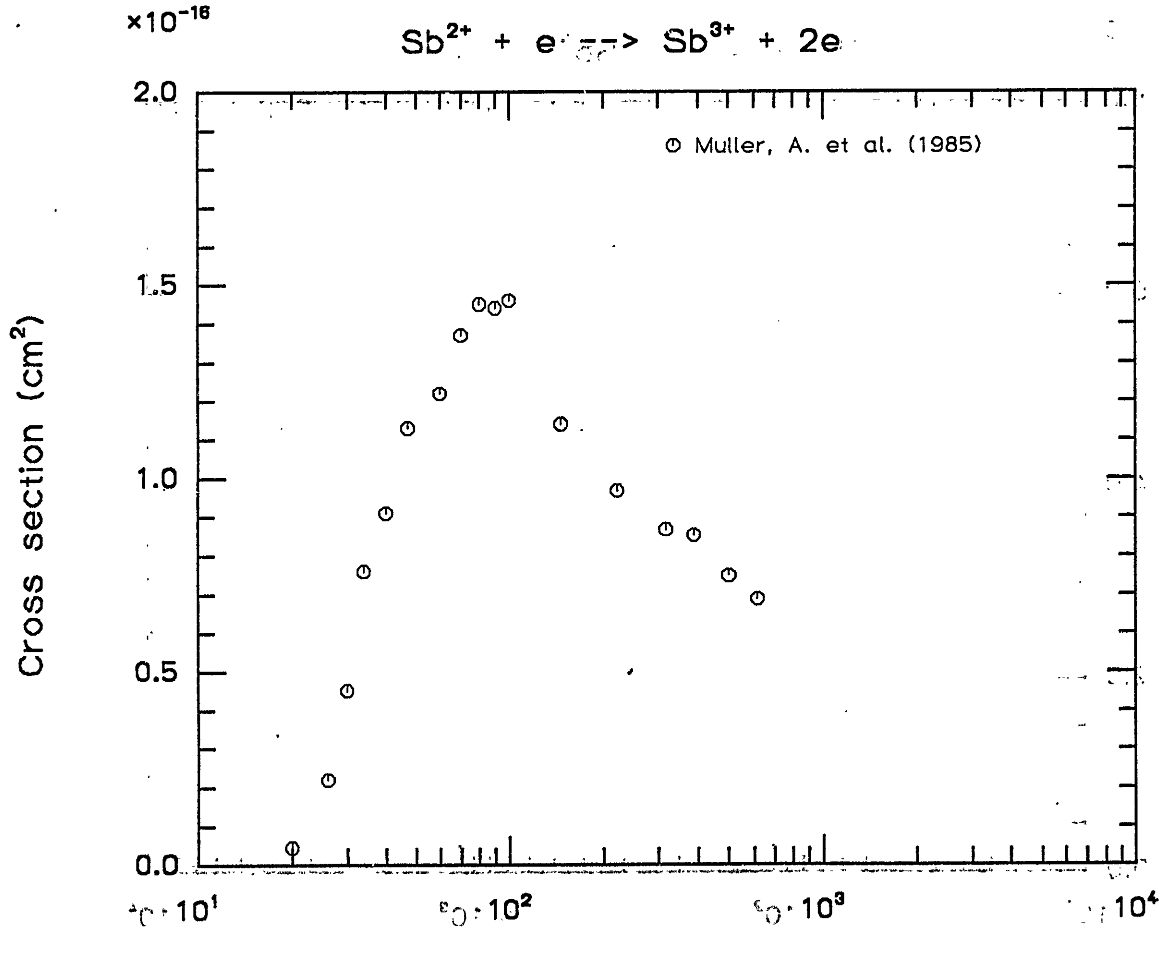

×10-17
Sb+ + e --> Sb3+ + 3e
Muller, A. et al. (1985)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 221



Sb2+ + e ==> Sb3+ + 2e
Muller, A. et al. (1985)
Cross section (cm2)
10-14
10-15
10-16
10-17
10-18
101
102
103
104
Electron energy (eV)



×10-16
Sb2+ + e ==> Sb3+ + 2e
Muller, A. et al. (1985)
Cross section (cm2)
2.0
1.5
1.0
0.5
0.0
101
102
103
104
Electron energy (eV)

Fig. 222

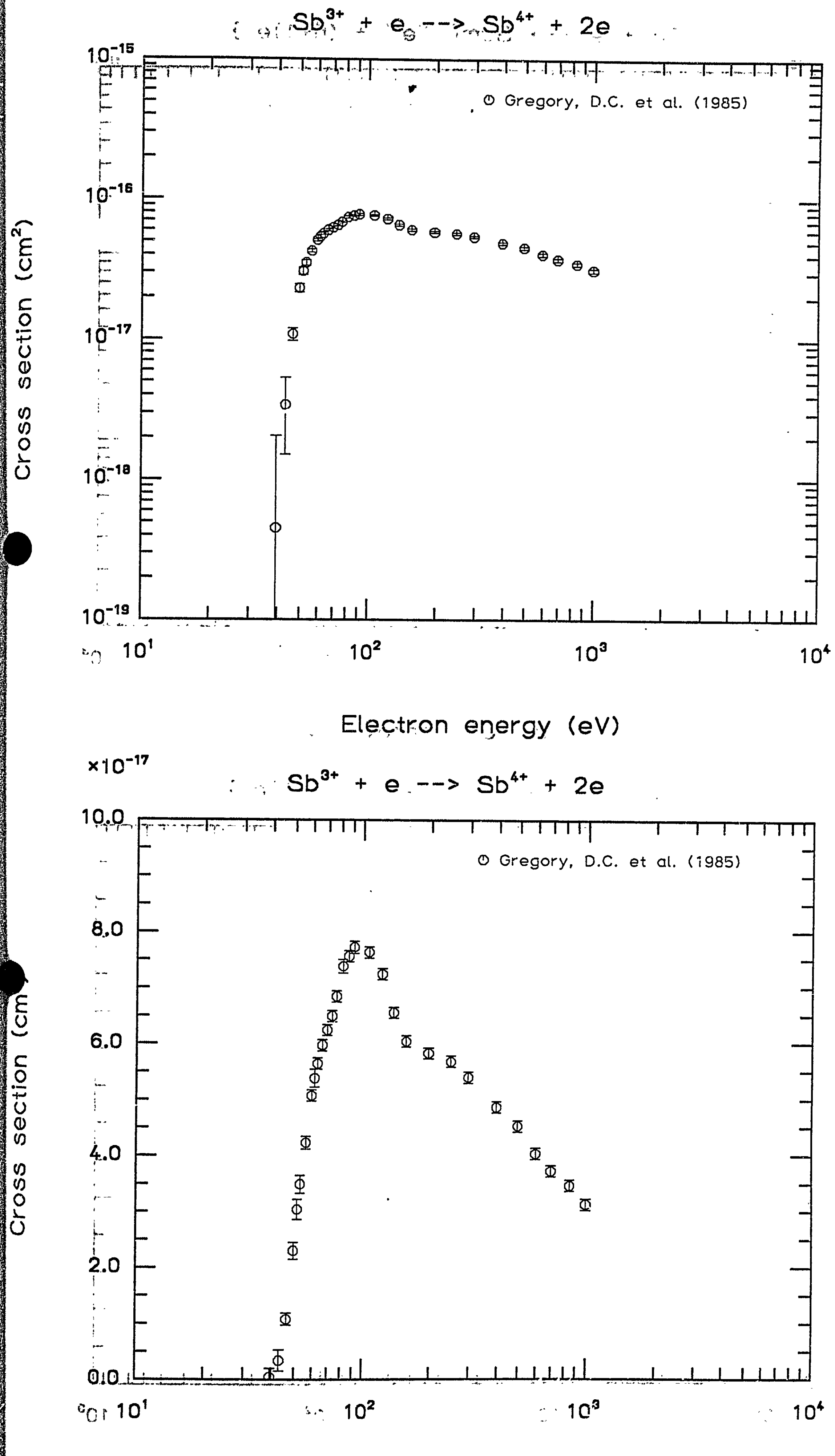
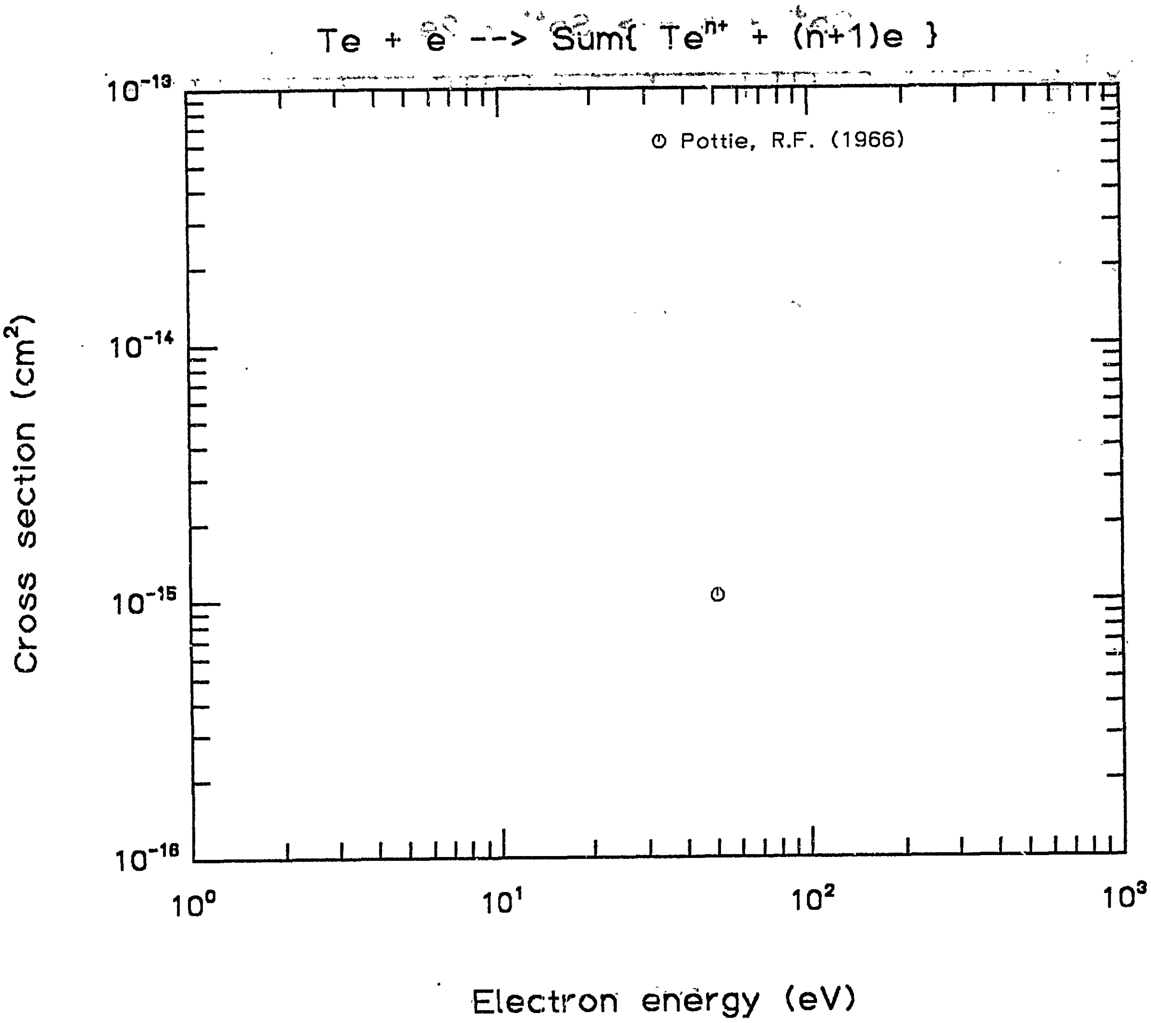
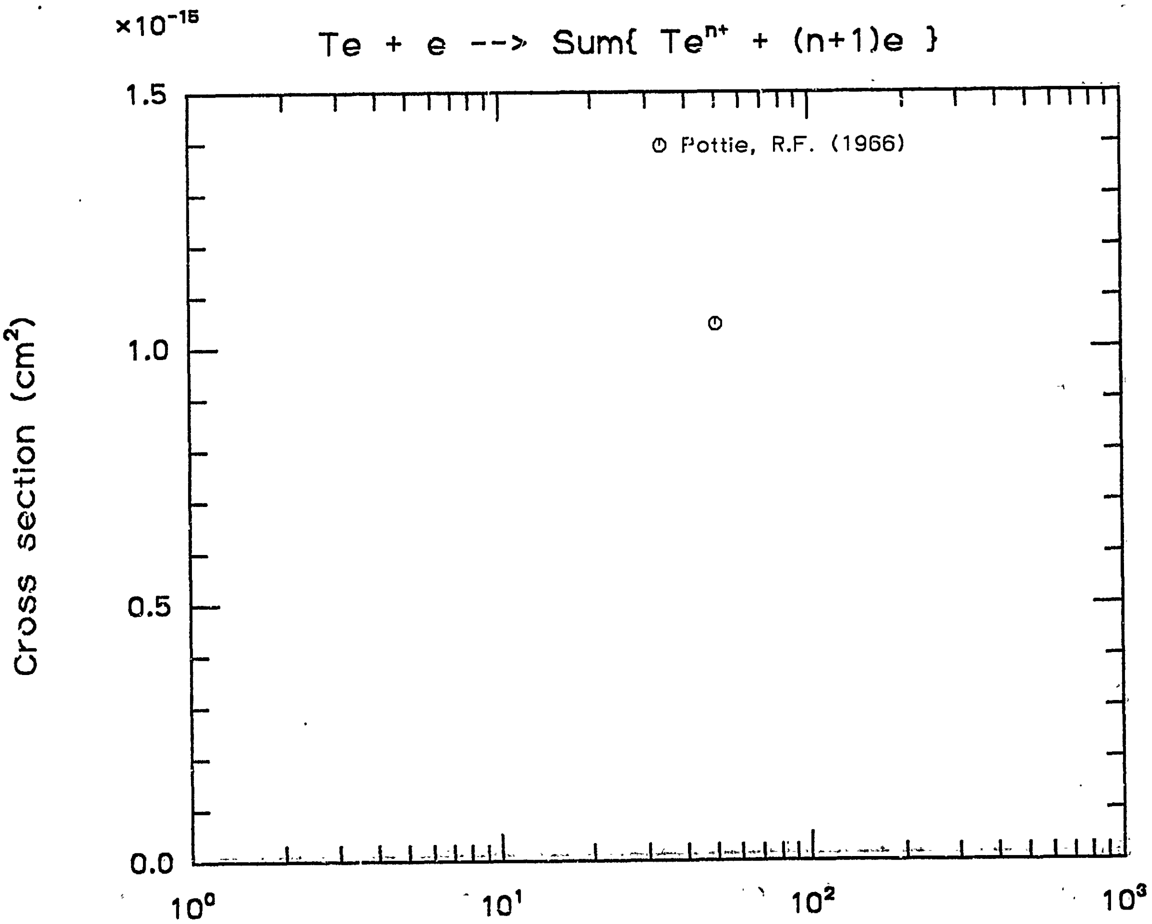

Sb3+ + e --> Sb4+ + 2e
Gregory, D.C. et al. (1985)
Cross section (cm2)
10-15
10-16
10-17
10-18
10-19
101
102
103
104
Electron energy (eV)
×10-17
Sb3+ + e --> Sb4+ + 2e
Gregory, D.C. et al. (1985)
Cross section (cm2)
10.0
8.0
6.0
4.0
2.0
0.0
101
102
103
104
Electron energy (eV)

Fig. 223

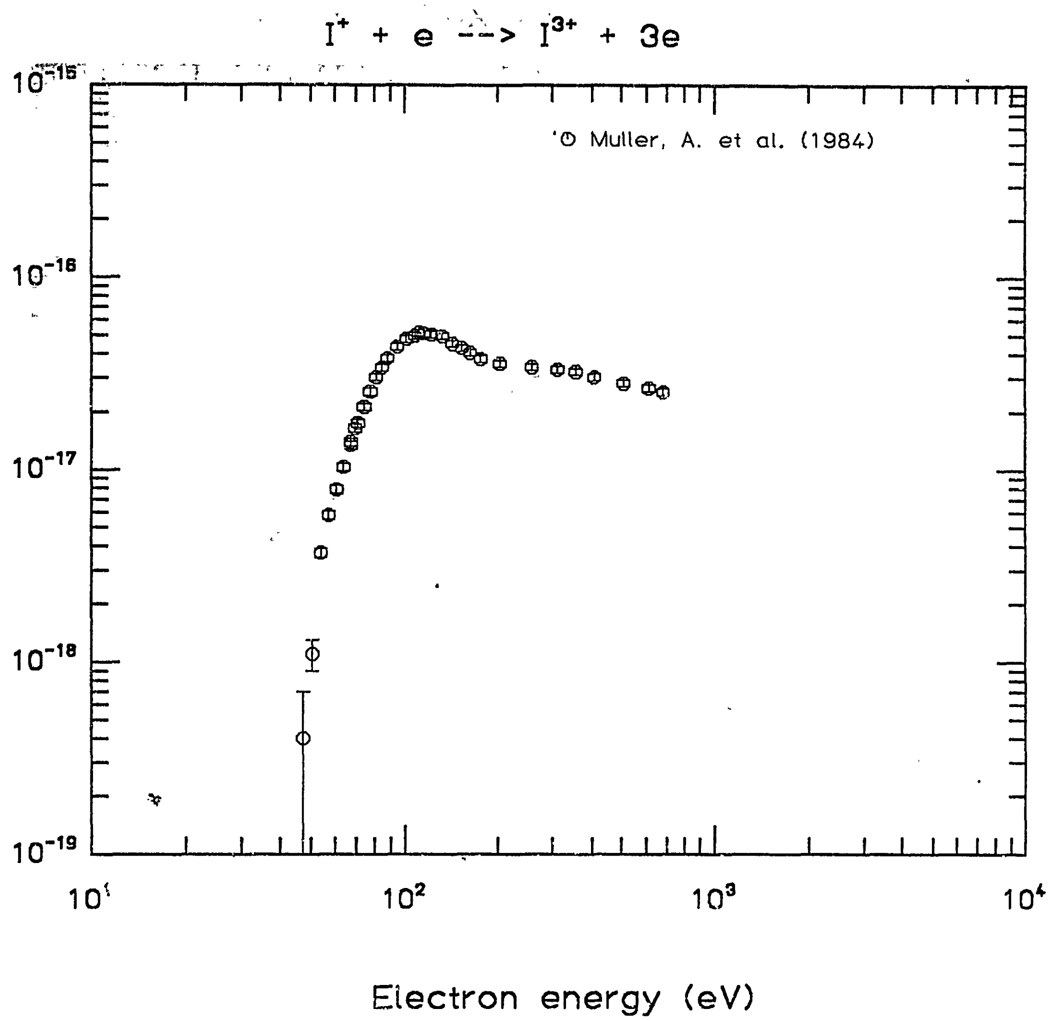


Te + e --> Sum{ Te^n+ + (n+1)e }
Pottie, R.F. (1966)
Cross section (cm²)
10⁻¹³
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁰
10¹
10²
10³
Electron energy (eV)



×10⁻¹⁵
Te + e --> Sum{ Te^n+ + (n+1)e }
Pottie, R.F. (1966)
Cross section (cm²)
1.5
1.0
0.5
0.0
10⁰
10¹
10²
10³
Electron energy (eV)

Fig. 224



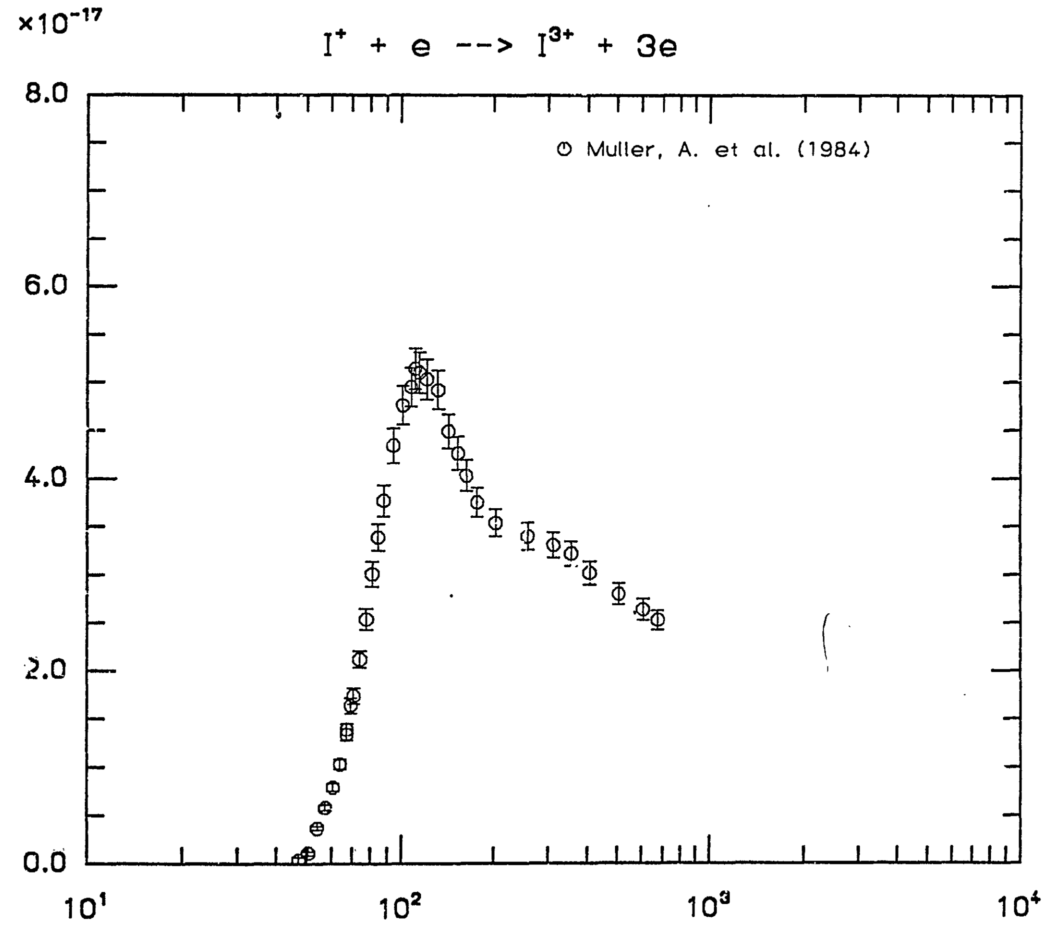
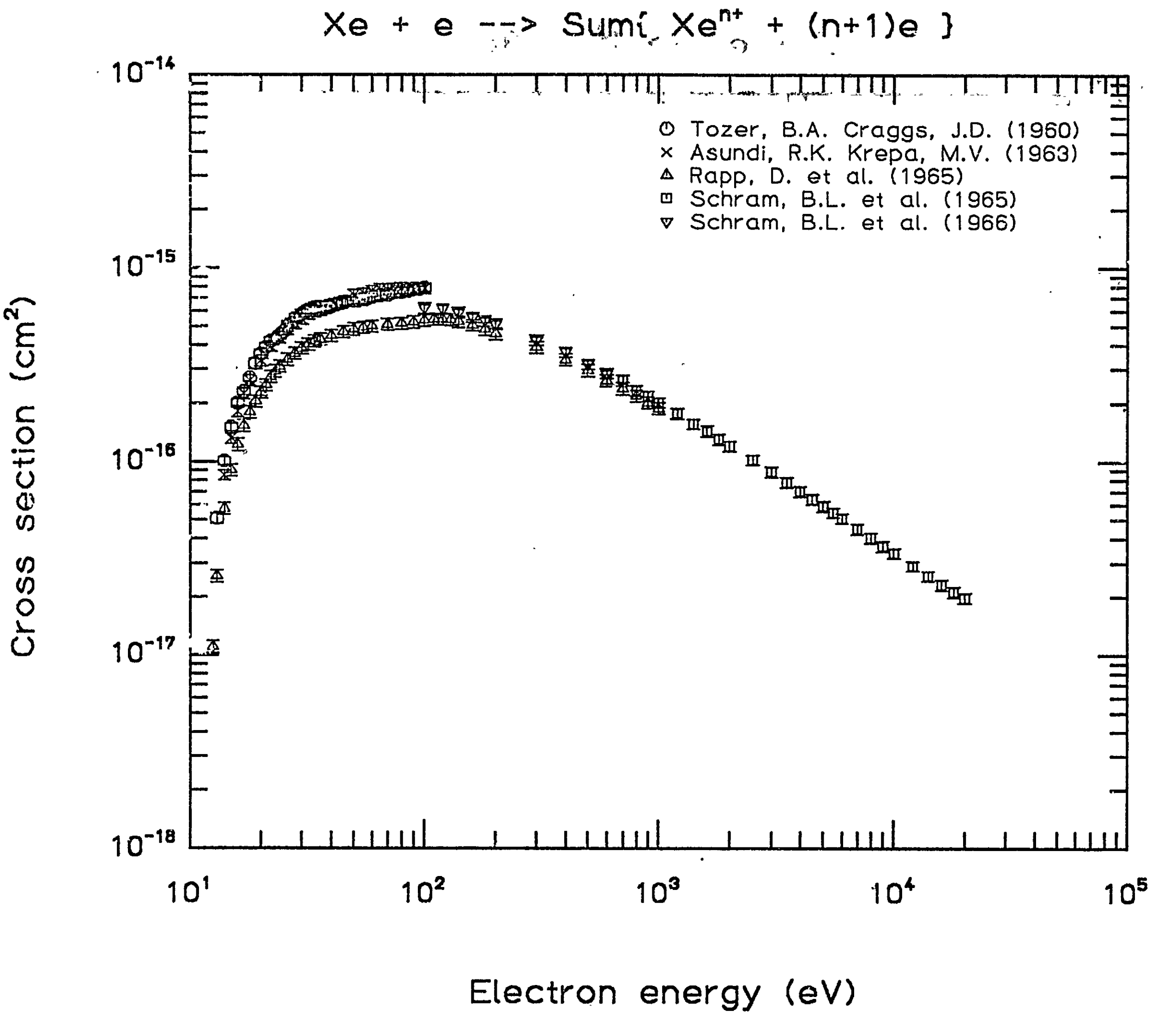


Fig. 225 Electron energy (eV)


Xe + e --> Sum{ Xe^n+ + (n+1)e }
Tozer, B.A. Craggs, J.D. (1960)
Asundi, R.K. Krepa, M.V. (1963)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Cross section (cm²)
Electron energy (eV)

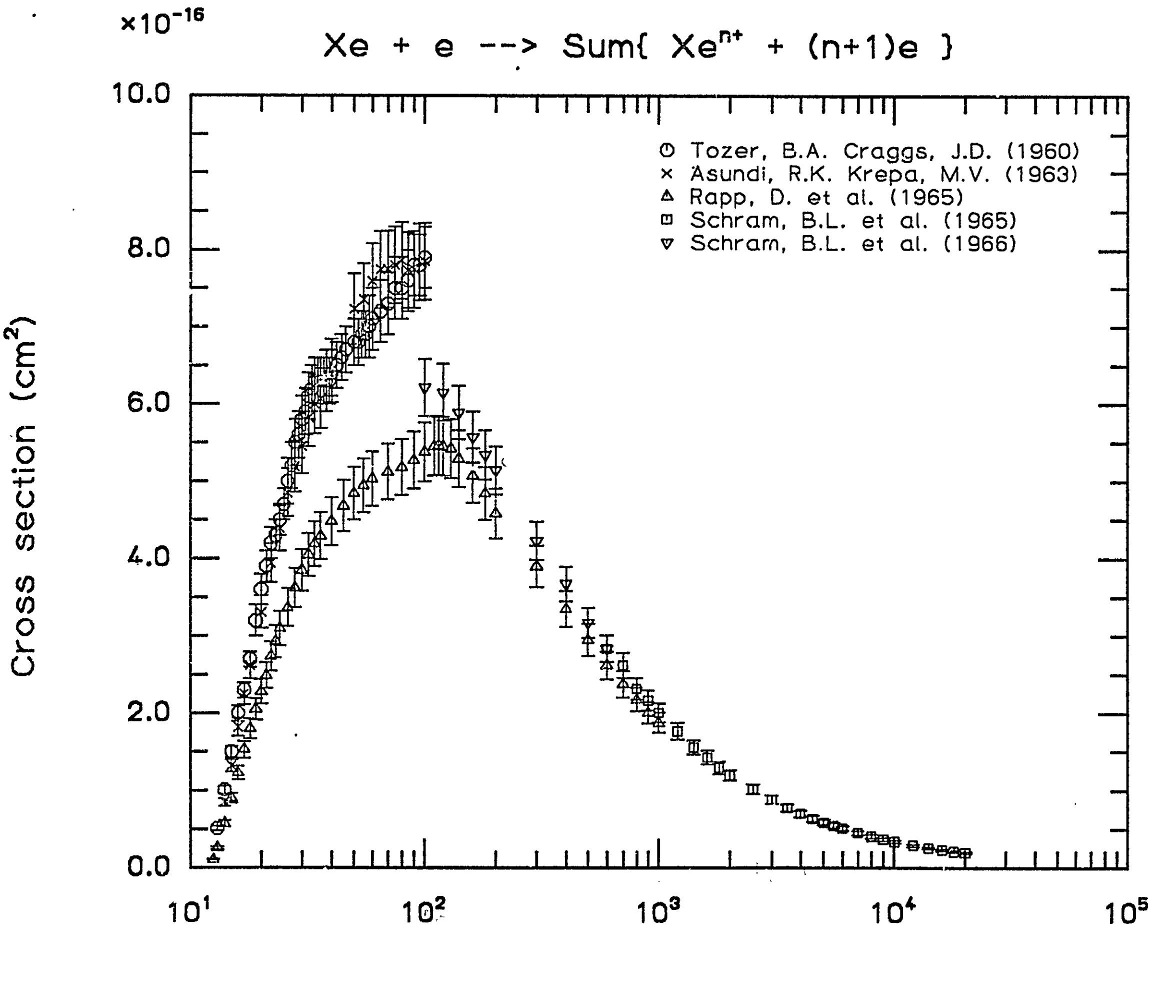
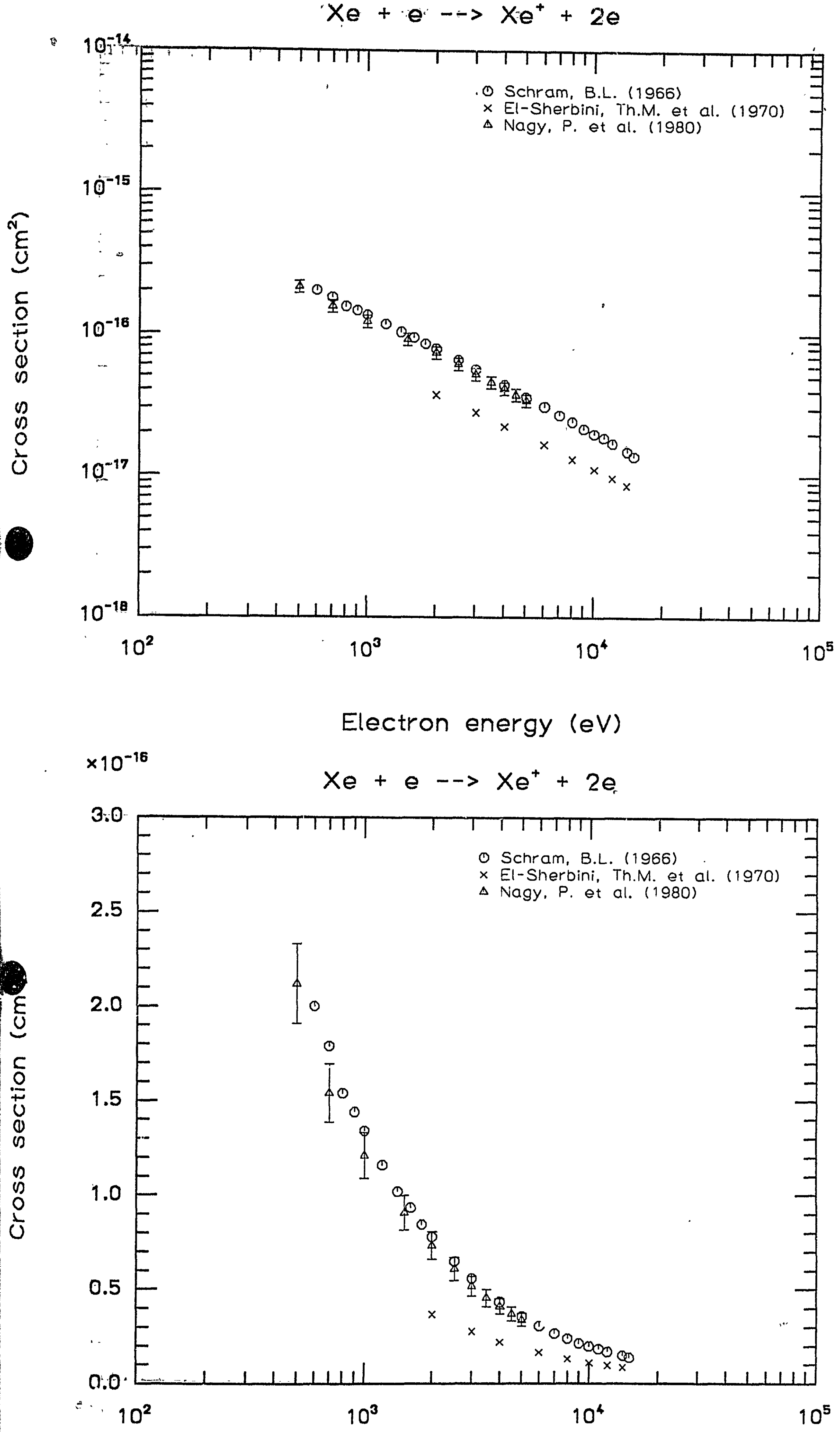
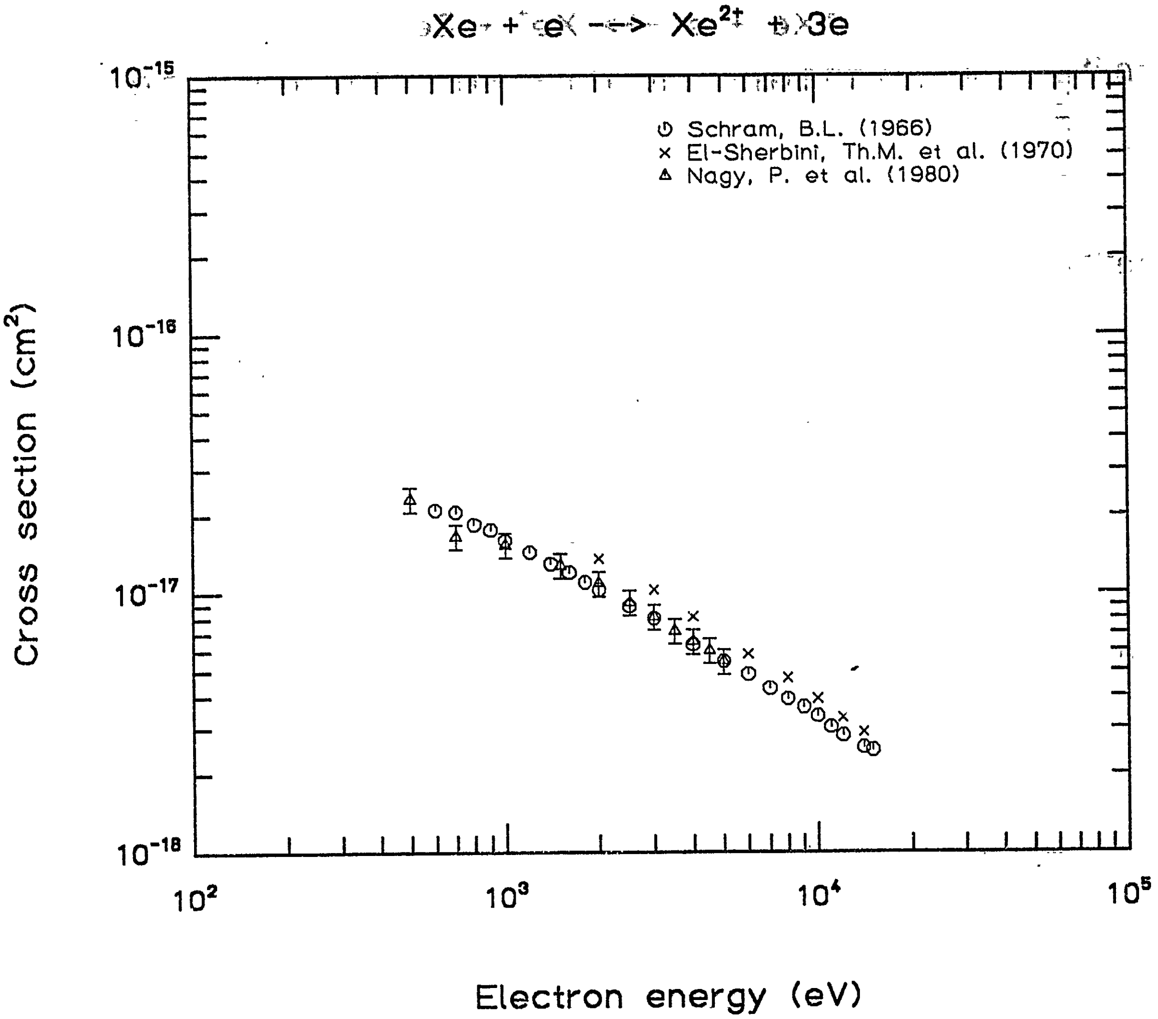

×10⁻¹⁶
Xe + e --> Sum{ Xe^n+ + (n+1)e }
Tozer, B.A. Craggs, J.D. (1960)
Asundi, R.K. Krepa, M.V. (1963)
Rapp, D. et al. (1965)
Schram, B.L. et al. (1965)
Schram, B.L. et al. (1966)
Cross section (cm²)
Electron energy (eV)

Fig. 226



Xe + e --> Xe⁺ + 2e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Nagy, P. et al. (1980)
Cross section (cm²)
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10²
10³
10⁴
10⁵
Electron energy (eV)
×10⁻¹⁶
Xe + e --> Xe⁺ + 2e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Nagy, P. et al. (1980)
Cross section (cm²)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10²
10³
10⁴
10⁵
Electron energy (eV)

Fig. 227


Xe + e --> Xe2+ + 3e
Cross section (cm2)
10-15
10-16
10-17
10-18
10^2
10^3
10^4
10^5
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Nagy, P. et al. (1980)
Electron energy (eV)

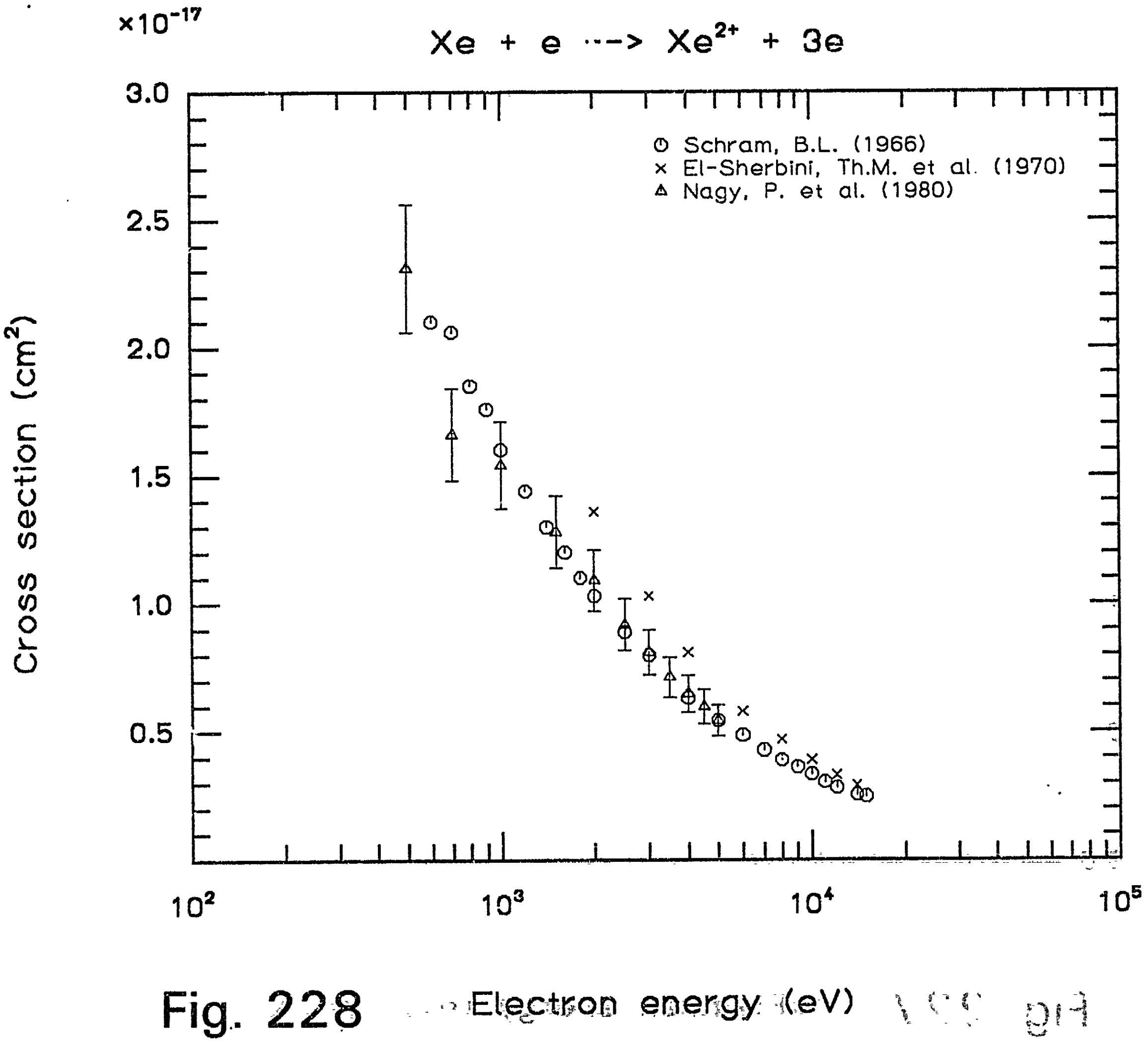
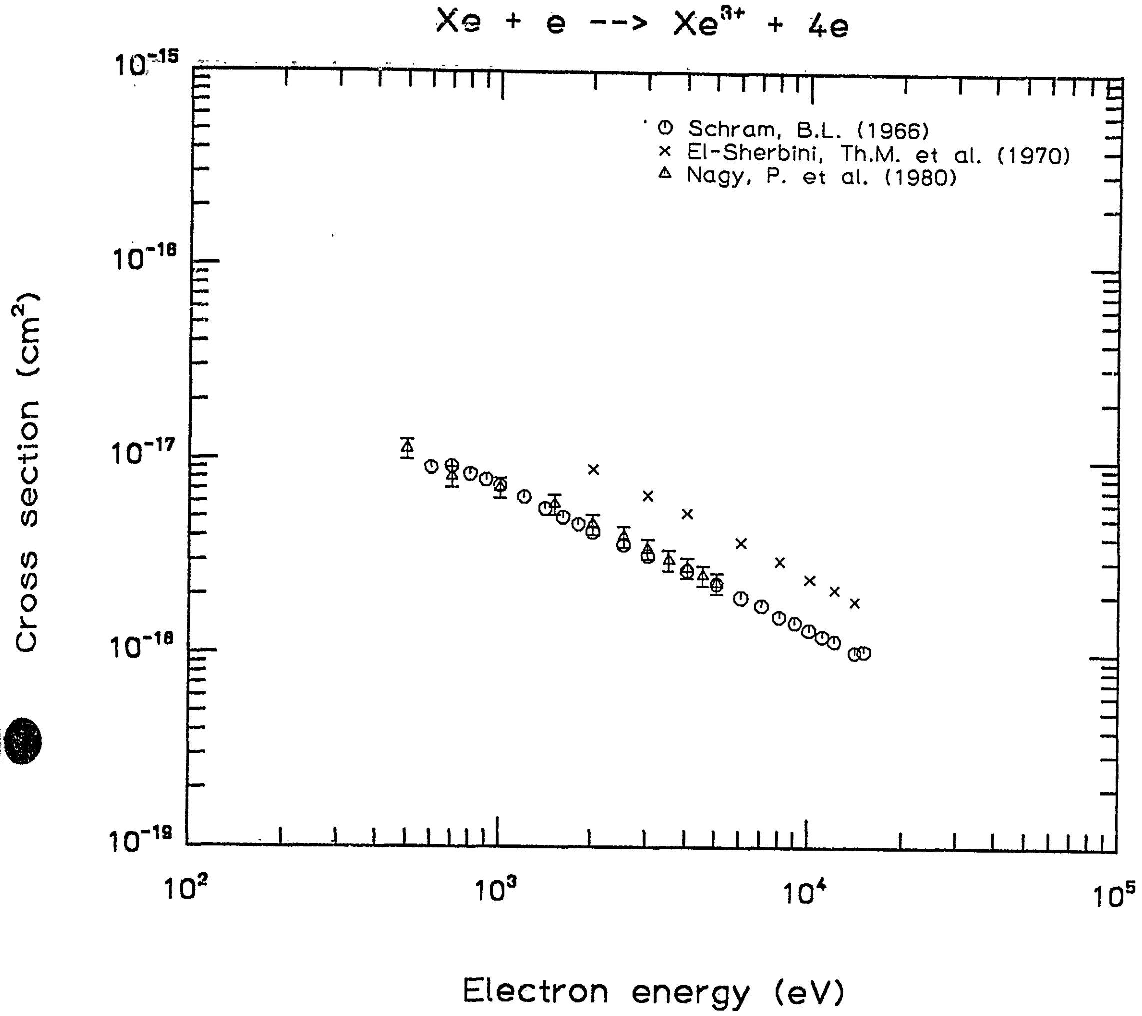

×10-17
Xe + e --> Xe2+ + 3e
Cross section (cm2)
3.0
2.5
2.0
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Nagy, P. et al. (1980)
Electron energy (eV)

Fig. 228



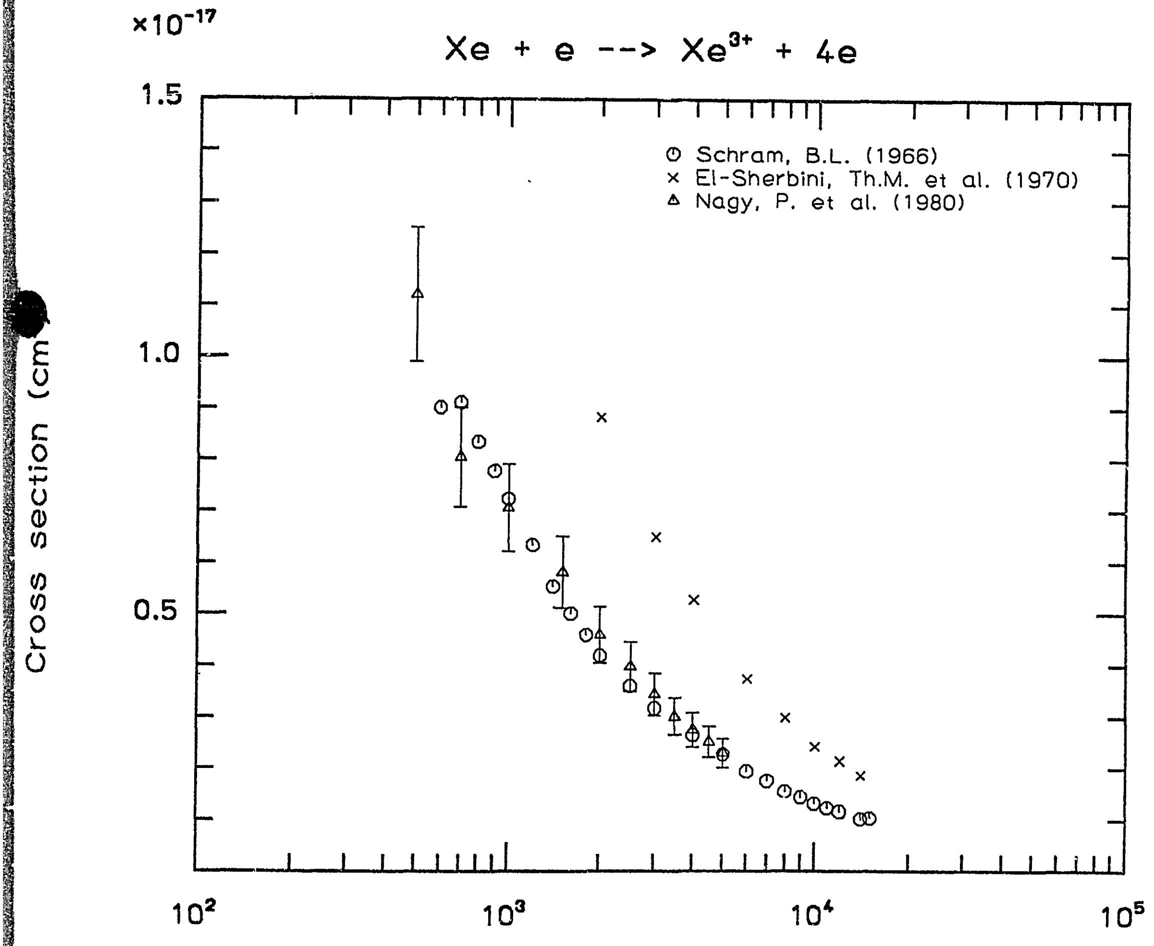


Fig. 229 Electron energy (eV)

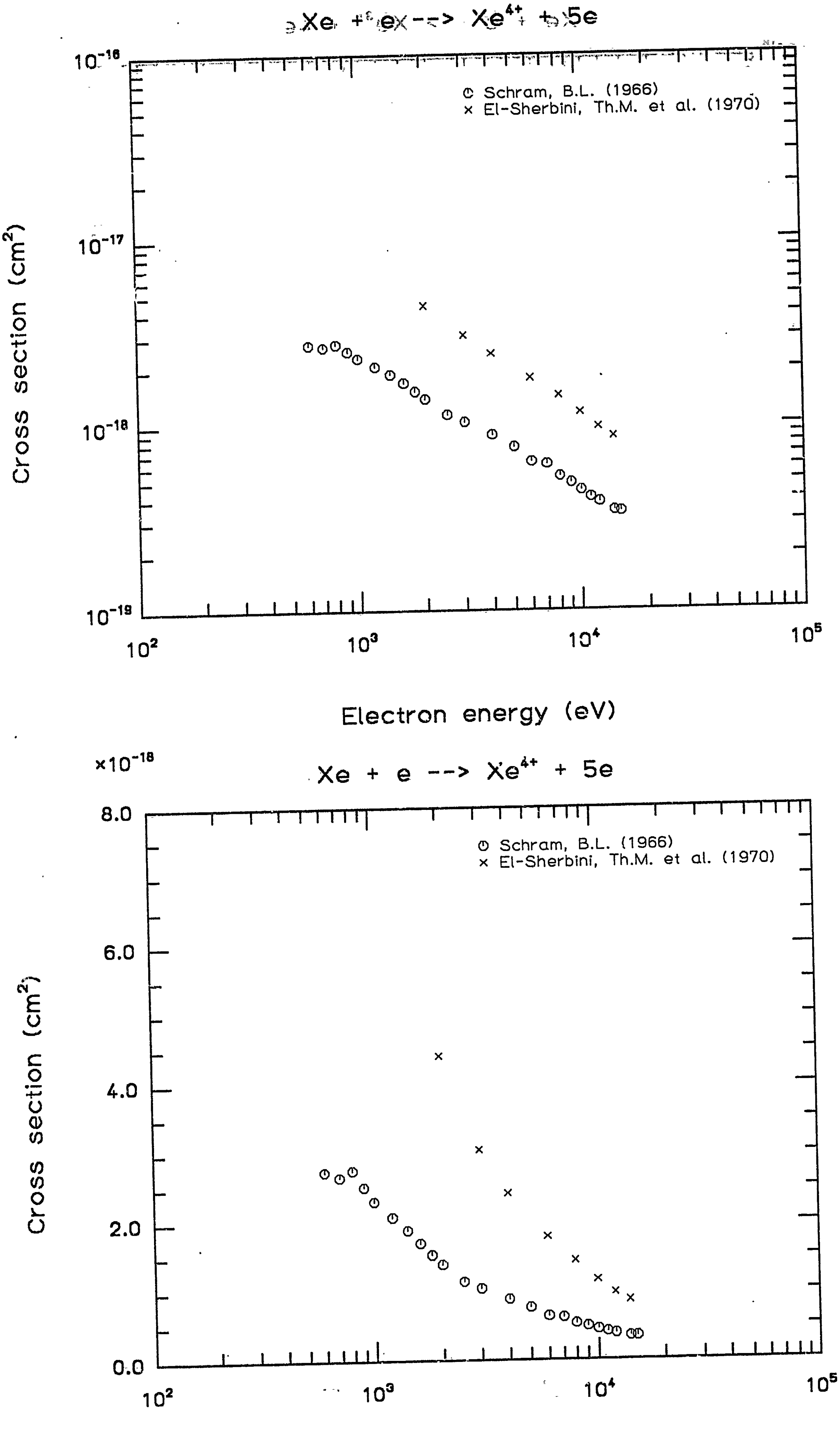
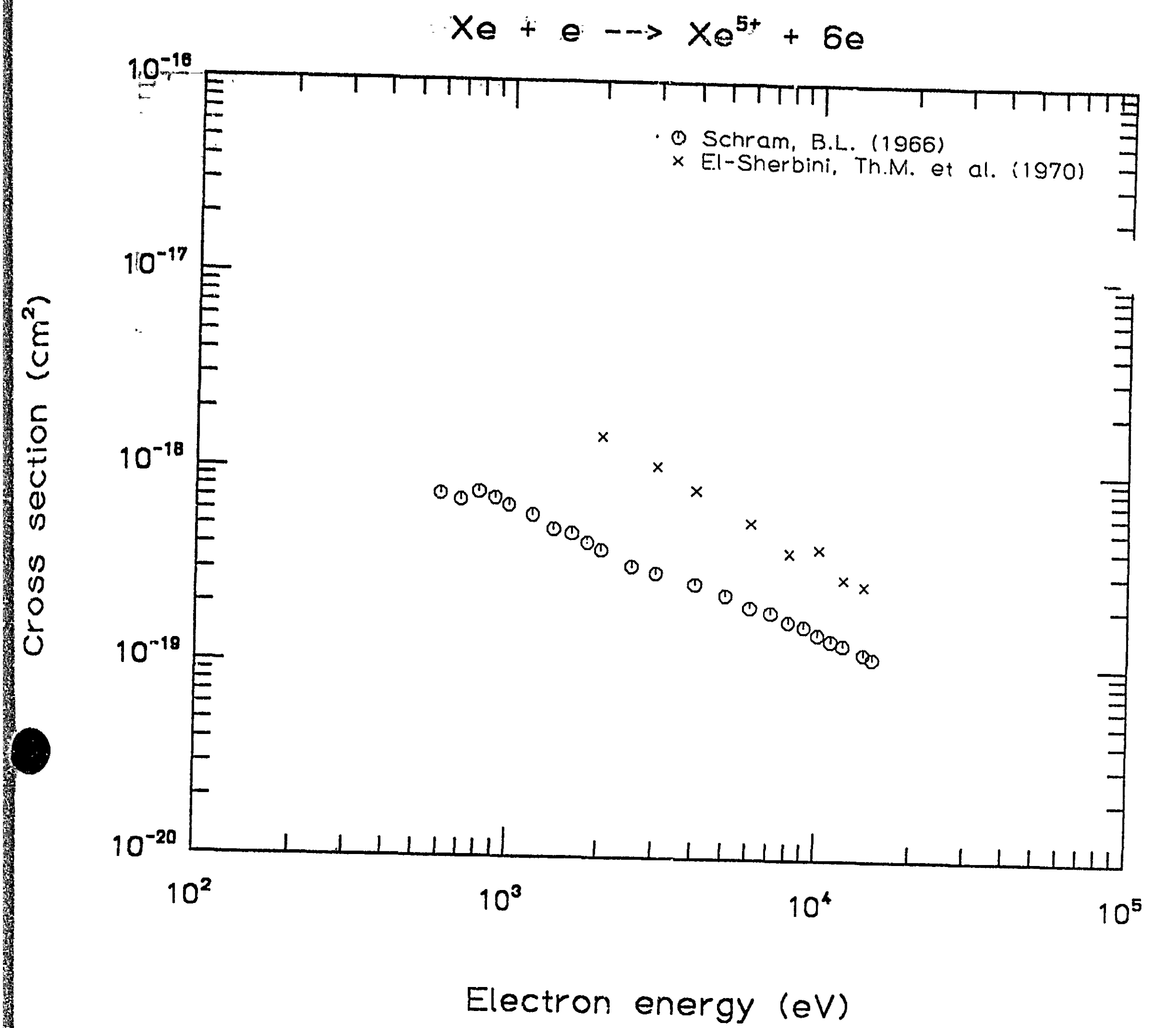


Fig. 230 Electron energy (eV)



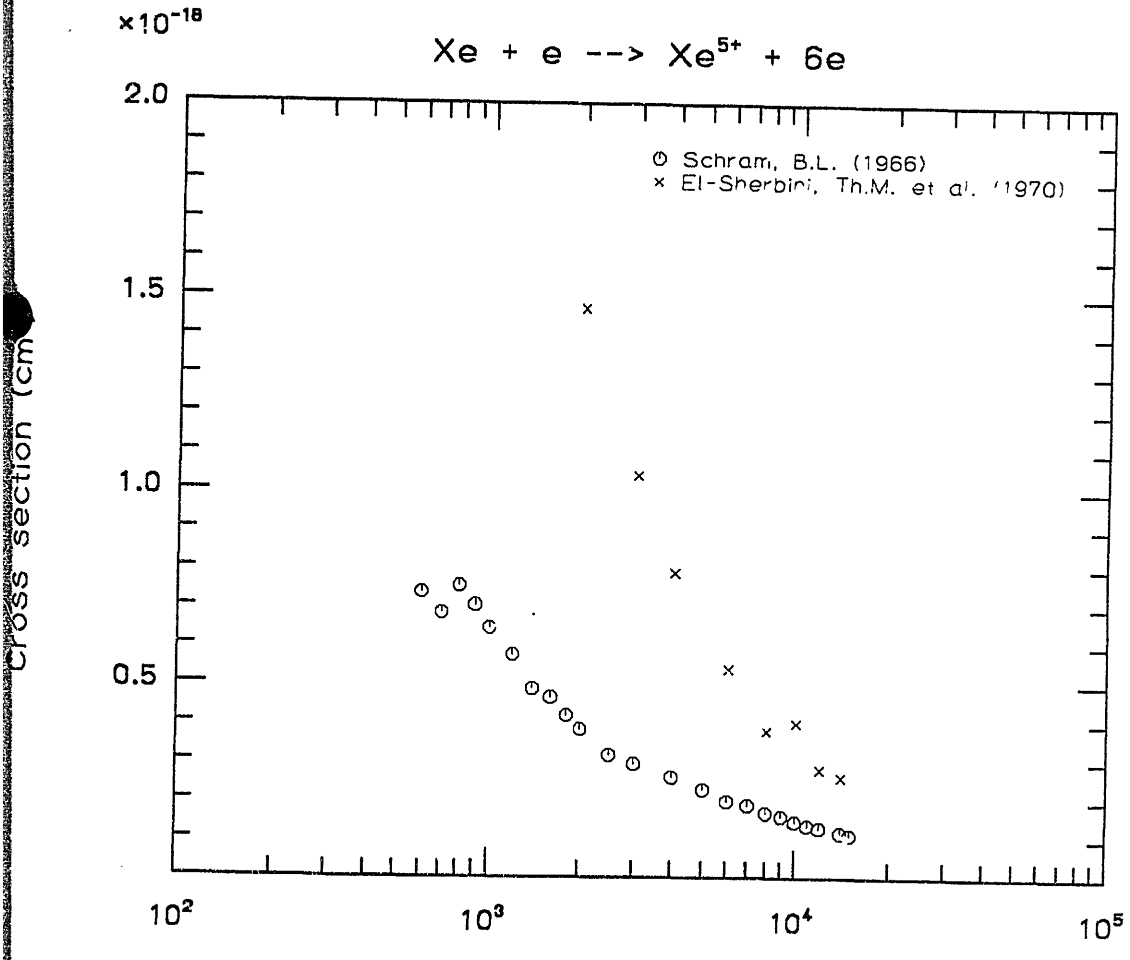
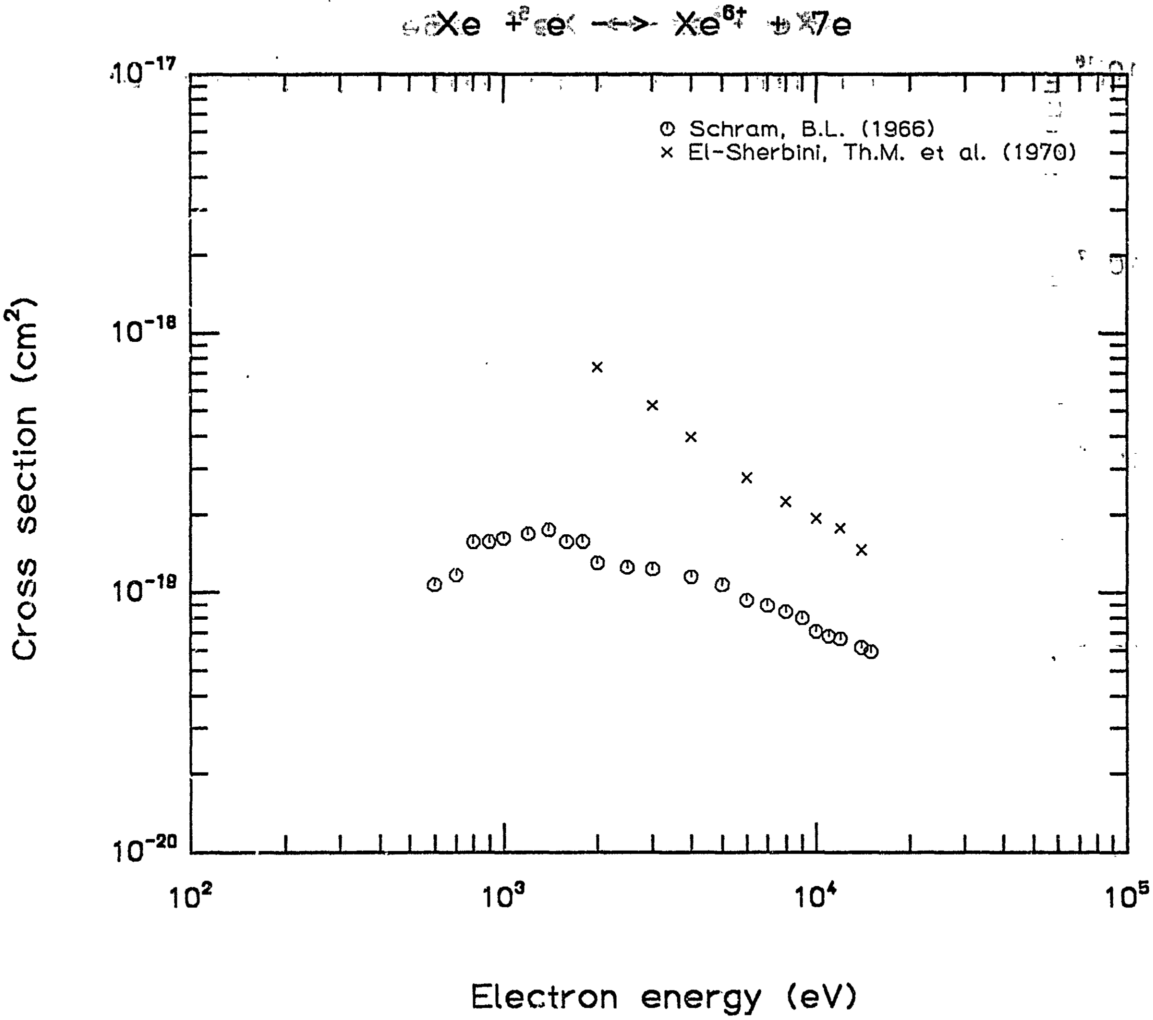


Fig. 231 Electron energy (eV)


Xe + e --> Xe^{6+} + 7e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Cross section (cm^2)
Electron energy (eV)

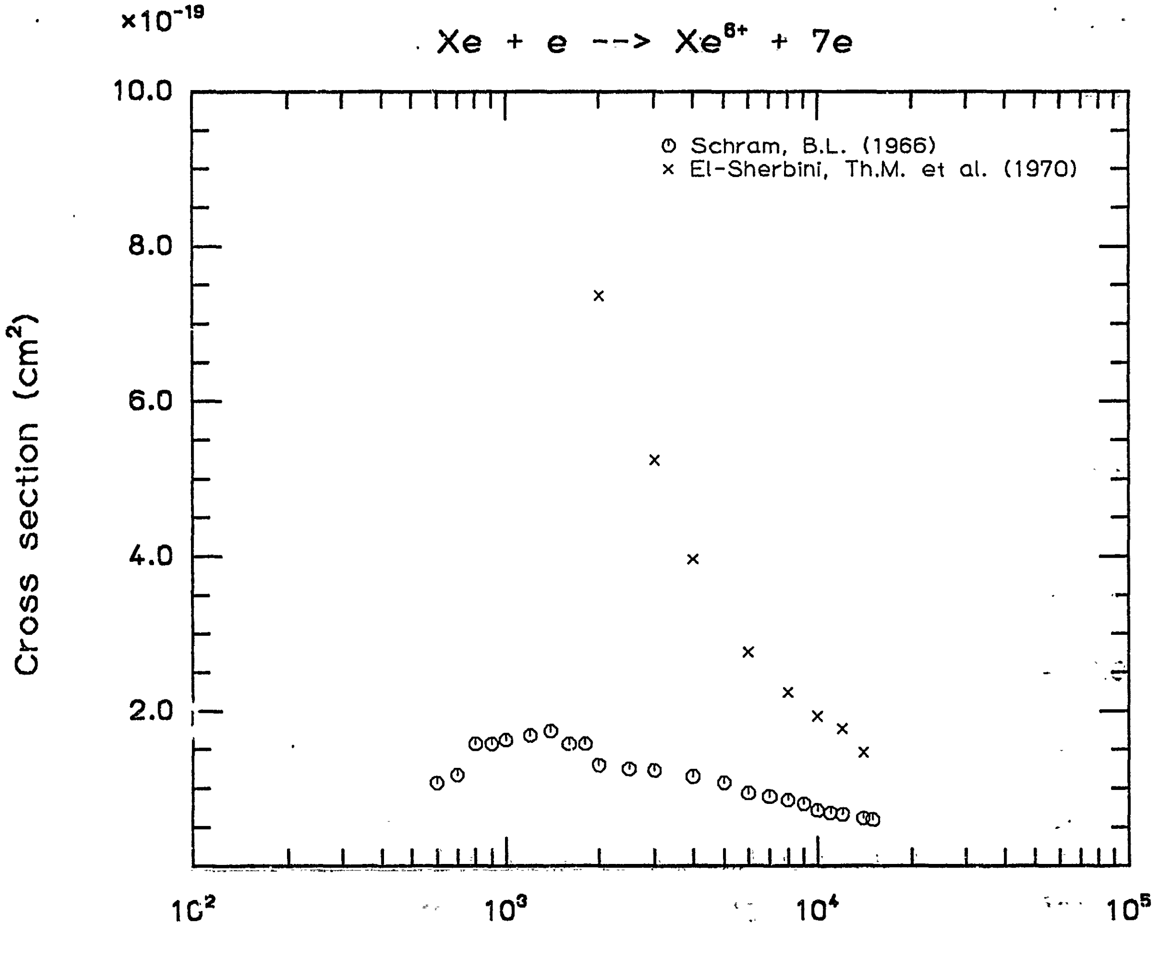
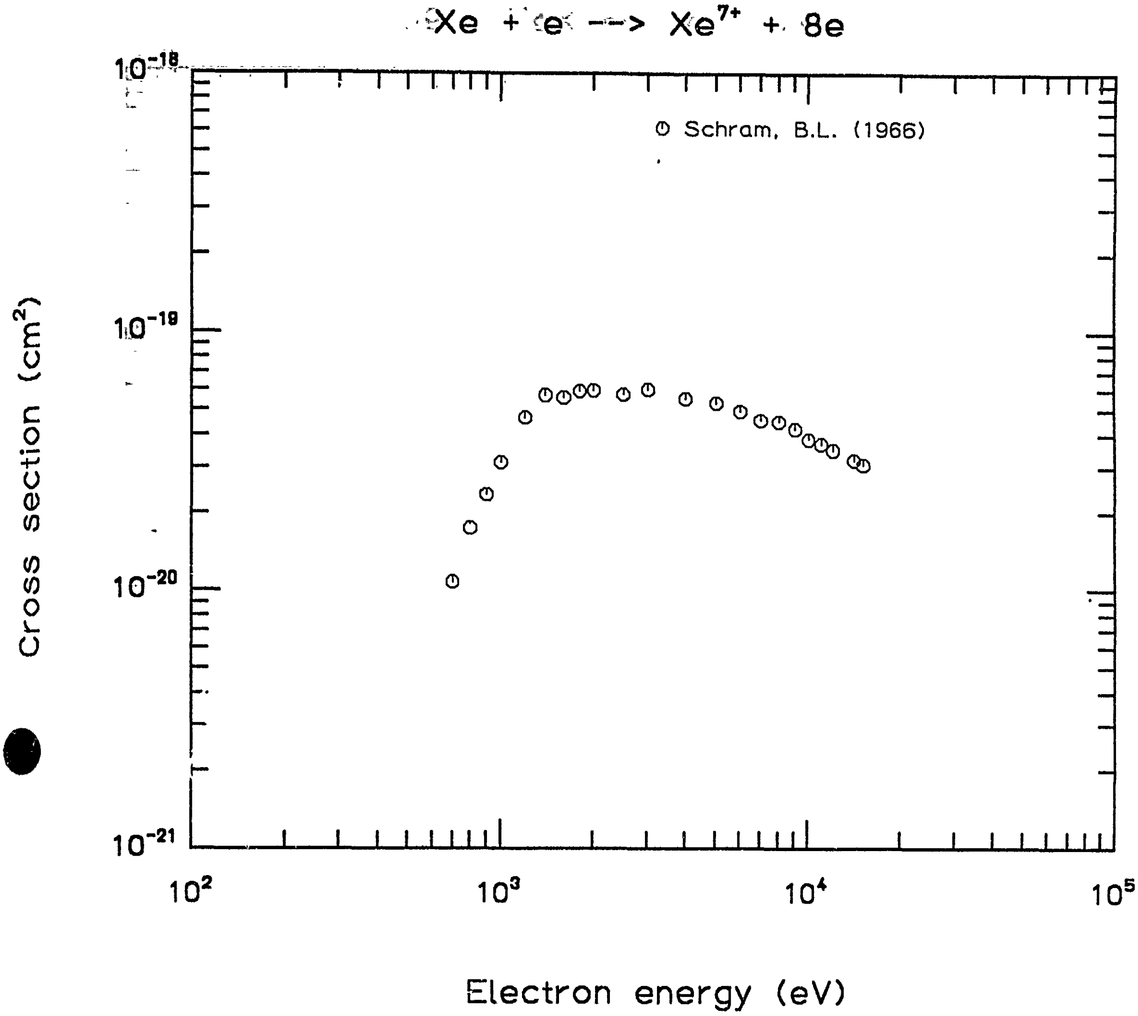

×10^{-19}
Xe + e --> Xe^{6+} + 7e
Schram, B.L. (1966)
El-Sherbini, Th.M. et al. (1970)
Cross section (cm^2)
Electron energy (eV)

Fig. 232


Xe + e --> Xe7+ + 8e
Schram, B.L. (1966)
Cross section (cm2)
10-18
10-19
10-20
10-21
102
103
104
105
Electron energy (eV)

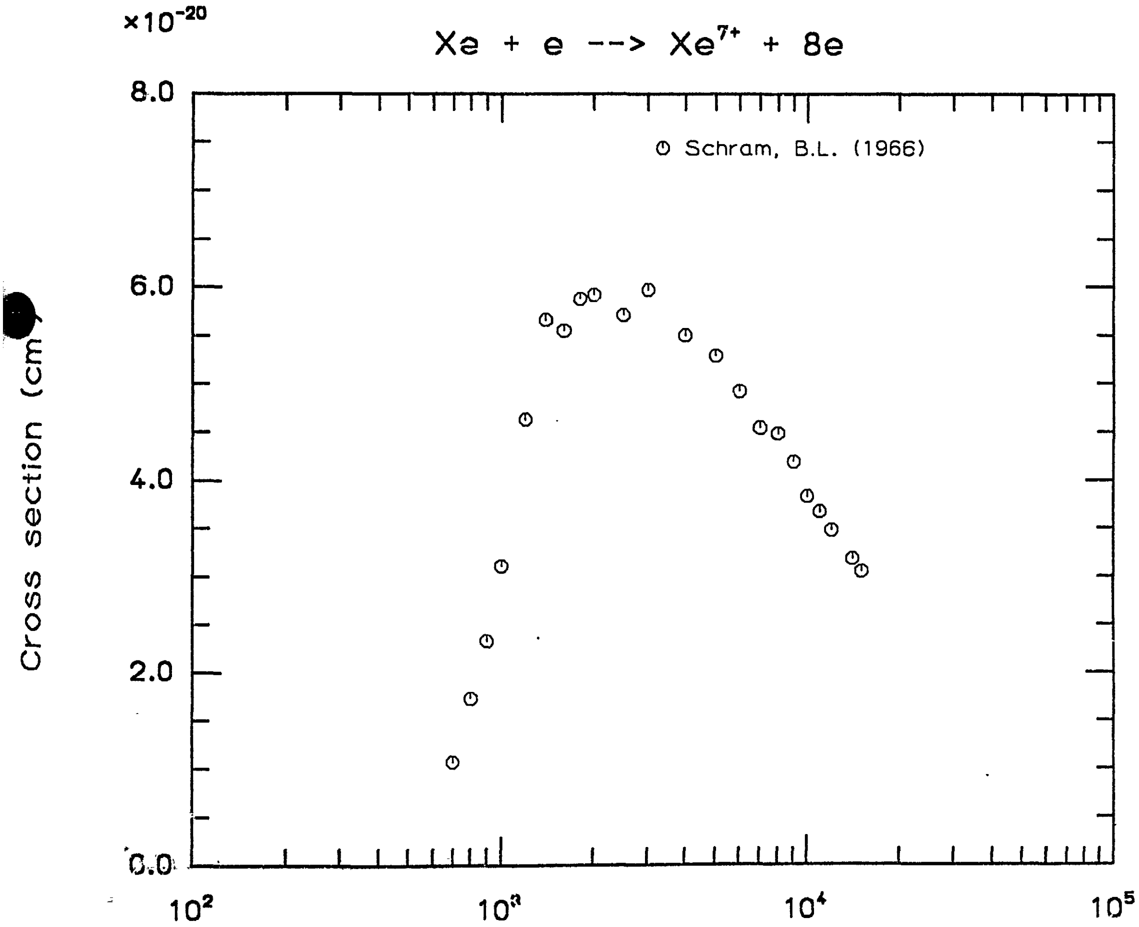
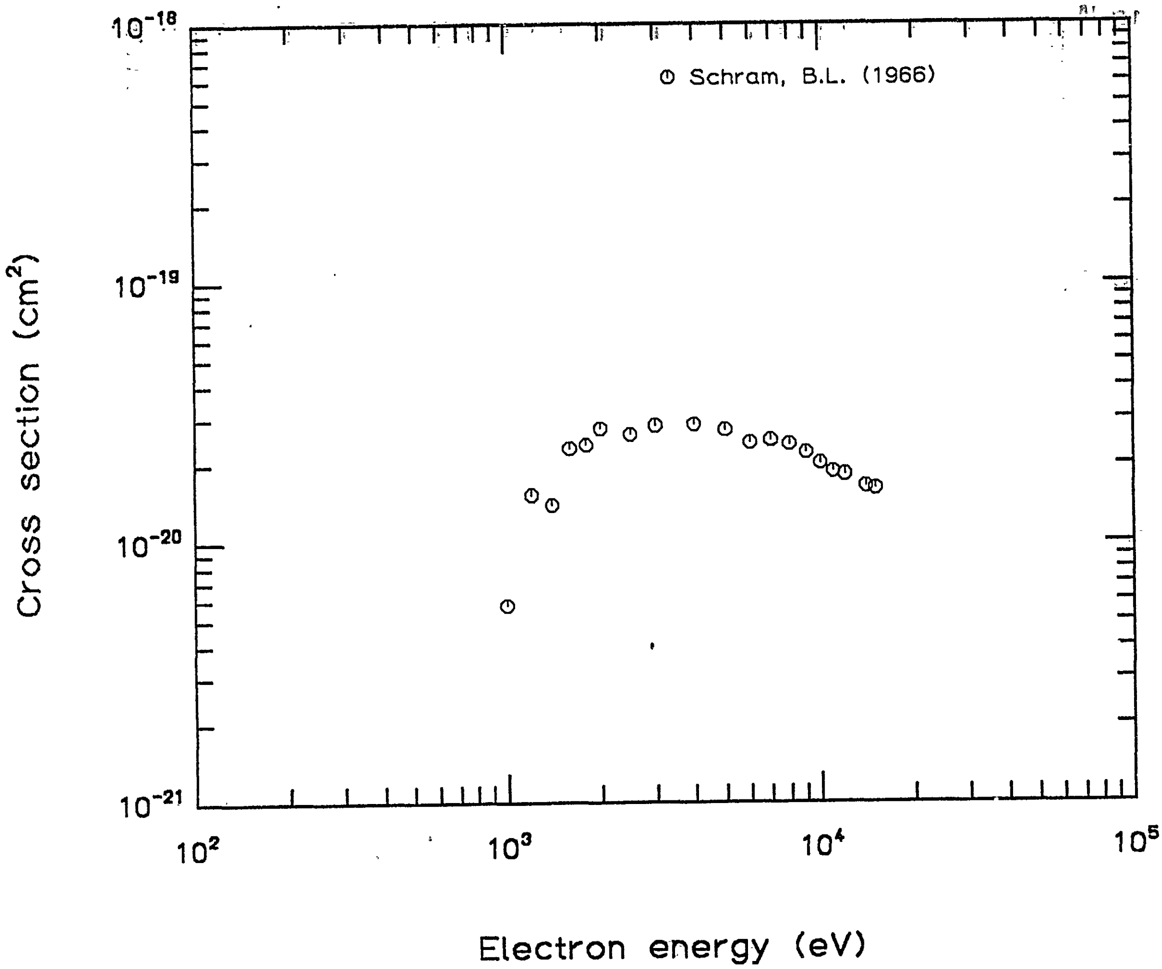

×10-20
Xe + e --> Xe7+ + 8e
Schram, B.L. (1966)
Cross section (cm
8.0
6.0
4.0
2.0
0.0
102
103
104
105
Electron energy (eV)

Fig. 233

Xe + e --> Xe^{8+} + 9e



Xe + e --> Xe^{8+} + 9e

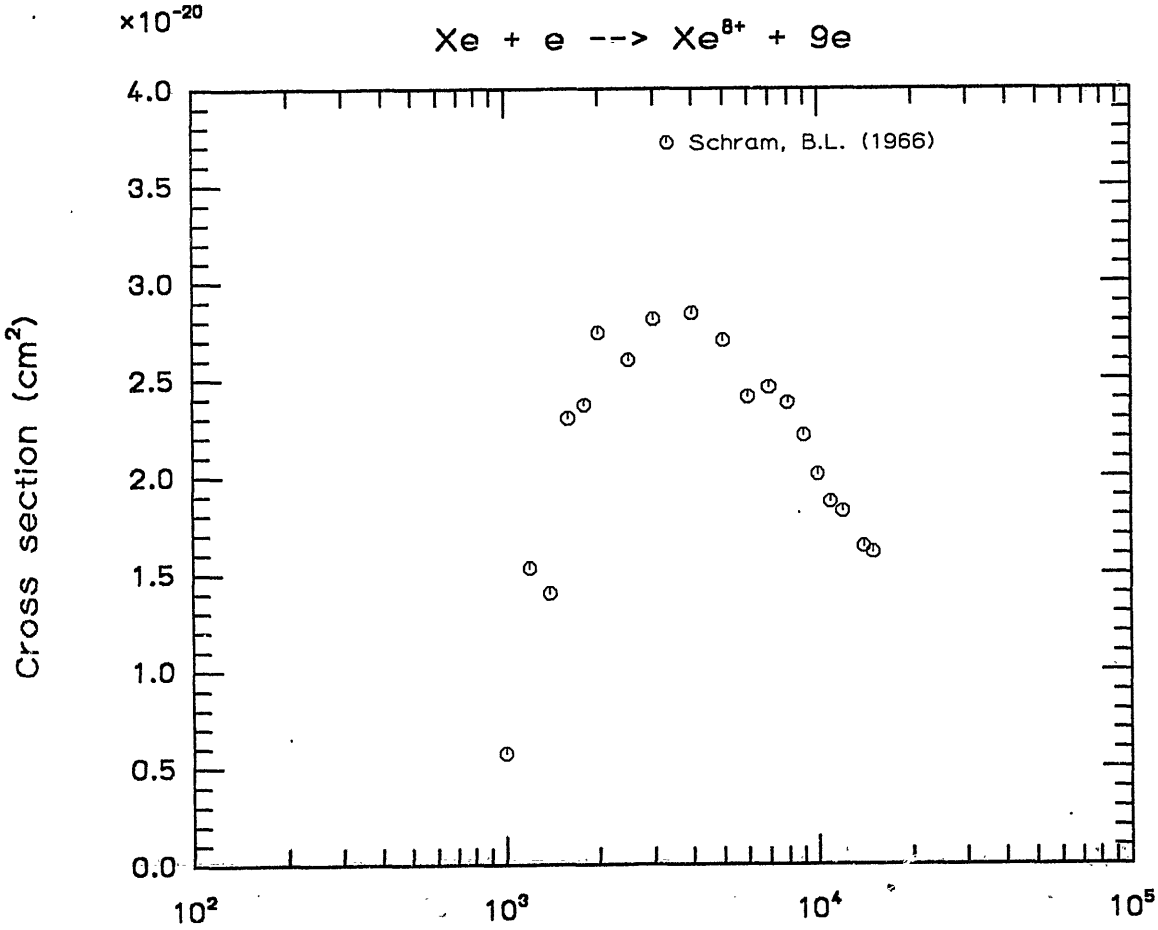
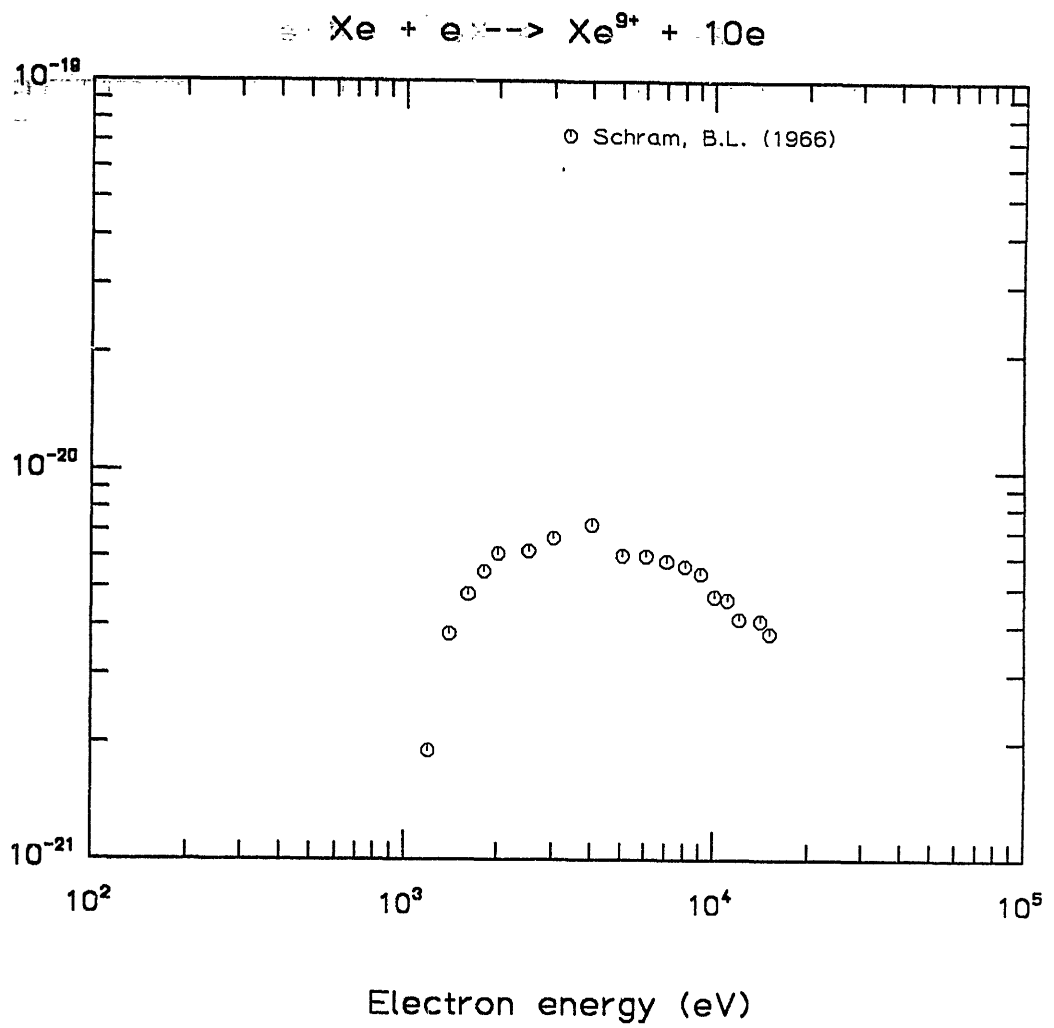


Fig. 234



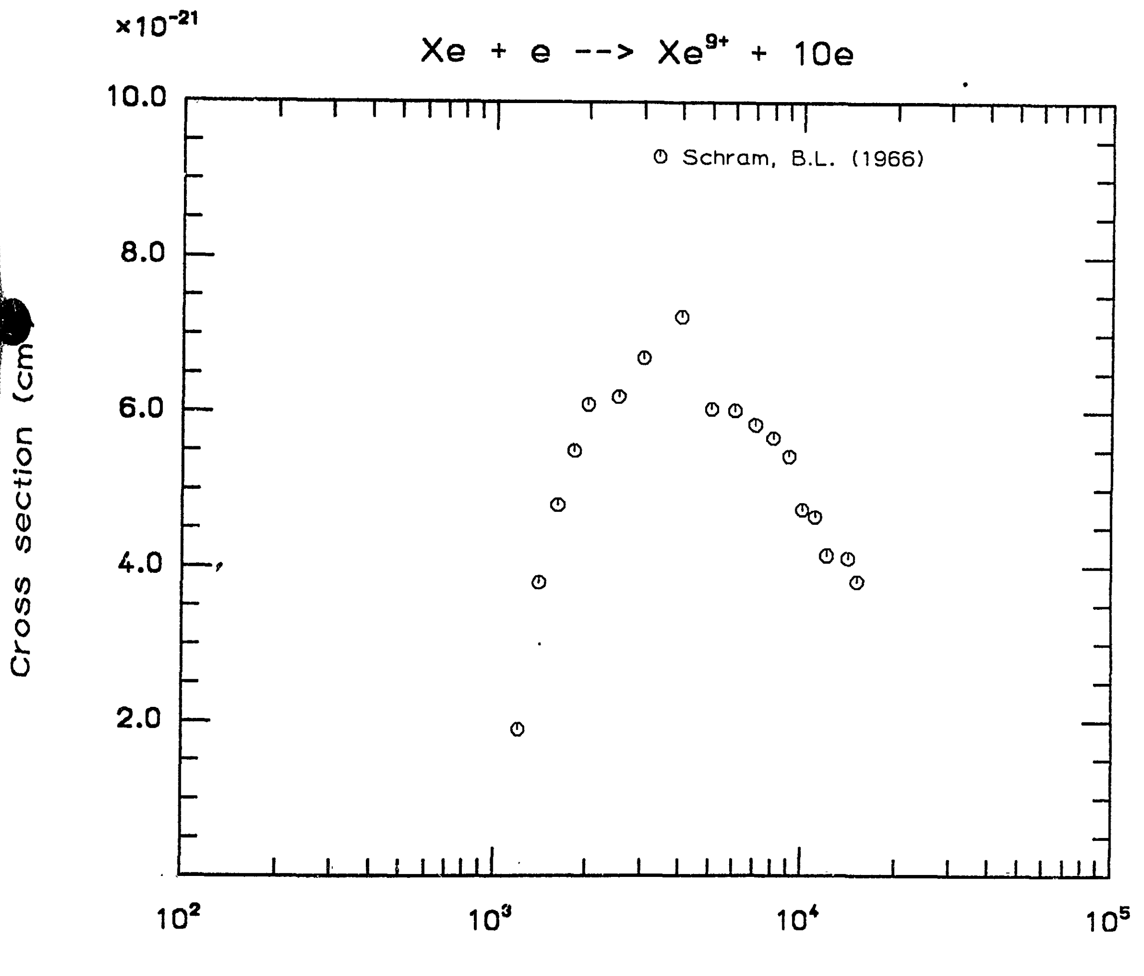
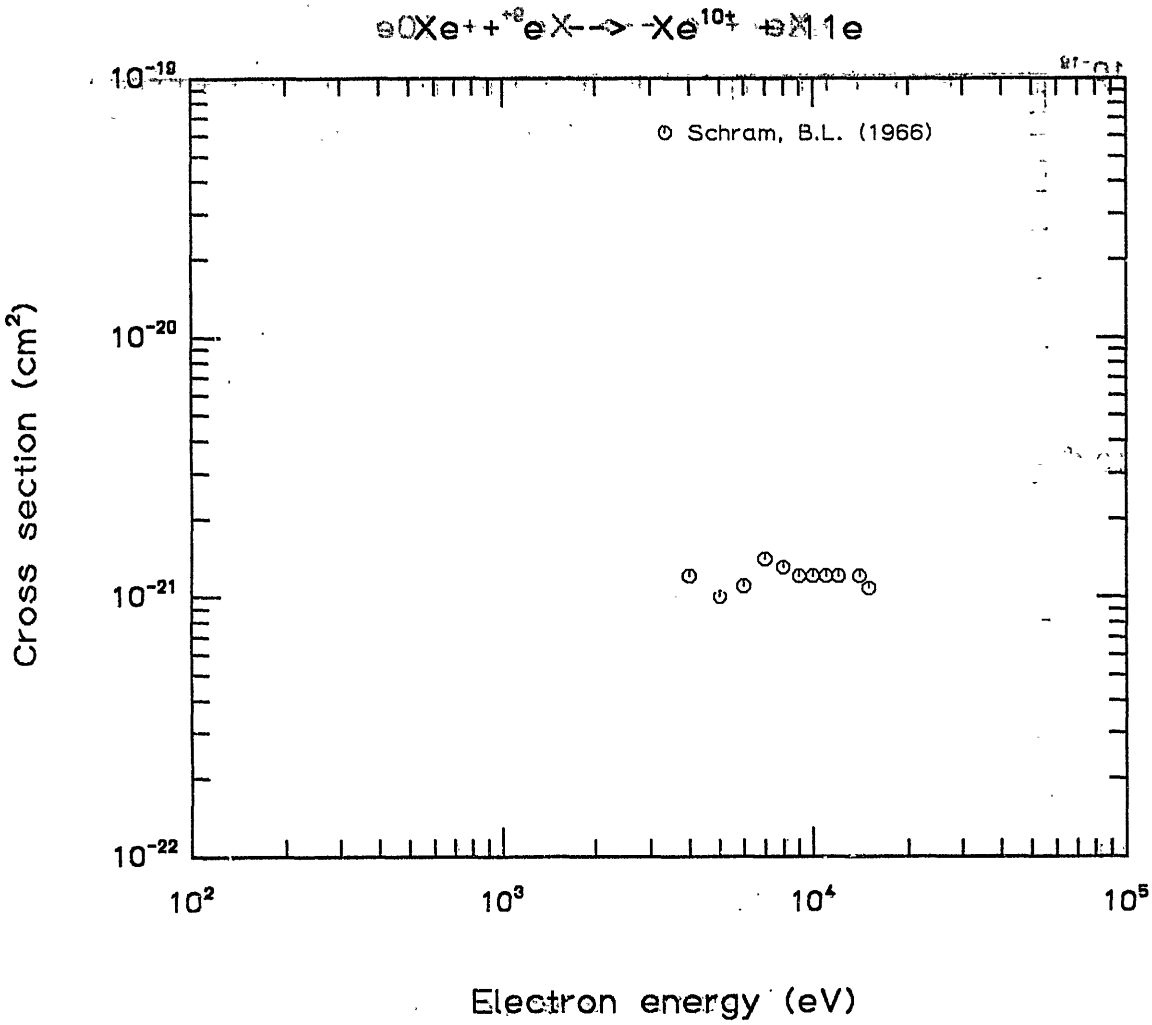
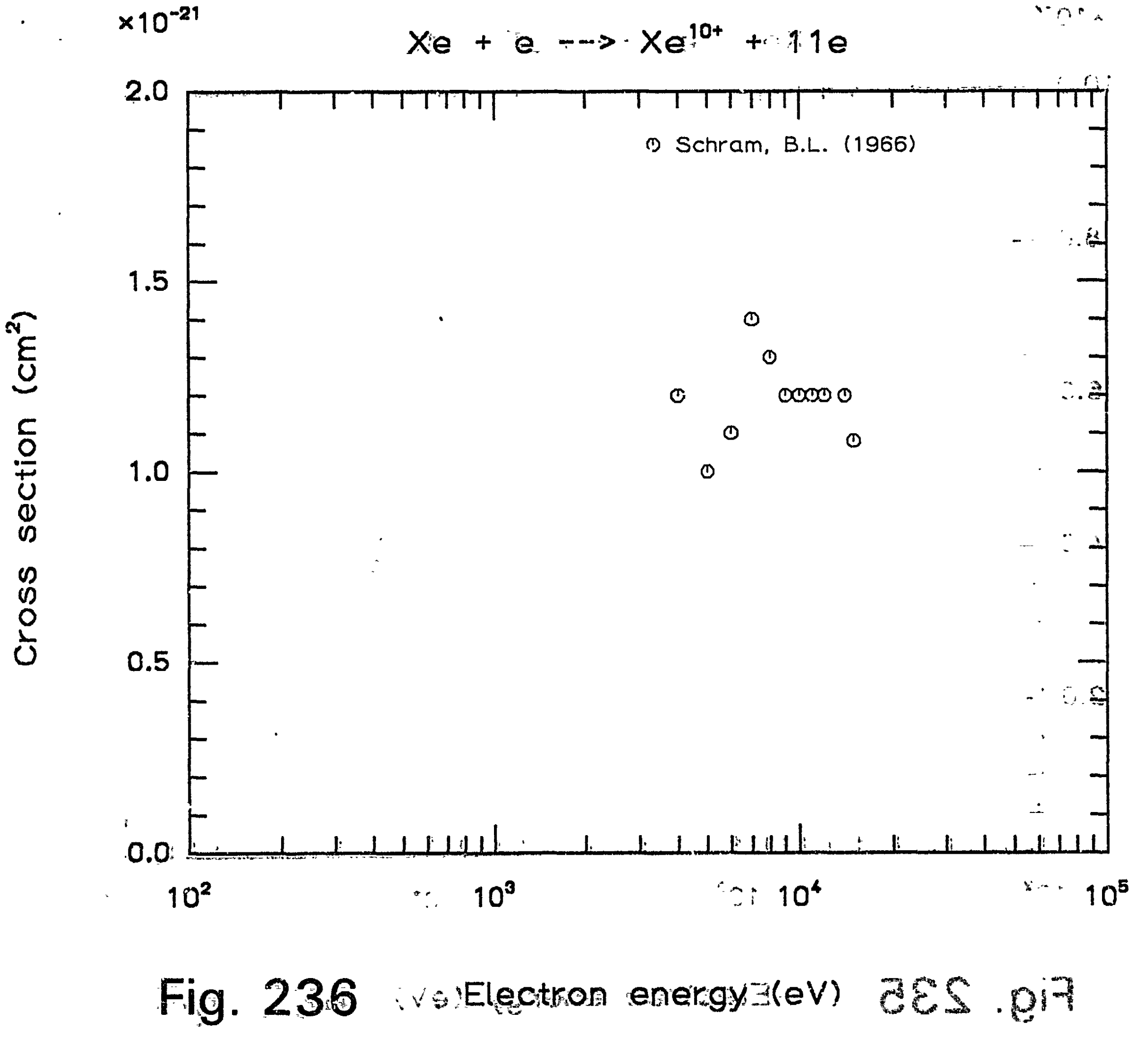


Fig. 235 Electron energy (eV)

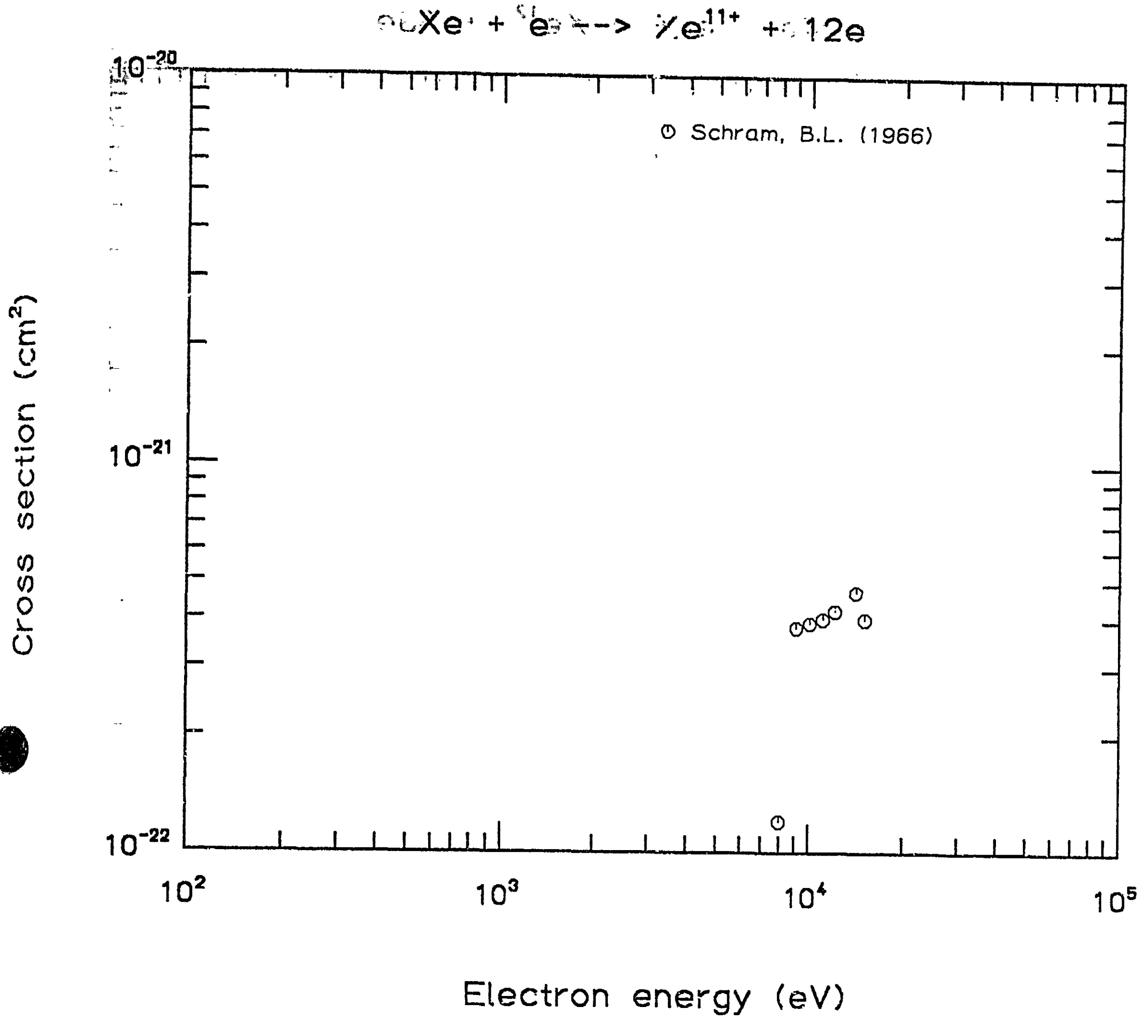


Xe + e ---> Xe10+ + 11e
Schram, B.L. (1966)
Cross section (cm2)
10-19
10-20
10-21
10-22
10^2
10^3
10^4
10^5
Electron energy (eV)



×10-21
Xe + e ---> Xe10+ + 11e
Schram, B.L. (1966)
Cross section (cm2)
2.0
1.5
1.0
0.5
0.0
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 236


Xe + e --> Xe11+ + 12e
Schram, B.L. (1966)
Cross section (cm2)
10-20
10-21
10-22
102
103
104
105
Electron energy (eV)

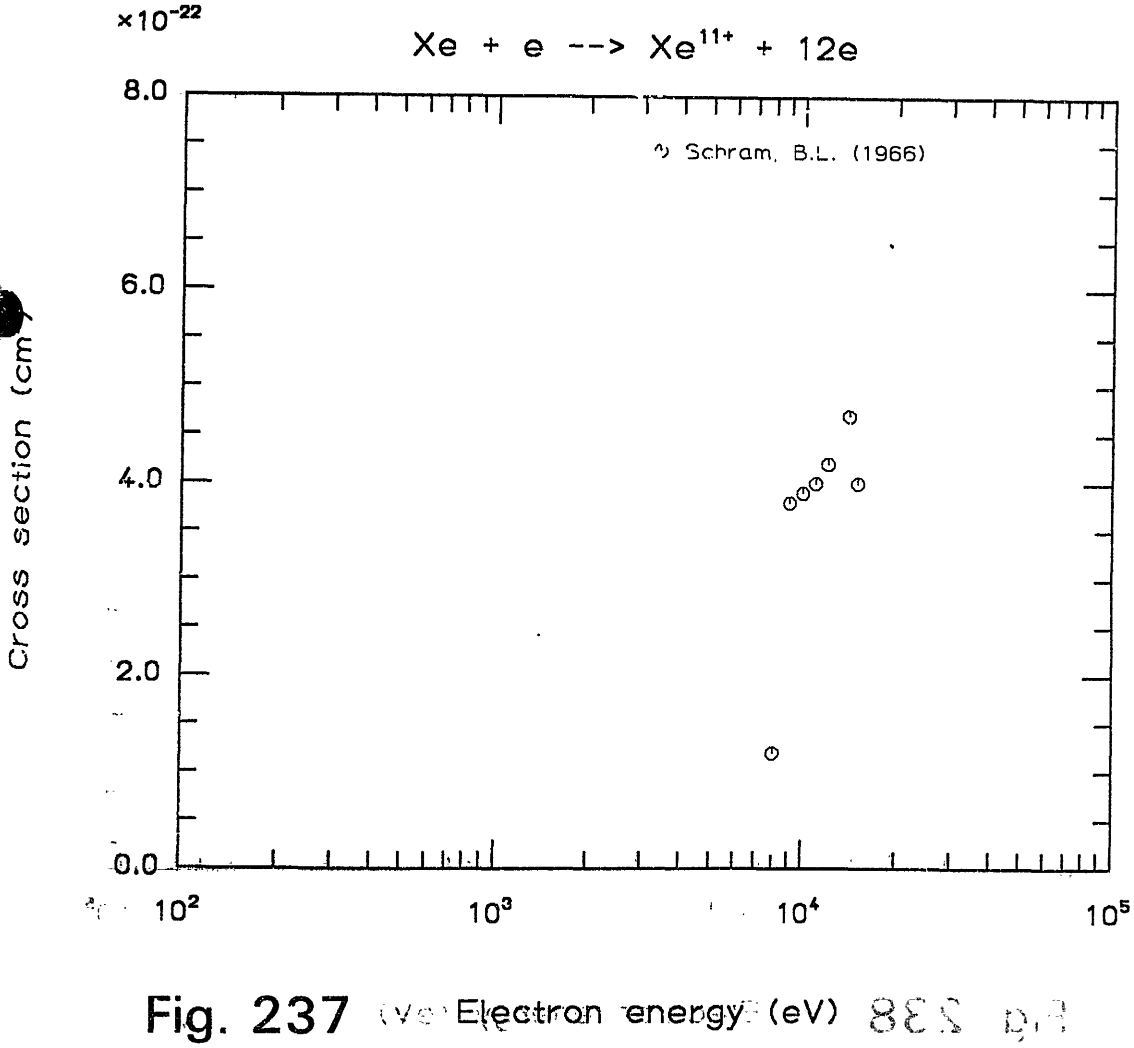
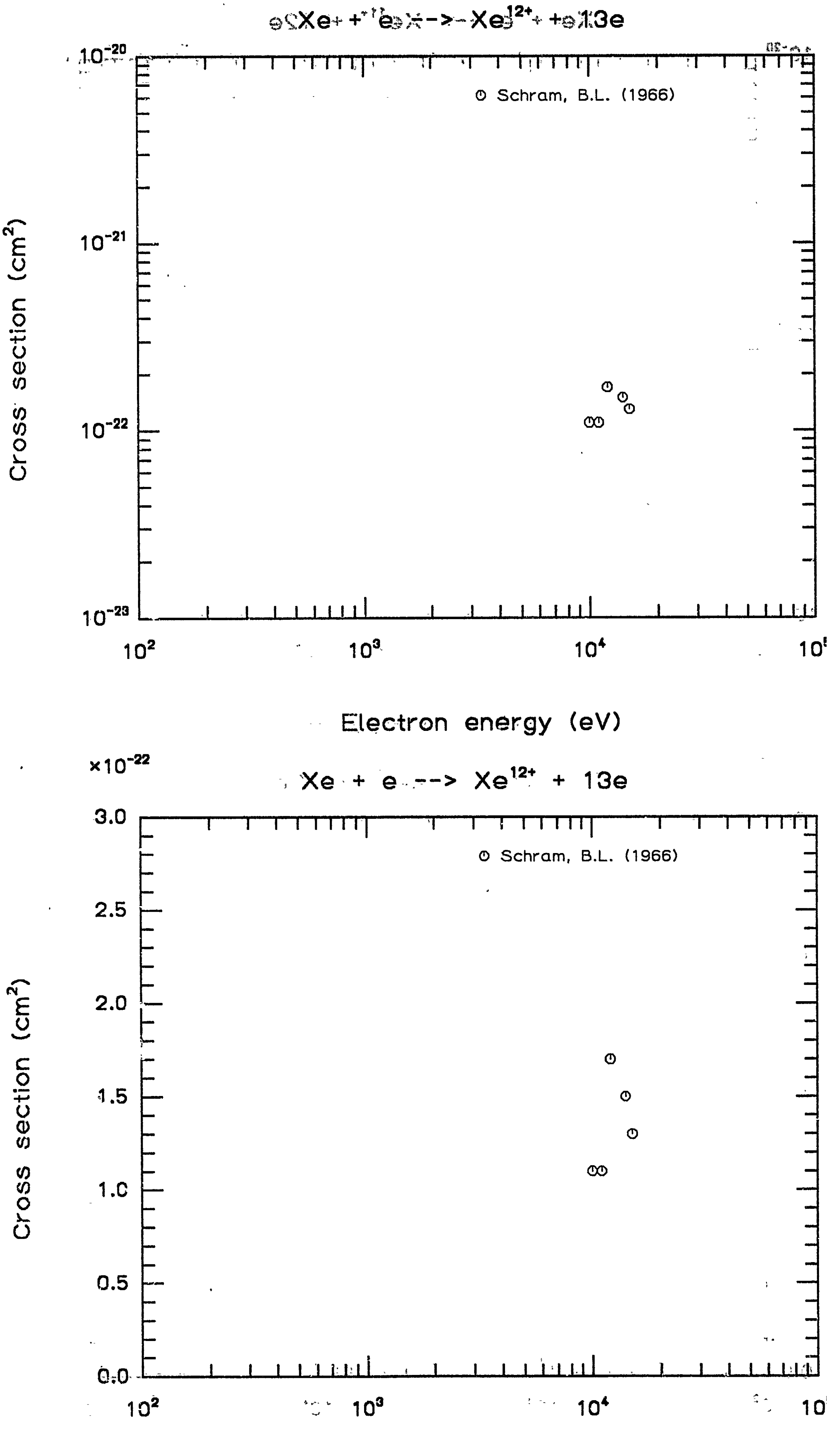
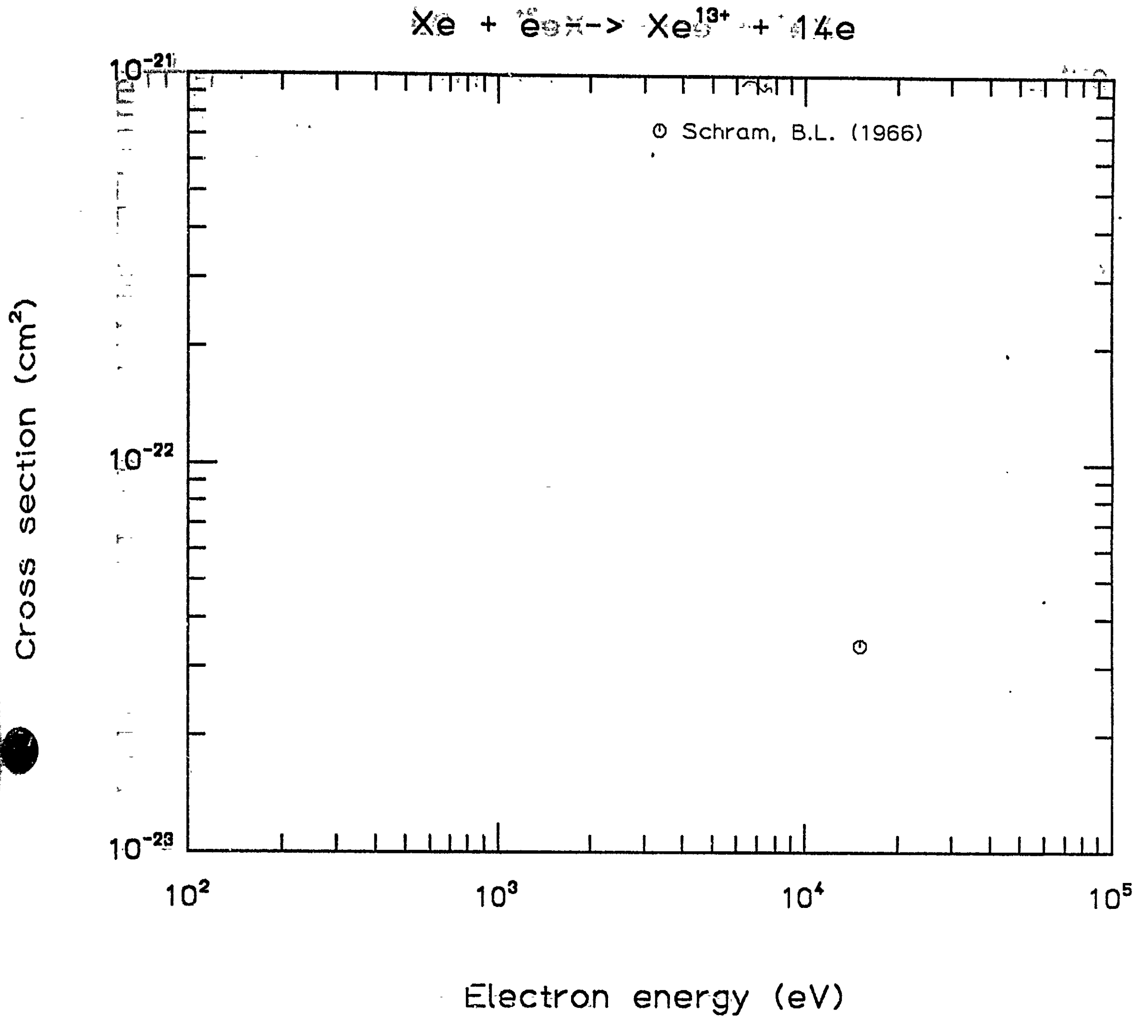

×10-22
Xe + e --> Xe11+ + 12e
Schram, B.L. (1966)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
102
103
104
105
Electron energy (eV)

Fig. 237



Xe + e --> Xe12+ + 13e
Schram, B.L. (1966)
Cross section (cm2)
10-20
10-21
10-22
10-23
102
103
104
105
Electron energy (eV)
×10-22
Xe + e --> Xe12+ + 13e
Schram, B.L. (1966)
Cross section (cm2)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
102
103
104
105
Electron energy (eV)

Fig. 238



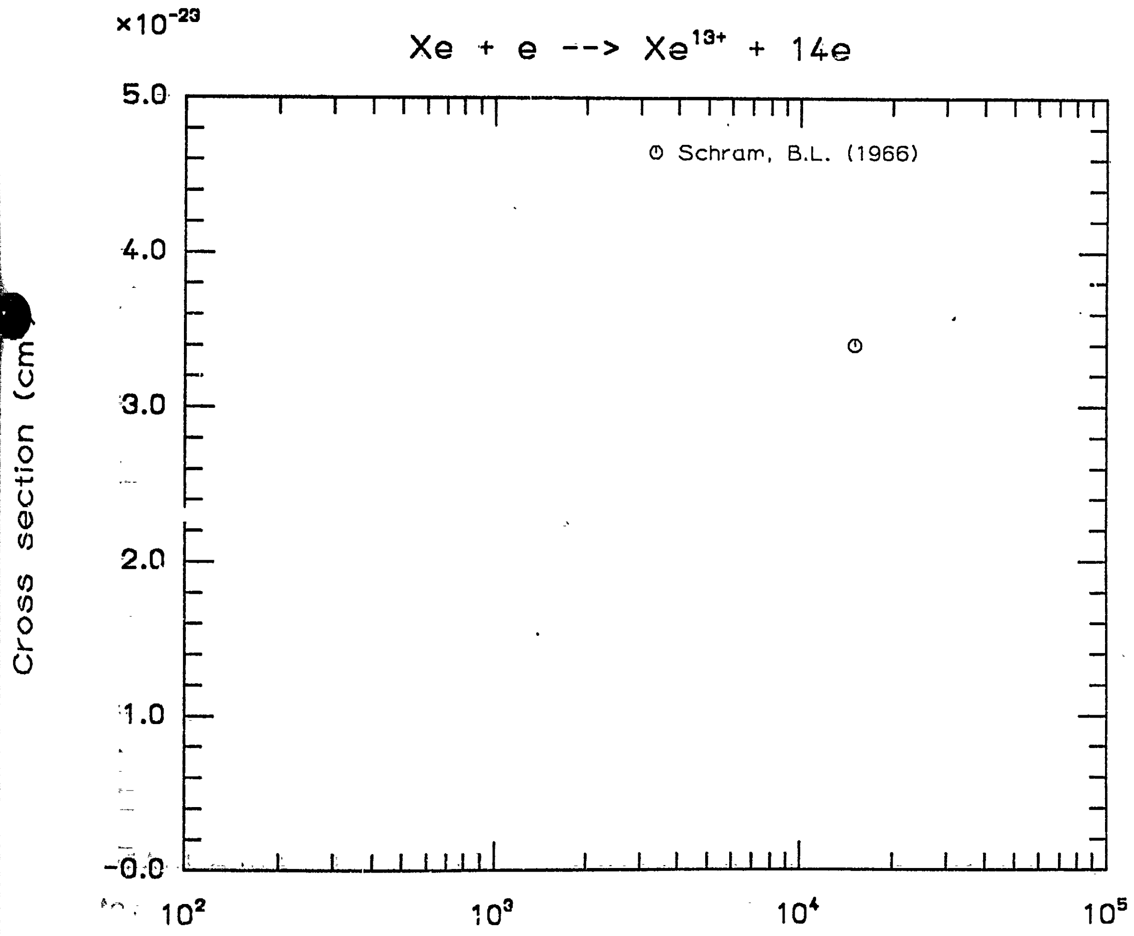
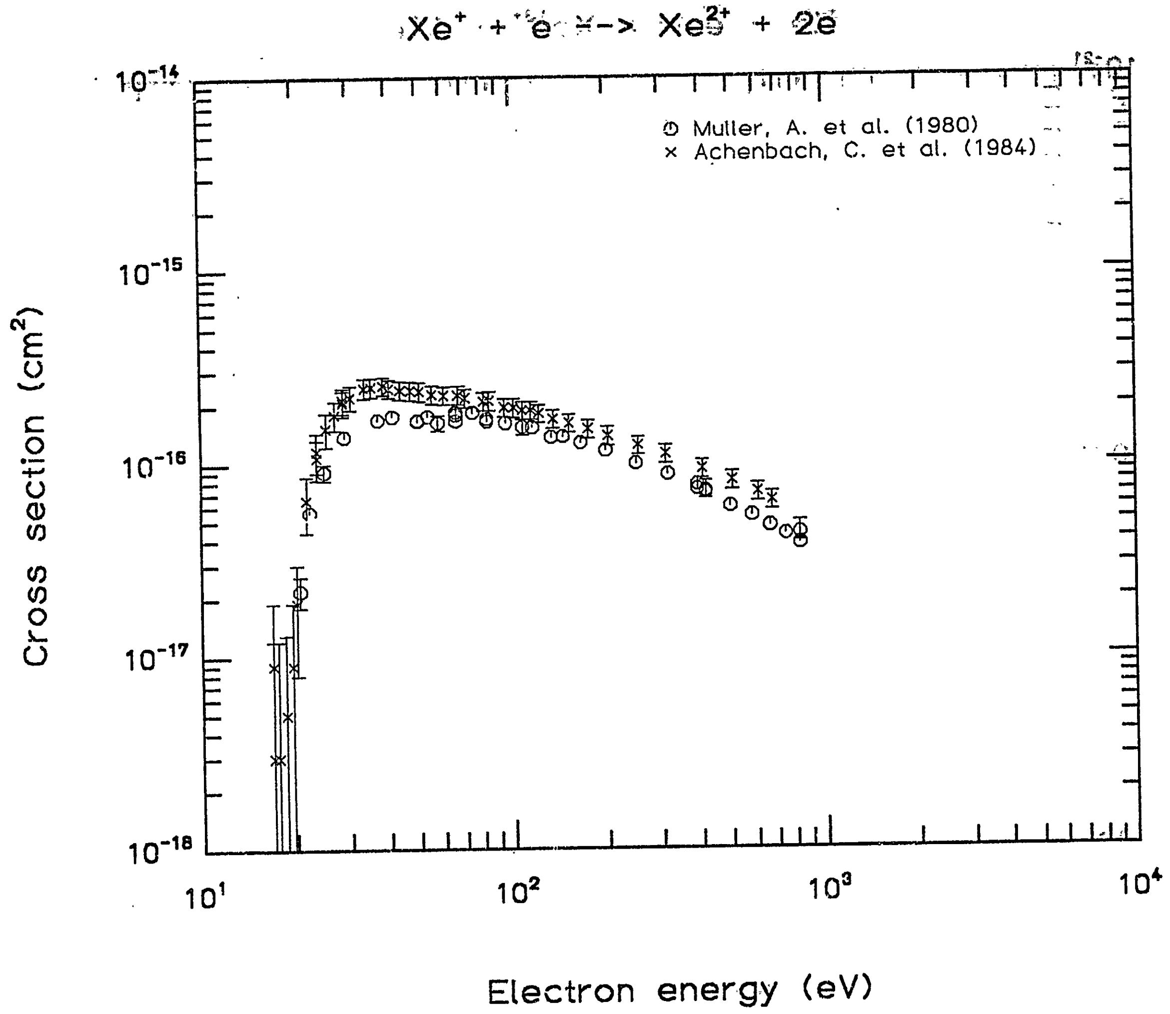


Fig. 239 Electron energy (eV)


Xe+ + e --> Xe2+ + 2e
Muller, A. et al. (1980)
Achenbach, C. et al. (1984)
Cross section (cm2)
10-14
10-15
10-16
10-17
10-18
101
102
103
104
Electron energy (eV)

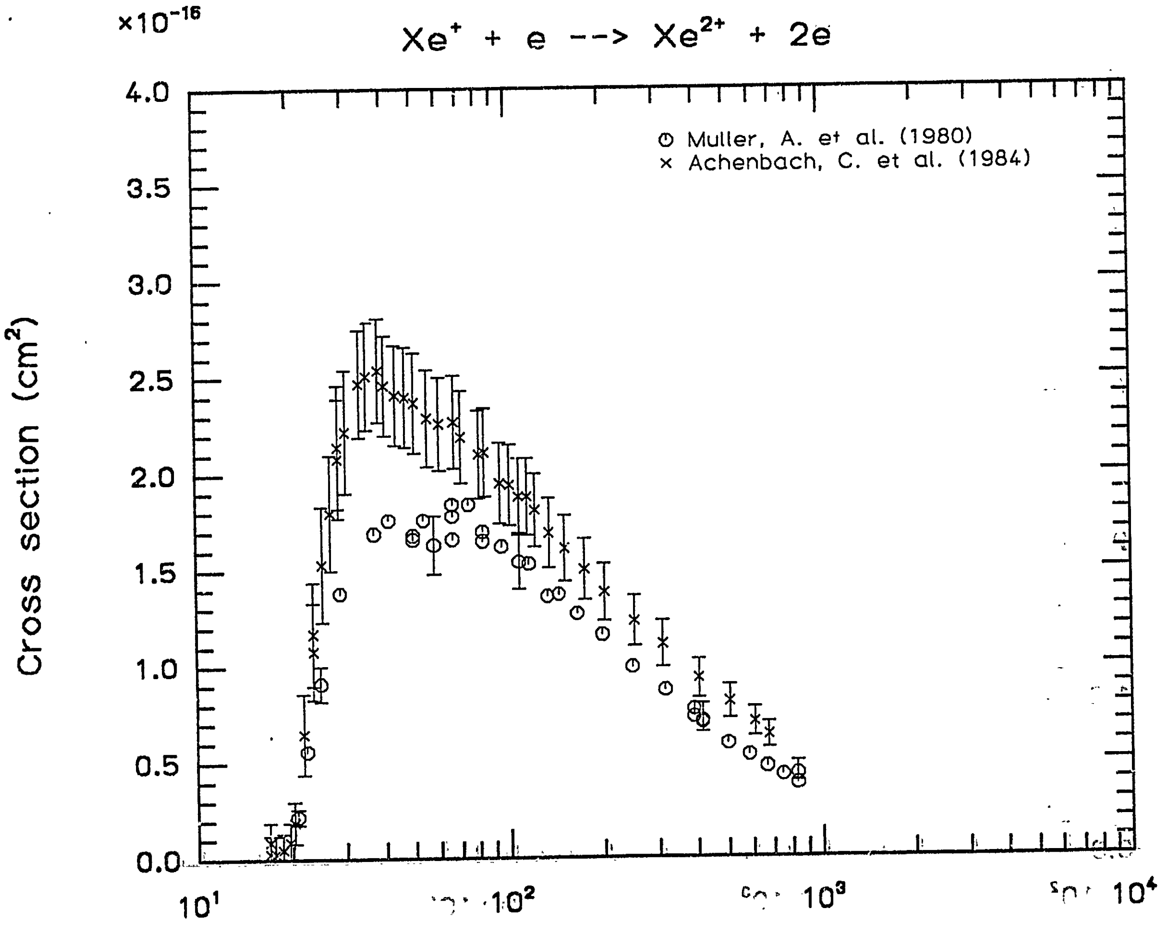
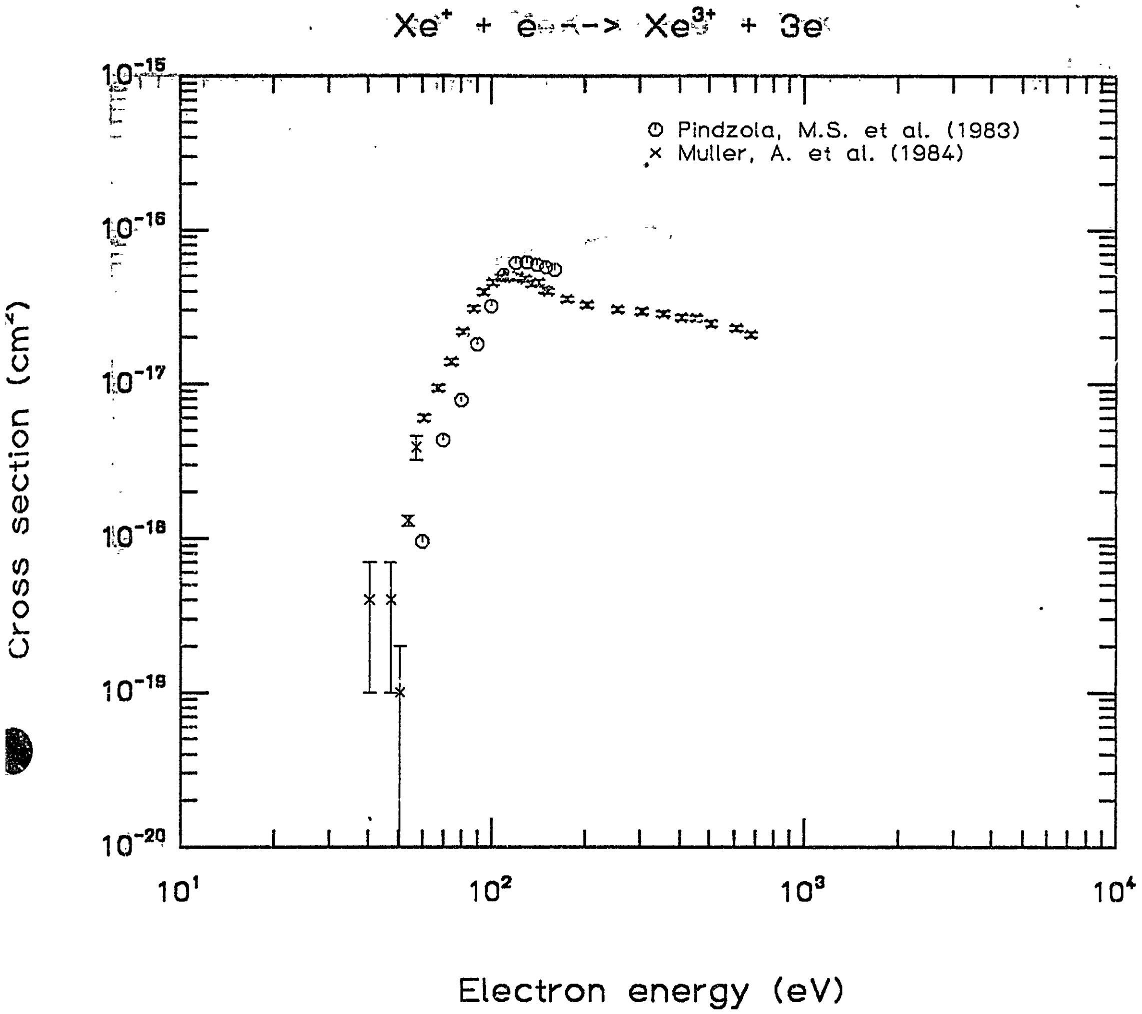

×10-16
Xe+ + e --> Xe2+ + 2e
Muller, A. et al. (1980)
Achenbach, C. et al. (1984)
Cross section (cm2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
101
102
103
104
Electron energy (eV)

Fig. 240



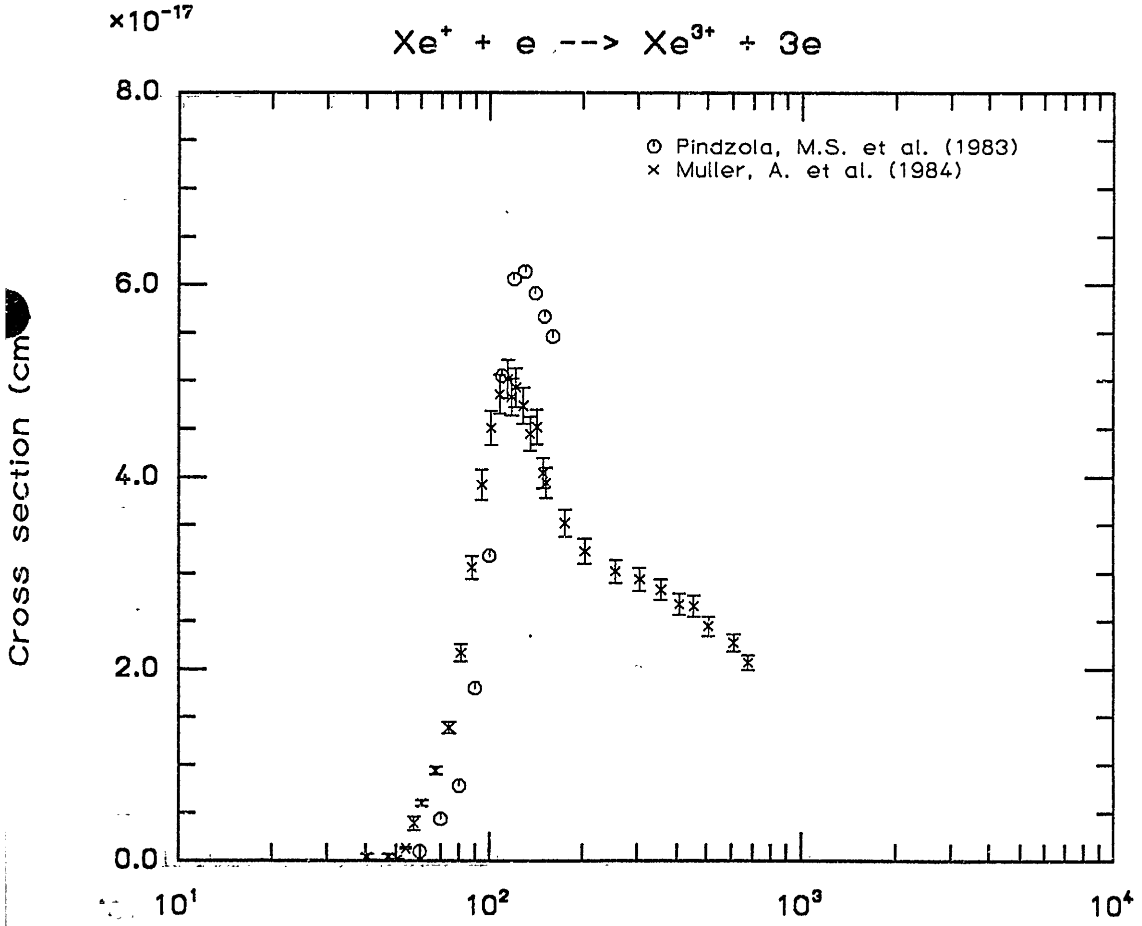


Fig. 241 Electron energy (eV)

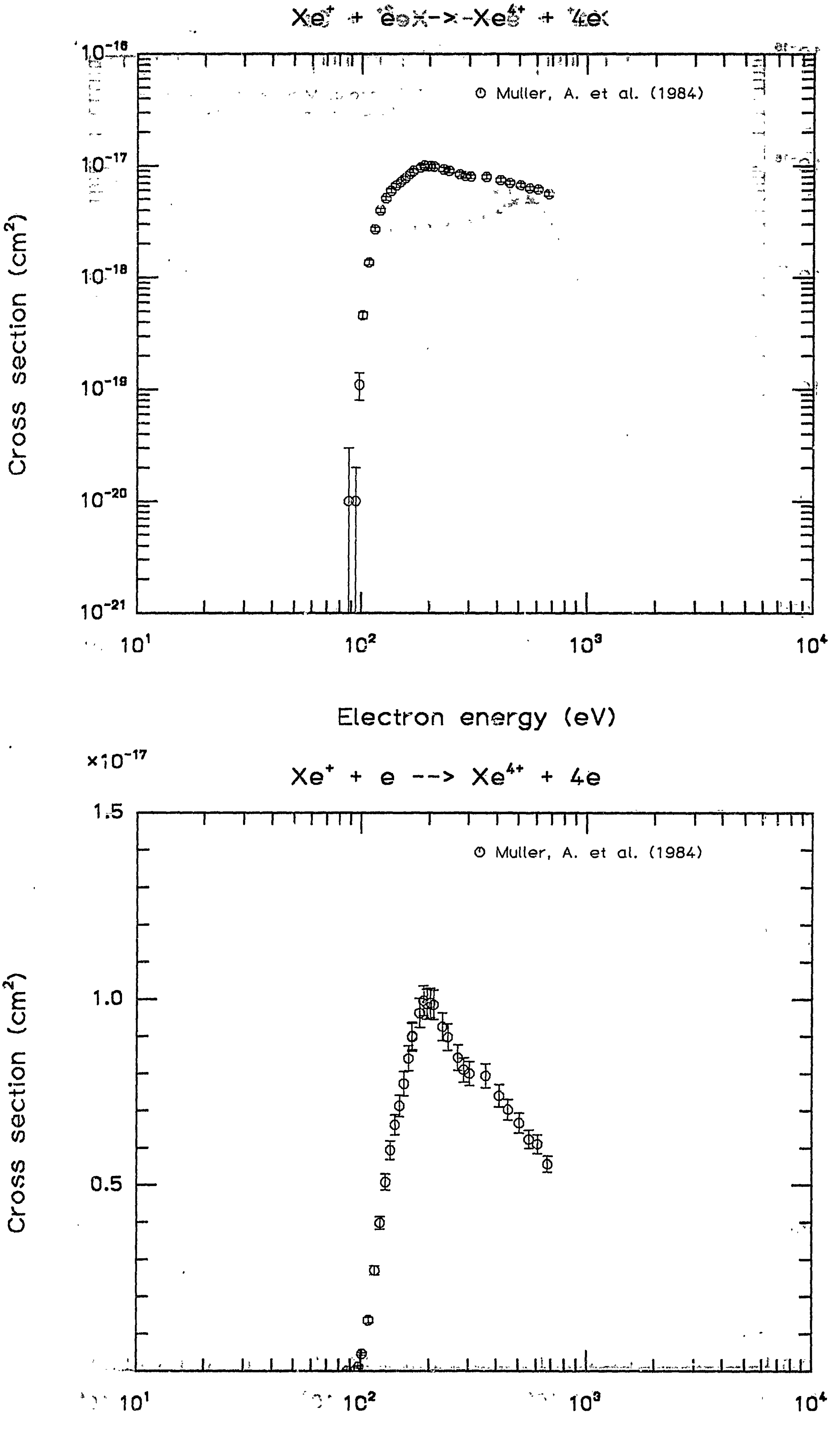
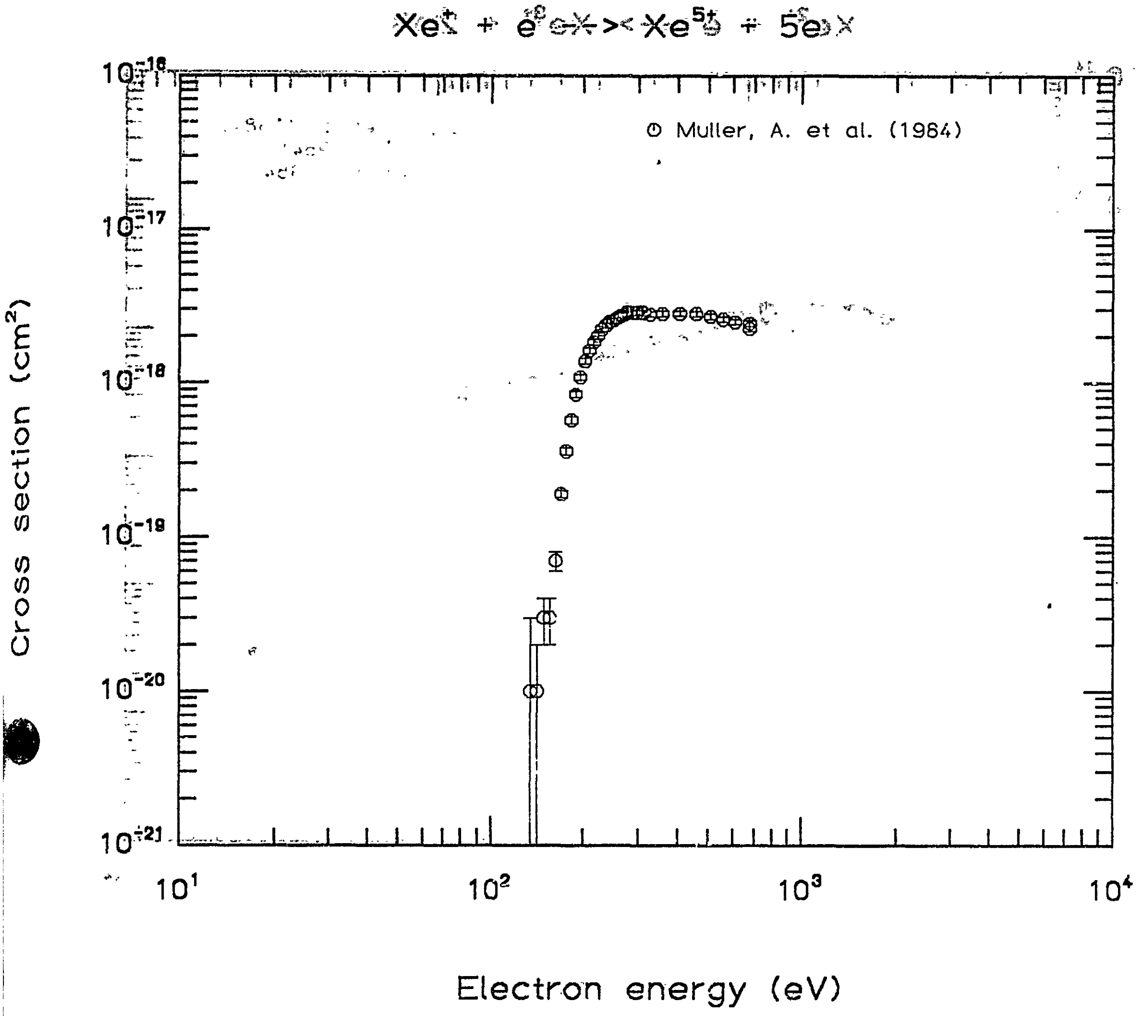

Xe+ + e --> Xe4+ + 4e
Muller, A. et al. (1984)
Cross section (cm2)
10-16
10-17
10-18
10-19
10-20
10-21
10¹
10²
10³
10⁴
Electron energy (eV)
×10-17
Xe+ + e --> Xe4+ + 4e
Muller, A. et al. (1984)
Cross section (cm2)
1.5
1.0
0.5
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 242



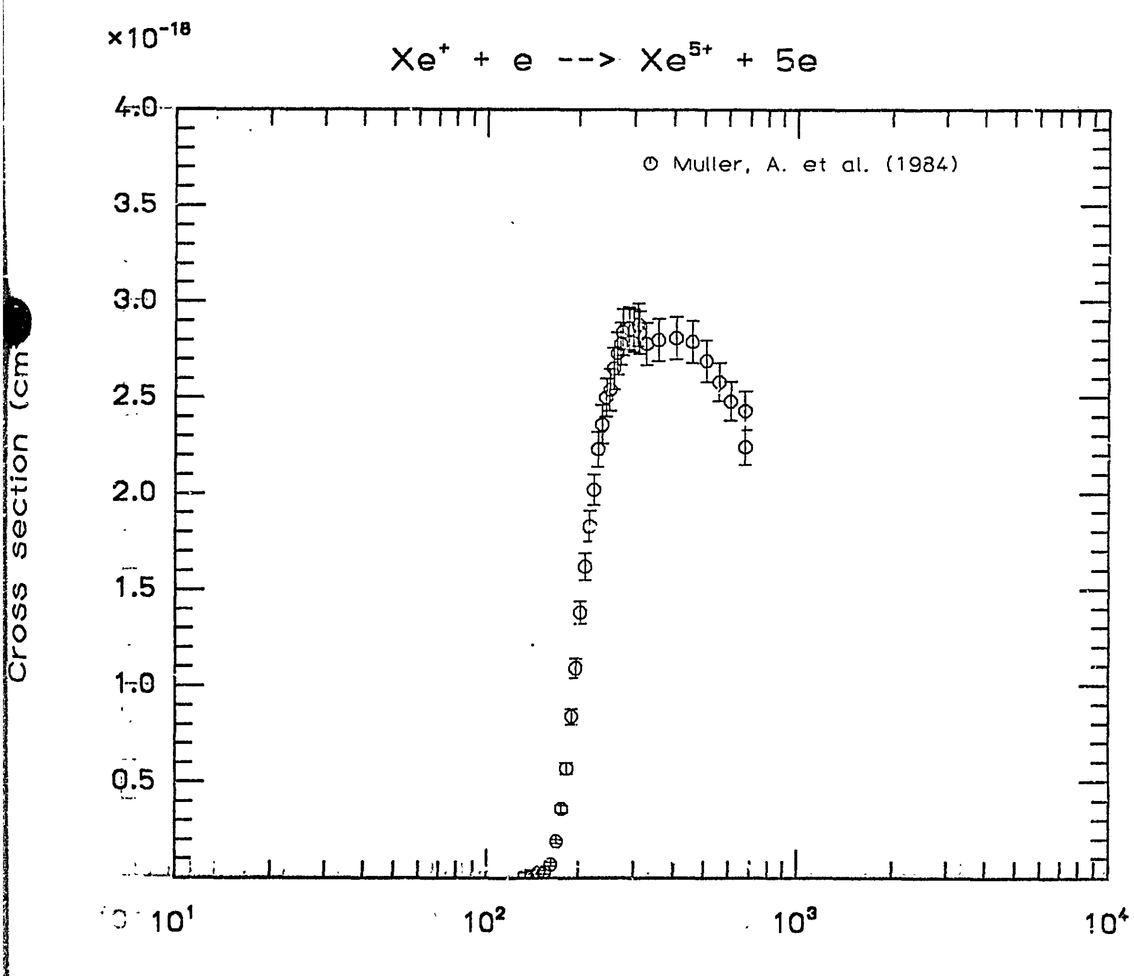
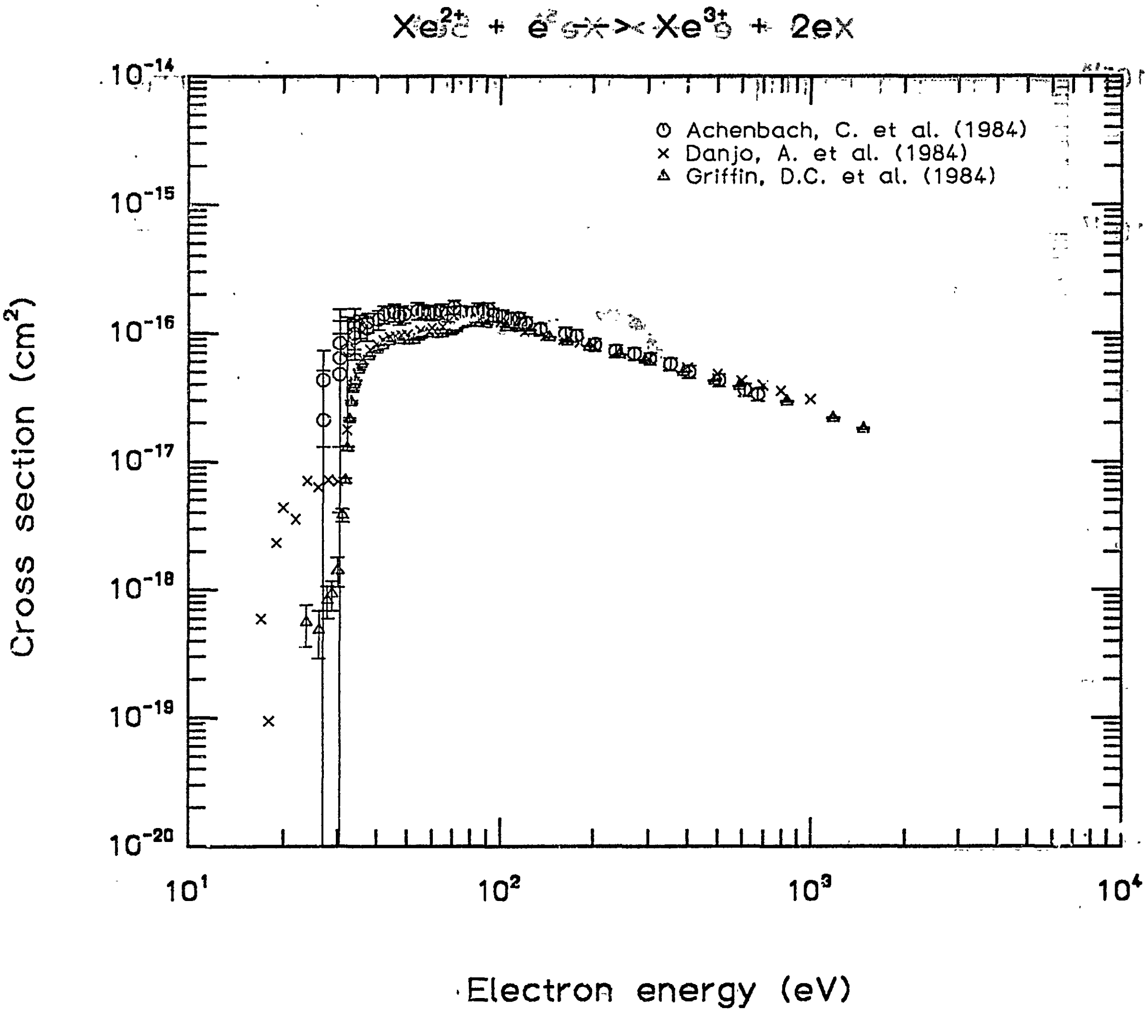


Fig. 243 Electron energy (eV)


Xe2+ + e --> Xe3+ + 2e
Achenbach, C. et al. (1984)
Danjo, A. et al. (1984)
Griffin, D.C. et al. (1984)
Cross section (cm2)
10-14
10-15
10-16
10-17
10-18
10-19
10-20
101
102
103
104
Electron energy (eV)

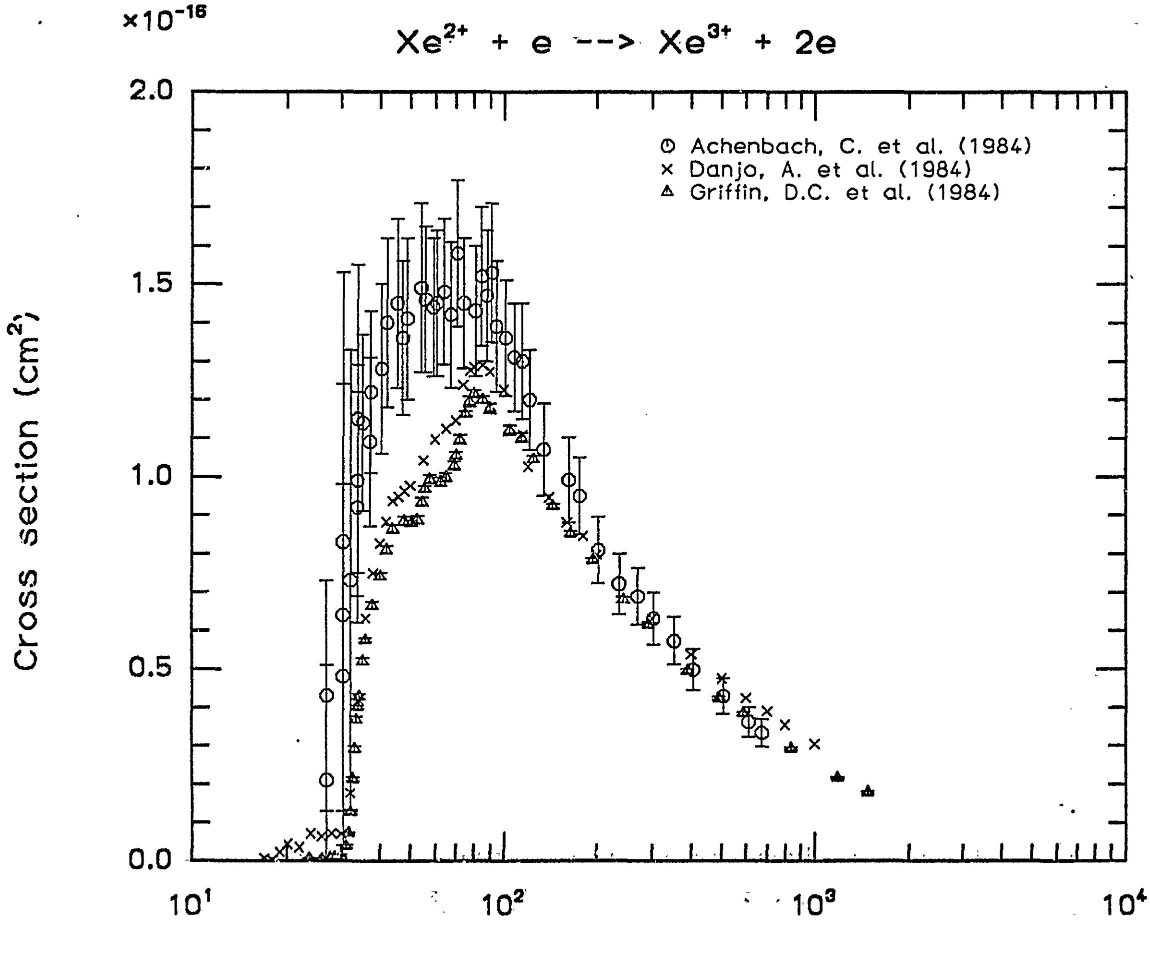
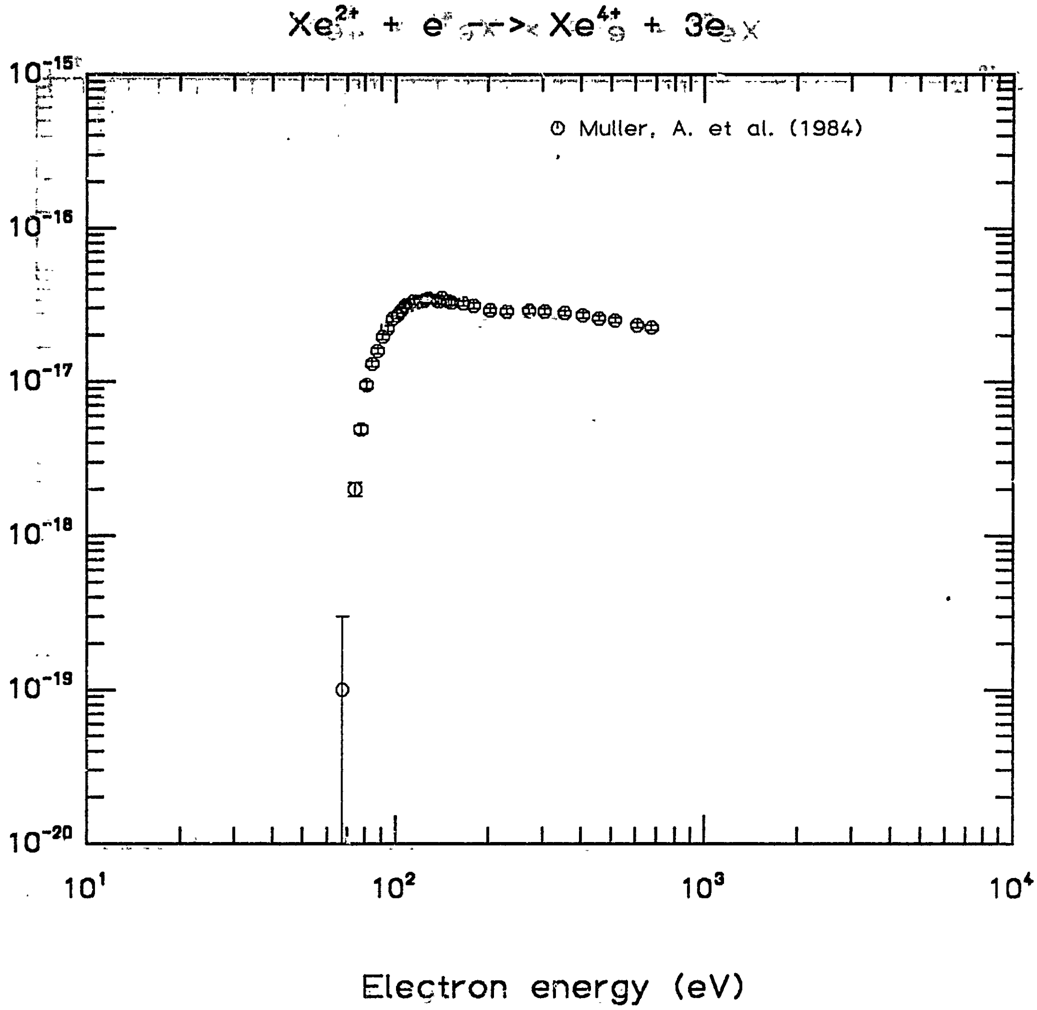

×10-16
Xe2+ + e --> Xe3+ + 2e
Achenbach, C. et al. (1984)
Danjo, A. et al. (1984)
Griffin, D.C. et al. (1984)
Cross section (cm2)
2.0
1.5
1.0
0.5
0.0
101
102
103
104
Electron energy (eV)

Fig. 244


$Xe^{2+} + e --> Xe^{4+} + 3e$
Muller, A. et al. (1984)
Cross section (cm^2)
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^1
10^2
10^3
10^4
Electron energy (eV)

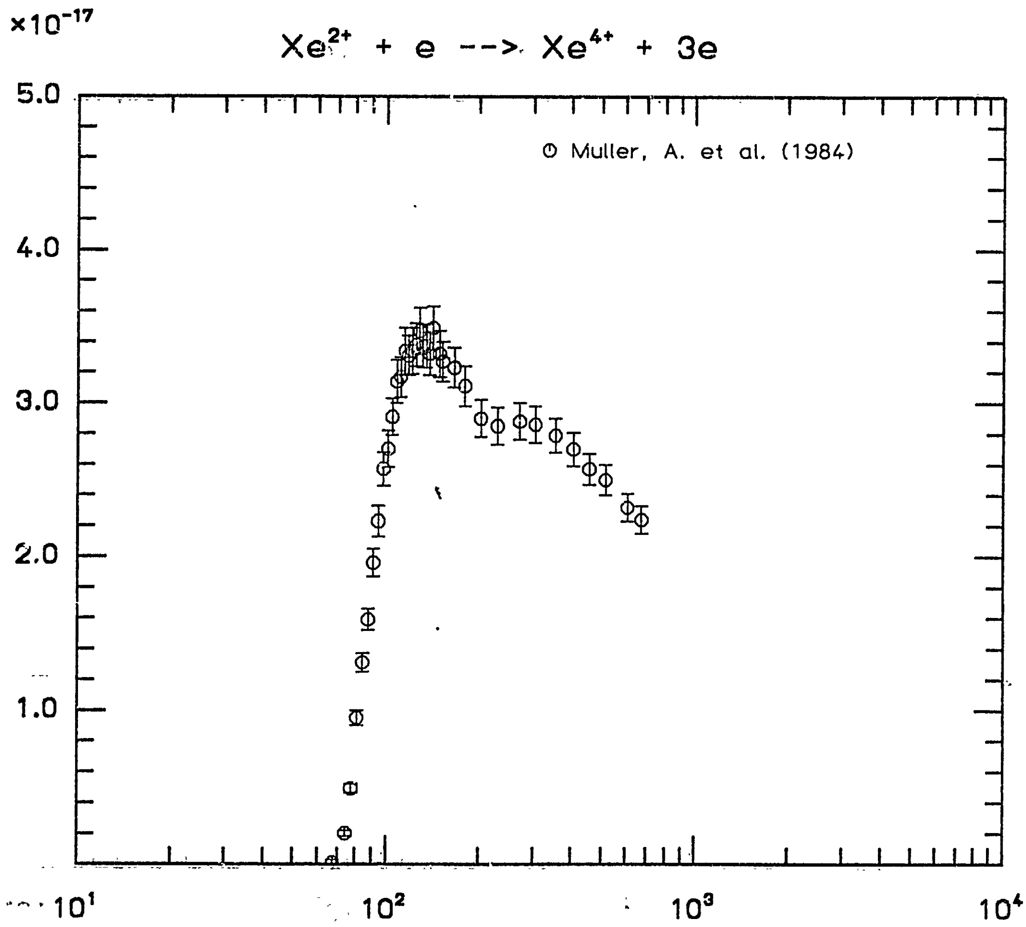
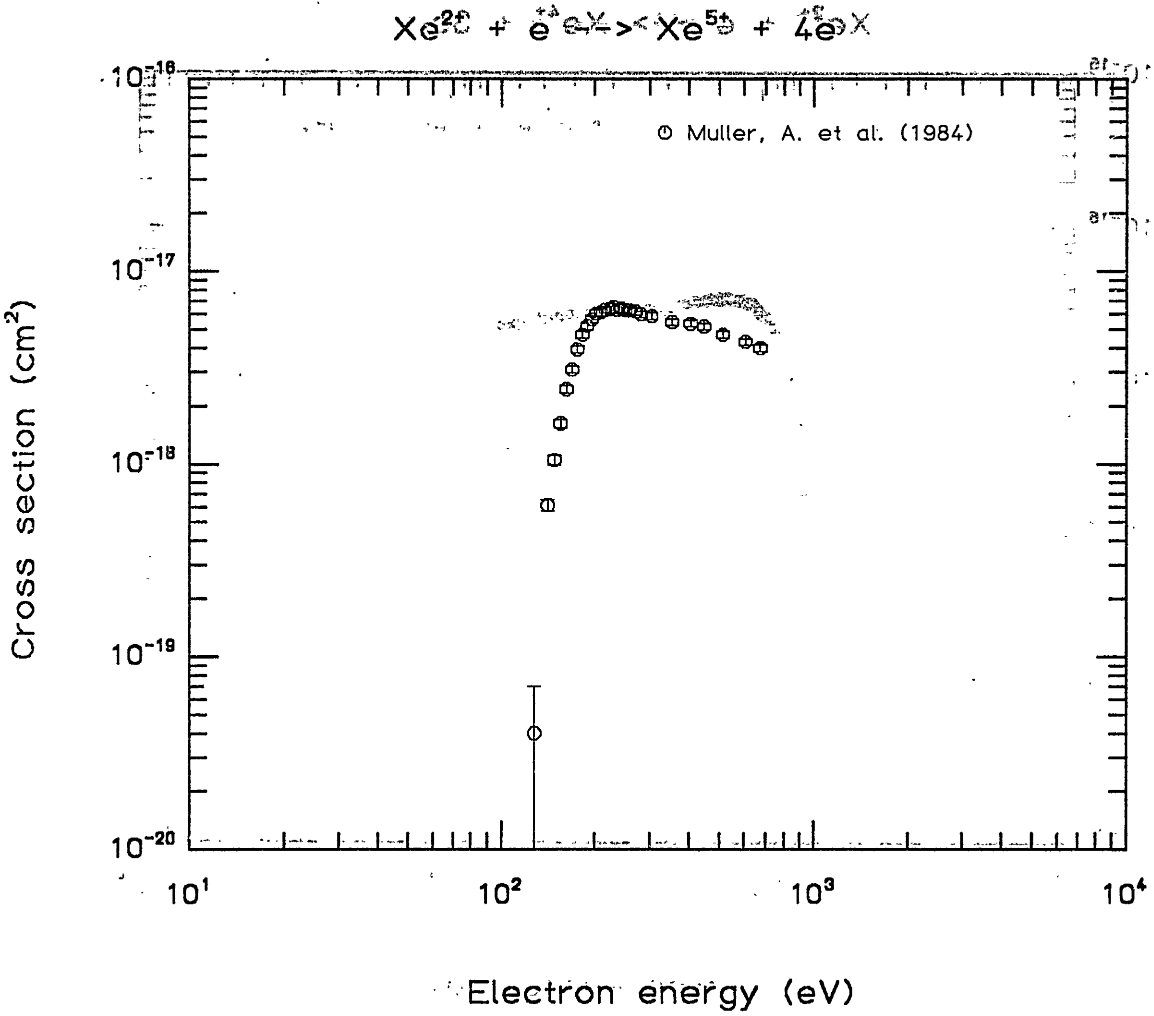
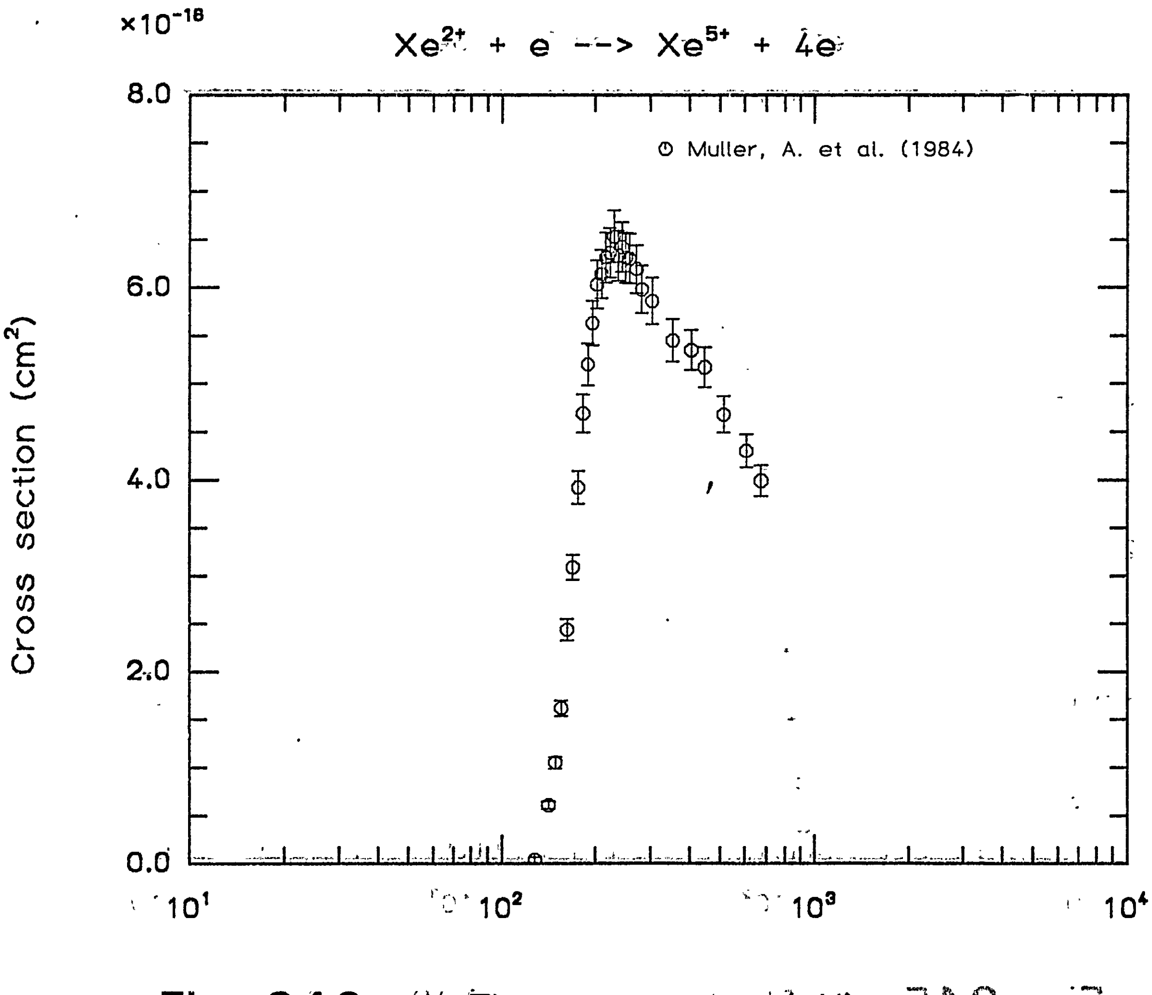

$\times10^{-17}$
$Xe^{2+} + e --> Xe^{4+} + 3e$
Muller, A. et al. (1984)
Cross section (cm
5.0
4.0
3.0
2.0
1.0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 245



Xe2+ + e --> Xe5+ + 4e
Muller, A. et al. (1984)
Cross section (cm2)
10-16
10-17
10-18
10-19
10-20
101
102
103
104
Electron energy (eV)



x10-18
Xe2+ + e --> Xe5+ + 4e
Muller, A. et al. (1984)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
101
102
103
104
Electron energy (eV)

Fig. 246

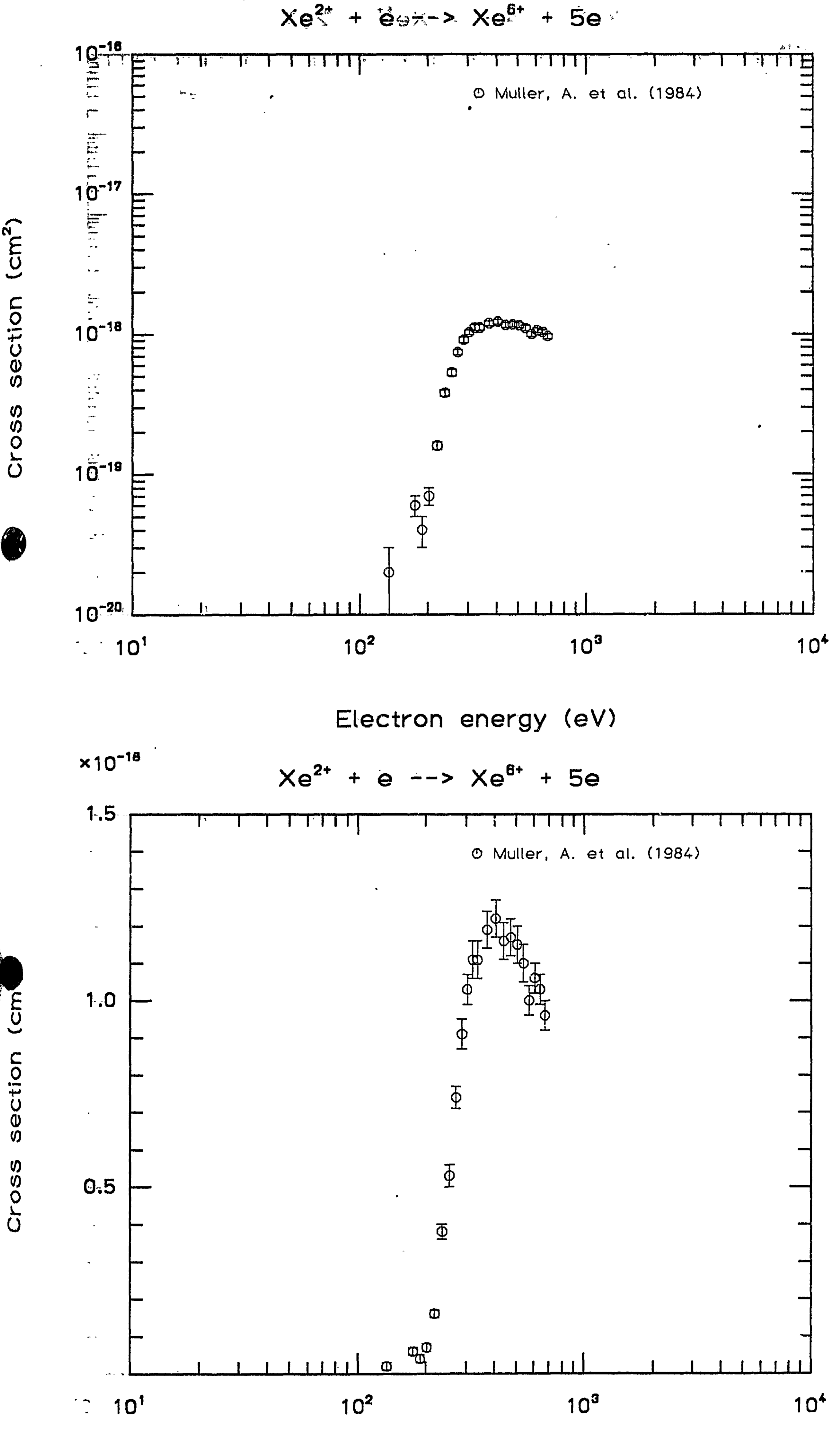
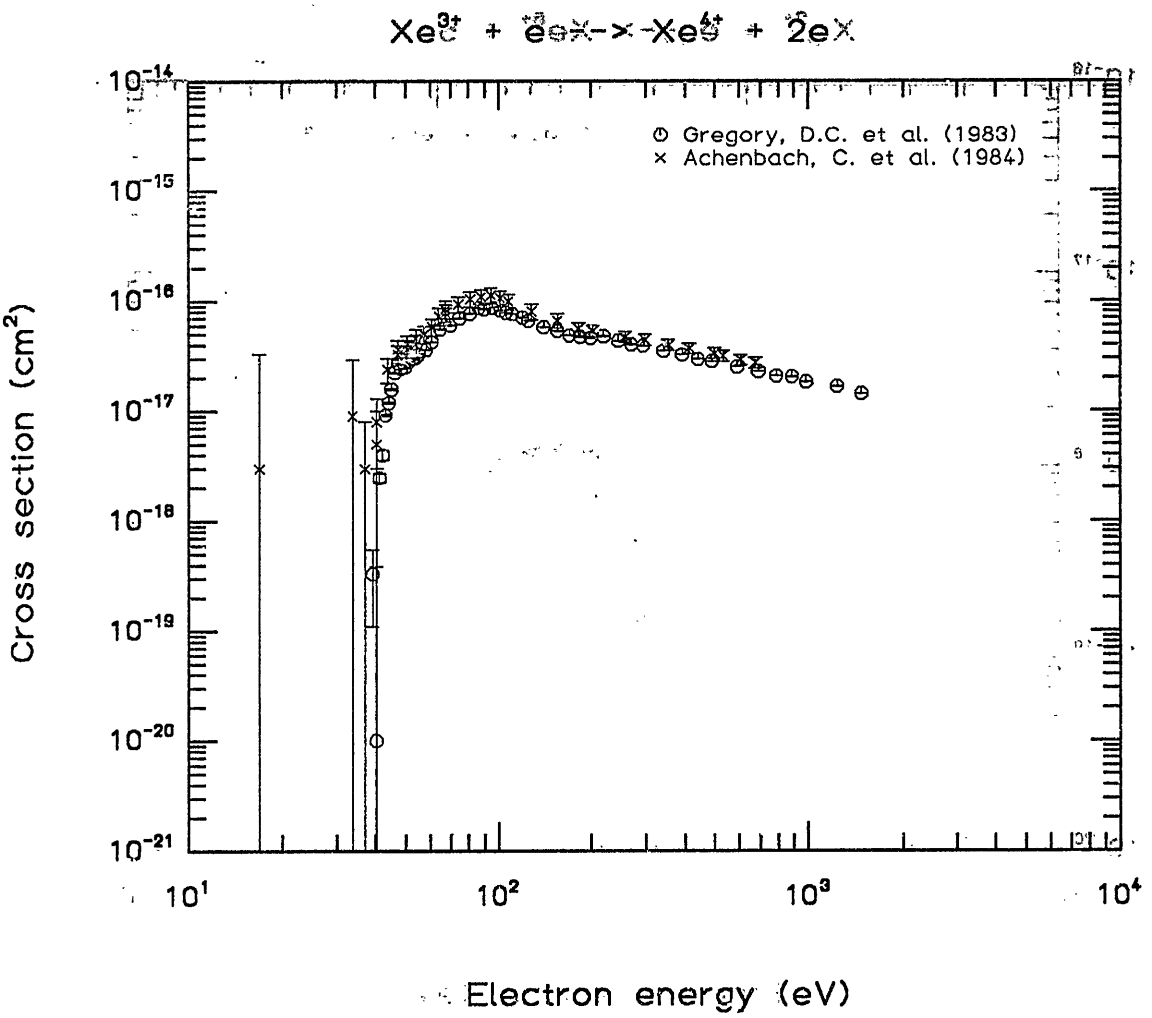
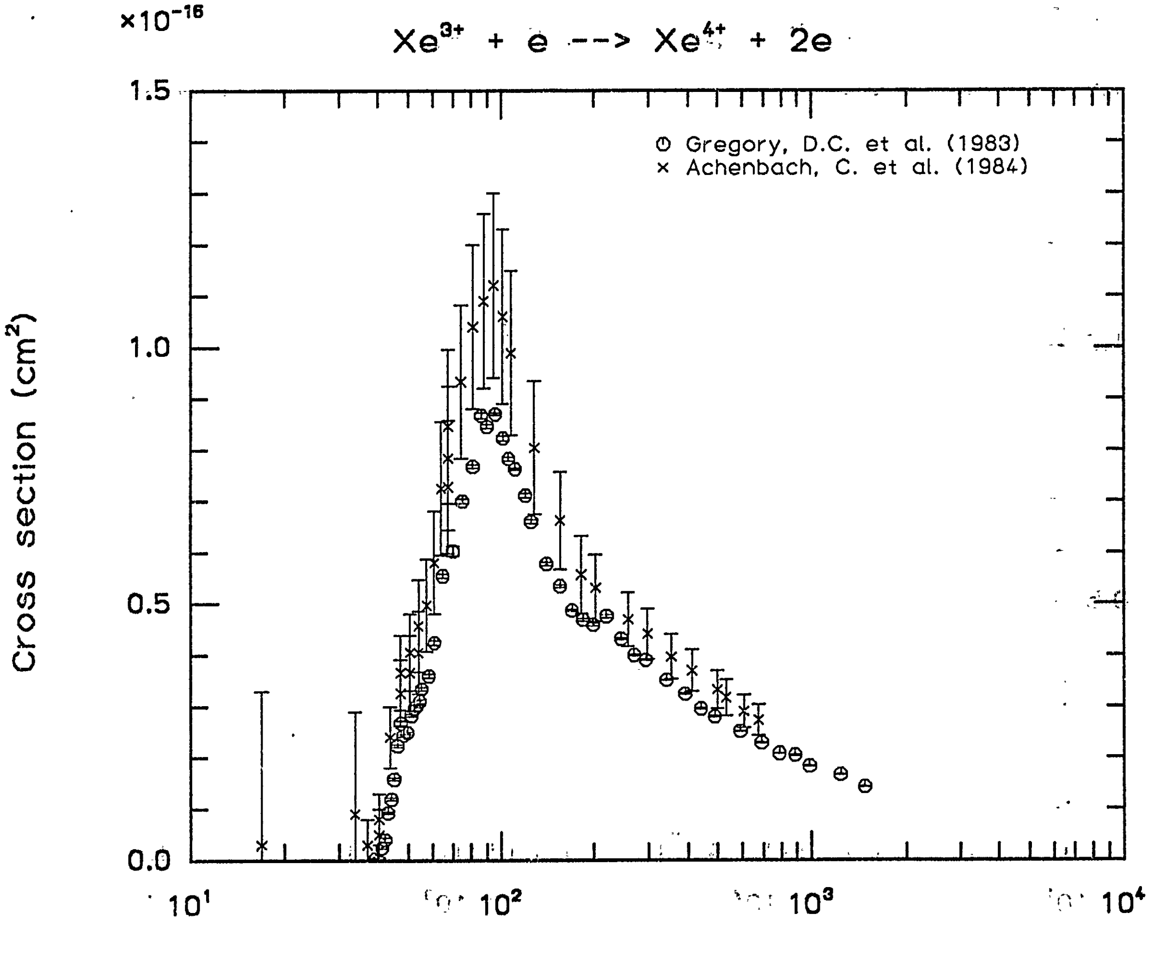


Fig. 247 Electron energy (eV)

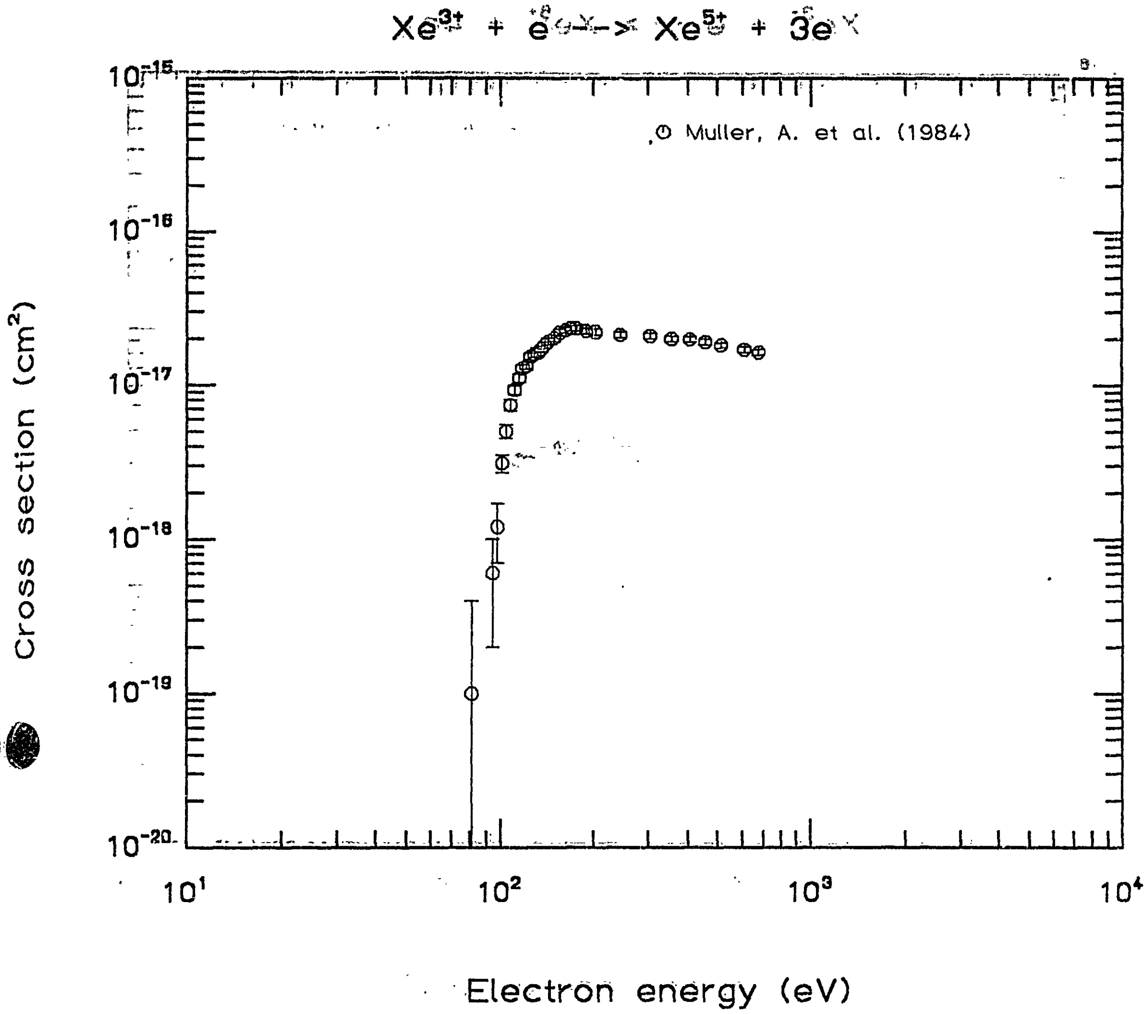


Xe3+ + e --> Xe4+ + 2e
Gregory, D.C. et al. (1983)
Achenbach, C. et al. (1984)
Cross section (cm2)
10-14
10-15
10-16
10-17
10-18
10-19
10-20
10-21
10¹
10²
10³
10⁴
Electron energy (eV)



×10-16
Xe3+ + e --> Xe4+ + 2e
Gregory, D.C. et al. (1983)
Achenbach, C. et al. (1984)
Cross section (cm2)
1.5
1.0
0.5
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 248



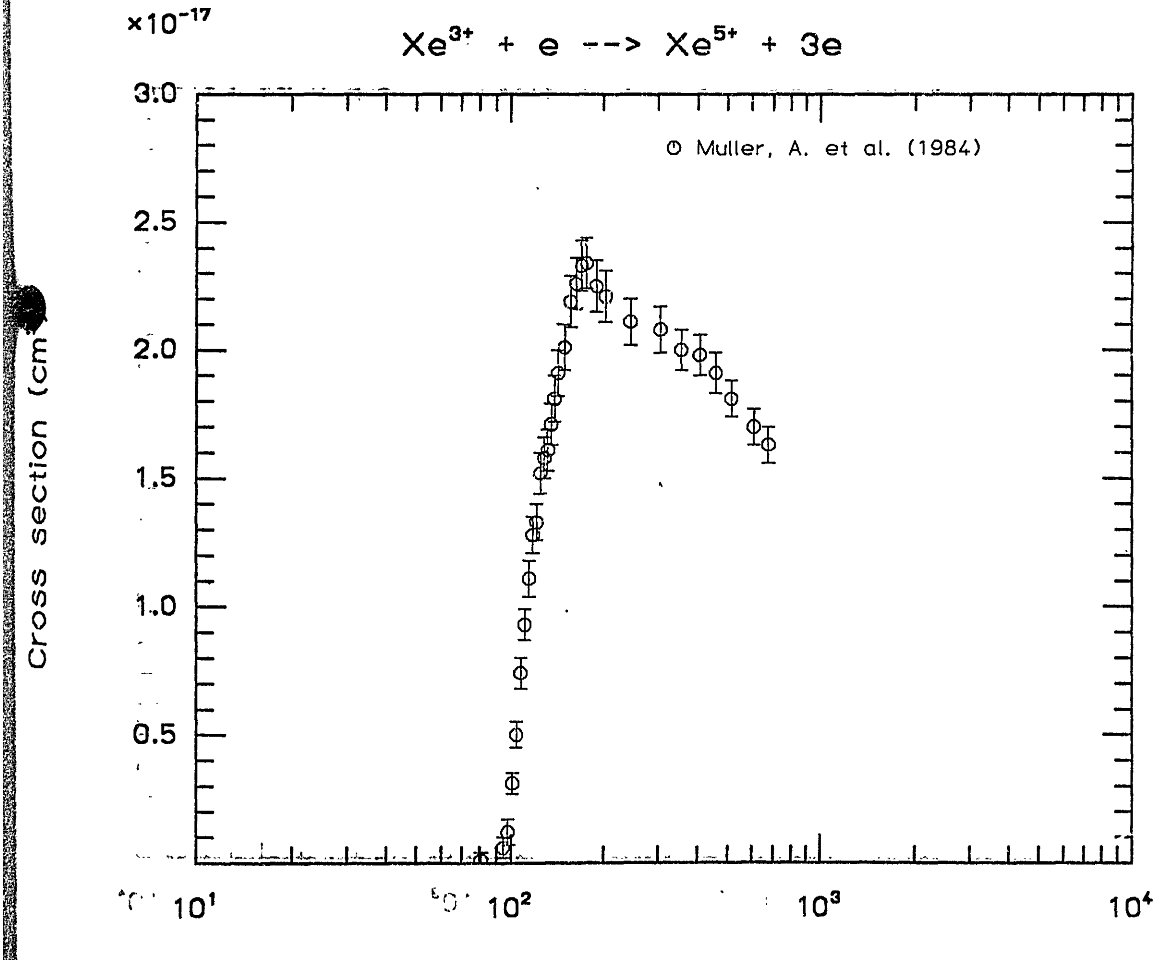
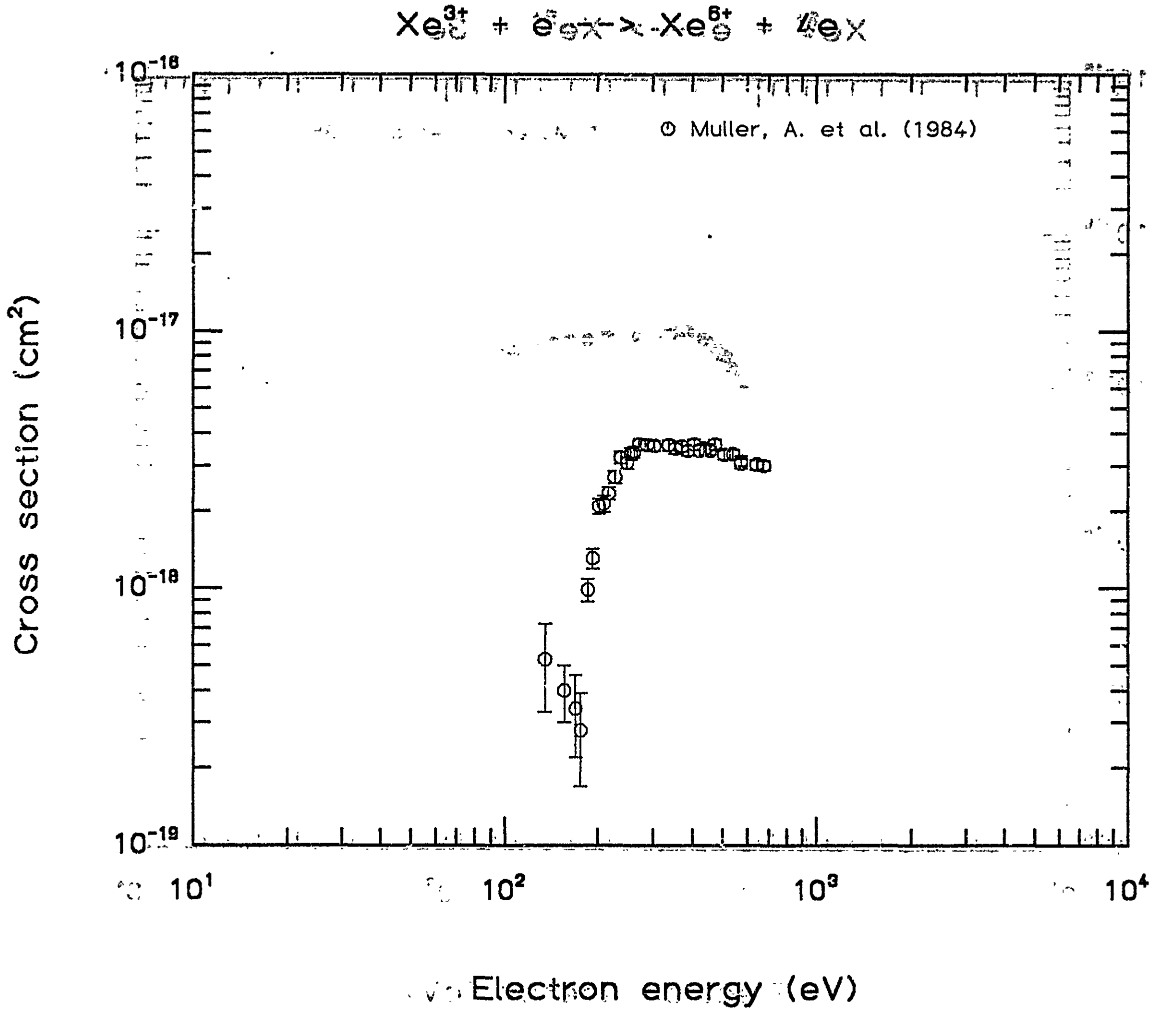


Fig. 249 Electron energy (eV)


$Xe^{3+} + e \rightarrow Xe^{6+} + 4e$
© Muller, A. et al. (1984)
Cross section (cm^2)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{1}
10^{2}
10^{3}
10^{4}
Electron energy (eV)

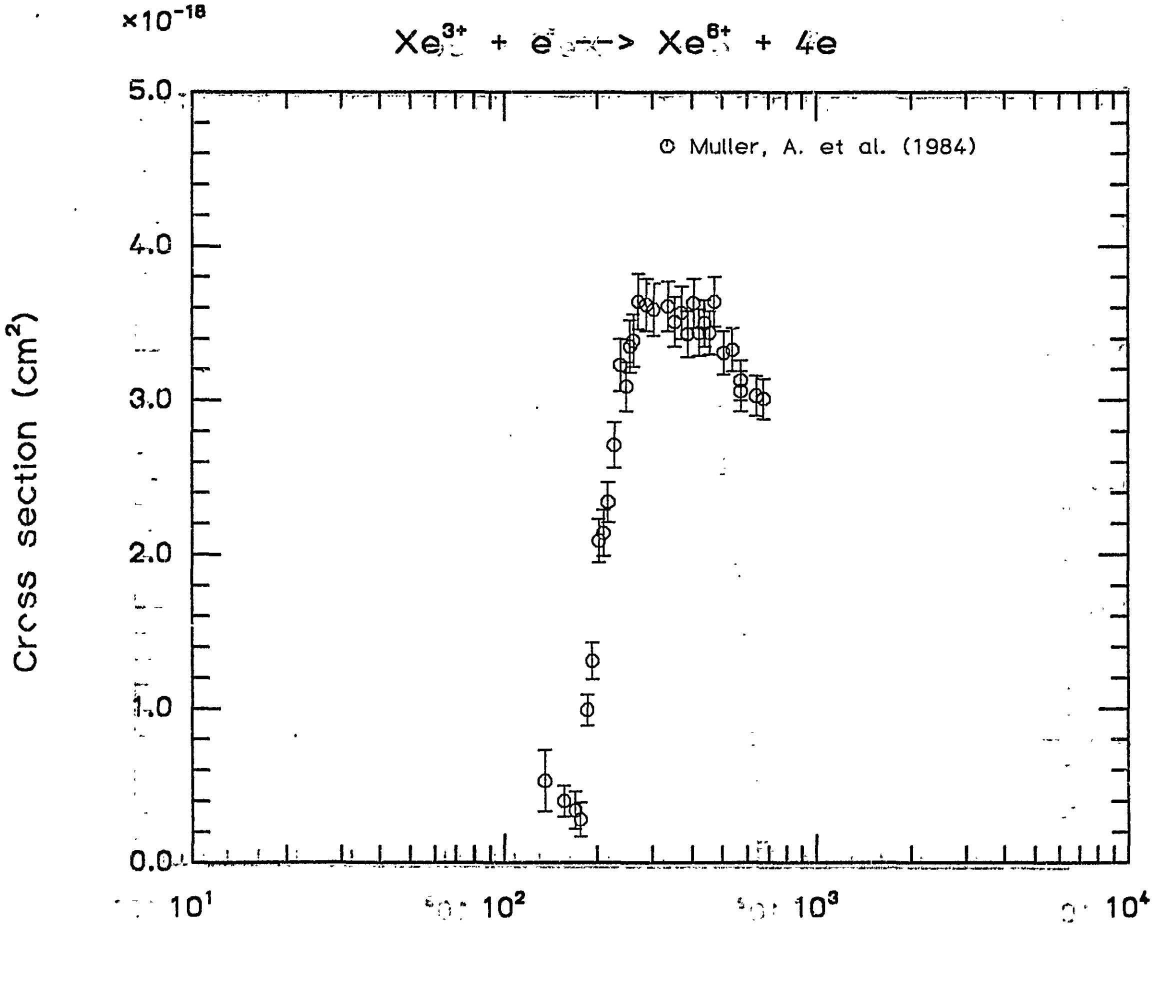
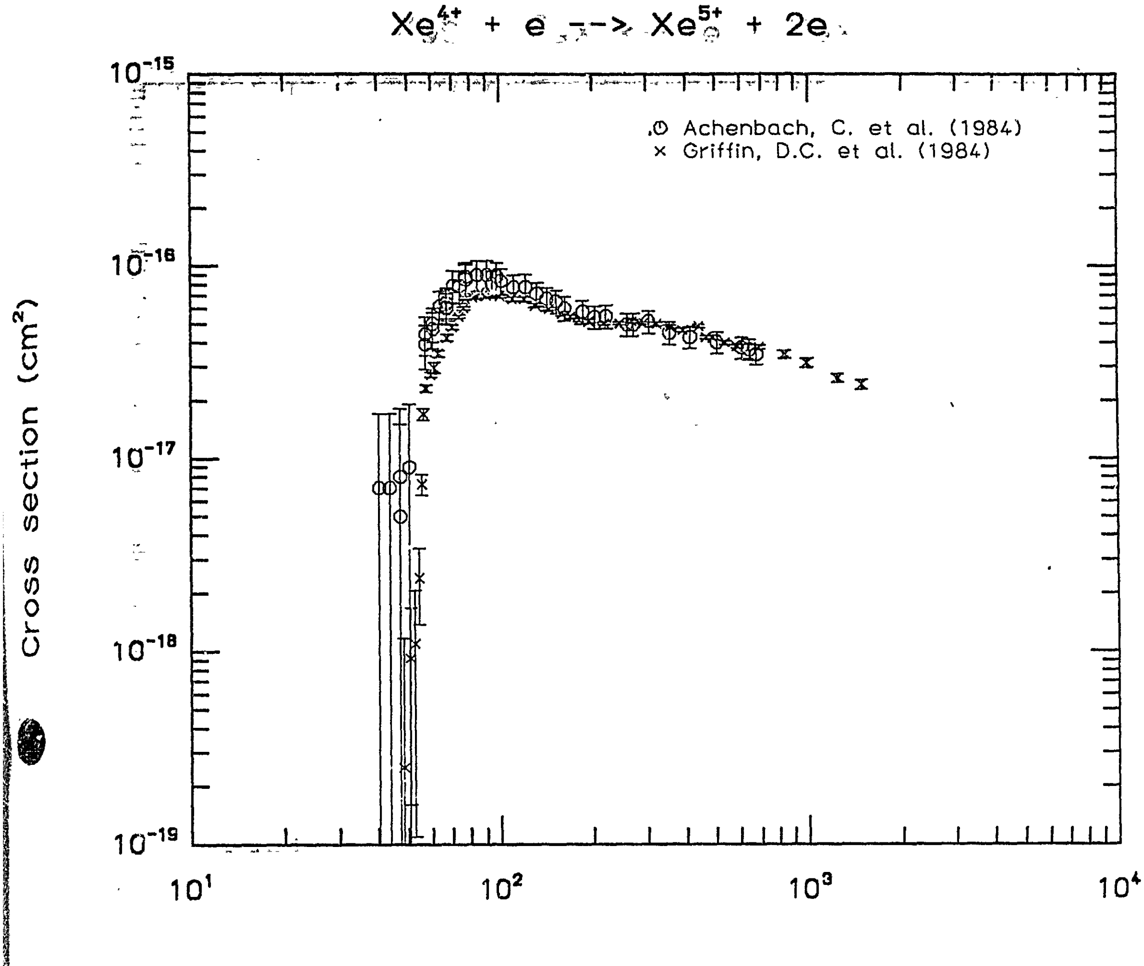

$\times 10^{-18}$
$Xe^{3+} + e \rightarrow Xe^{6+} + 4e$
© Muller, A. et al. (1984)
Cross section (cm^2)
5.0
4.0
3.0
2.0
1.0
0.0
10^{1}
10^{2}
10^{3}
10^{4}
Electron energy (eV)

Fig. 250



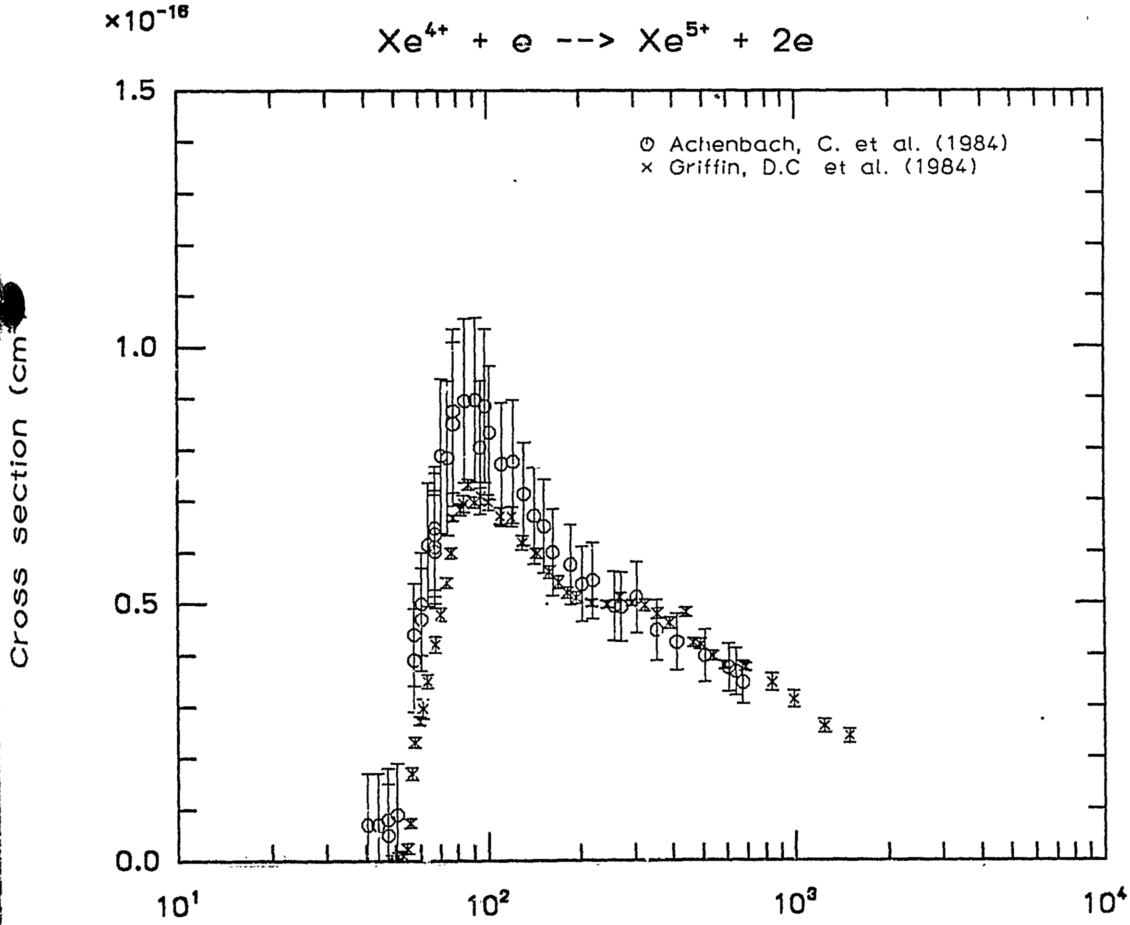
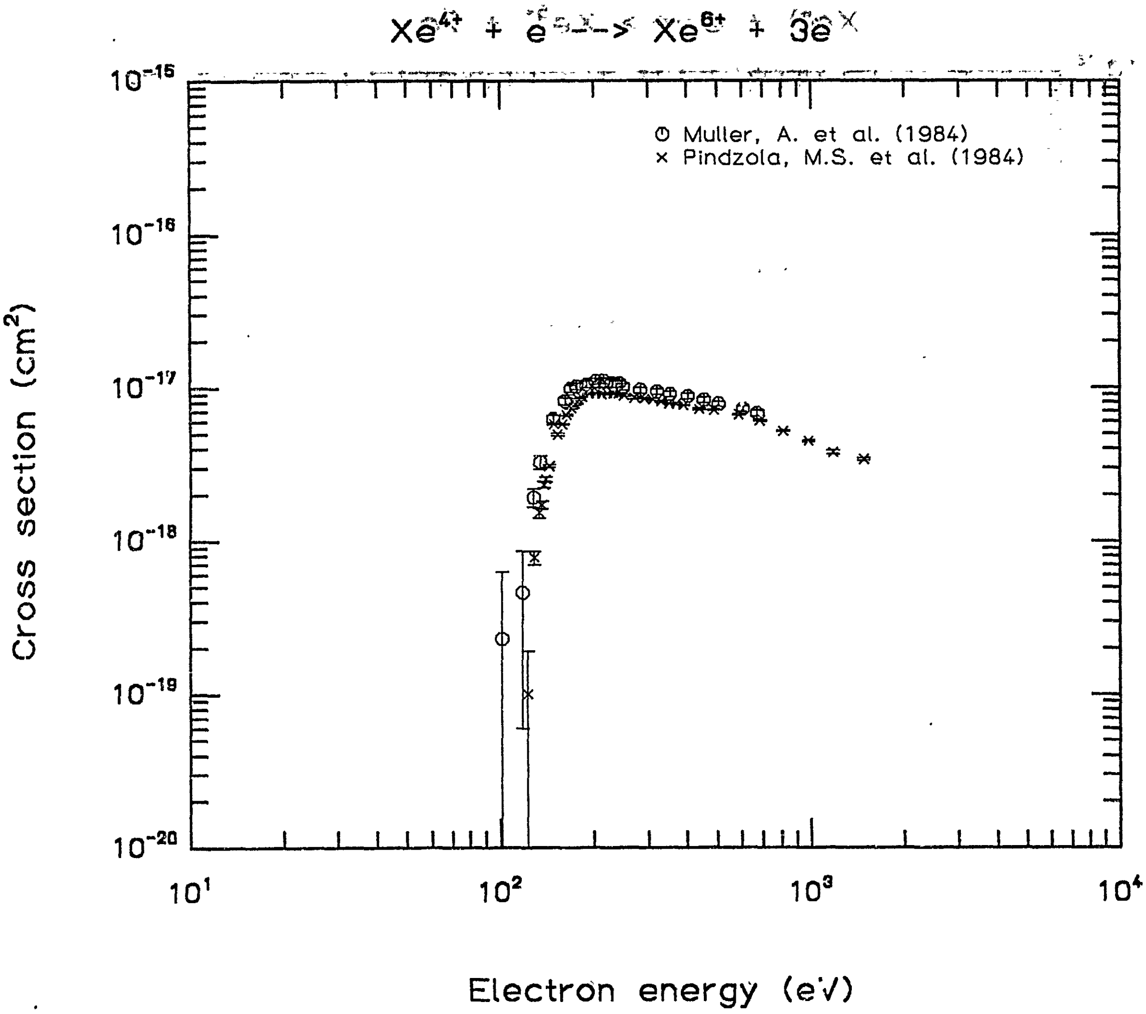


Fig. 251 Electron energy (eV)



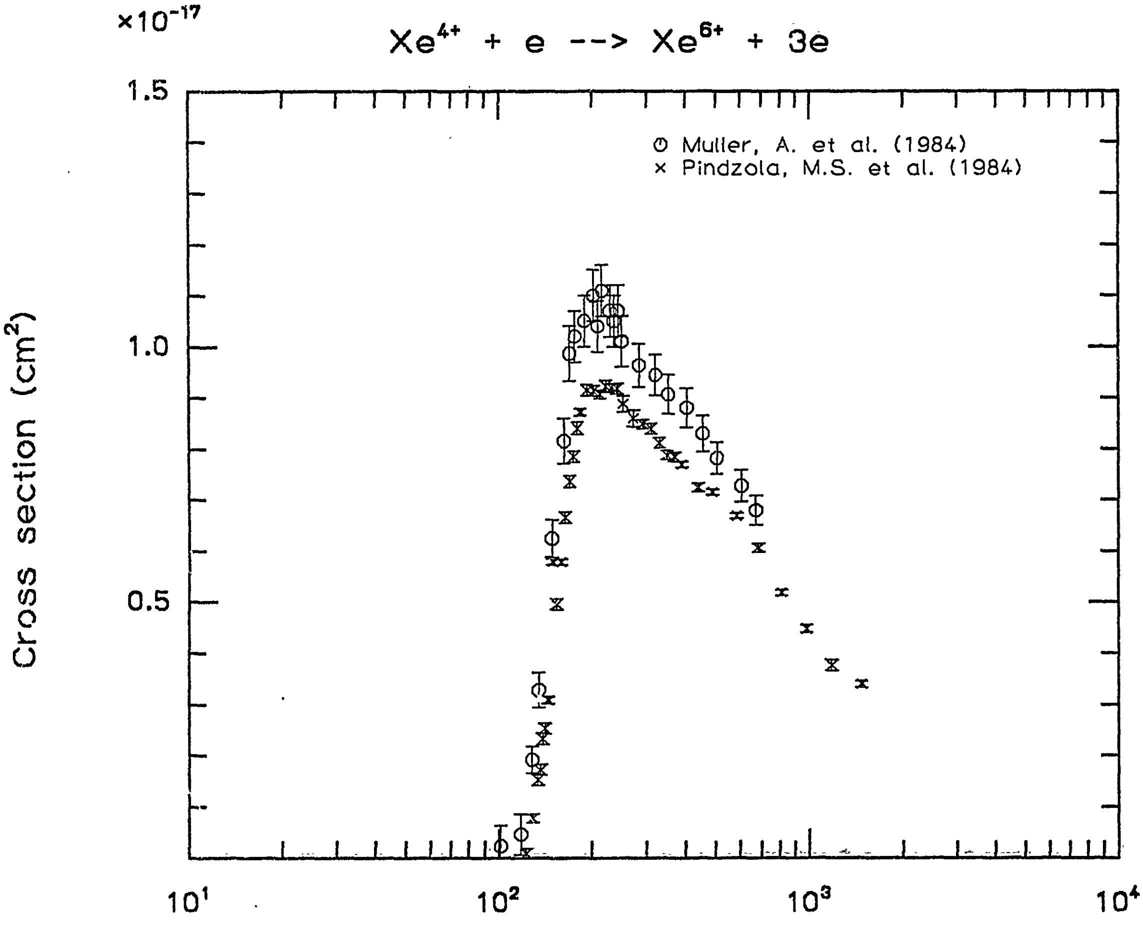
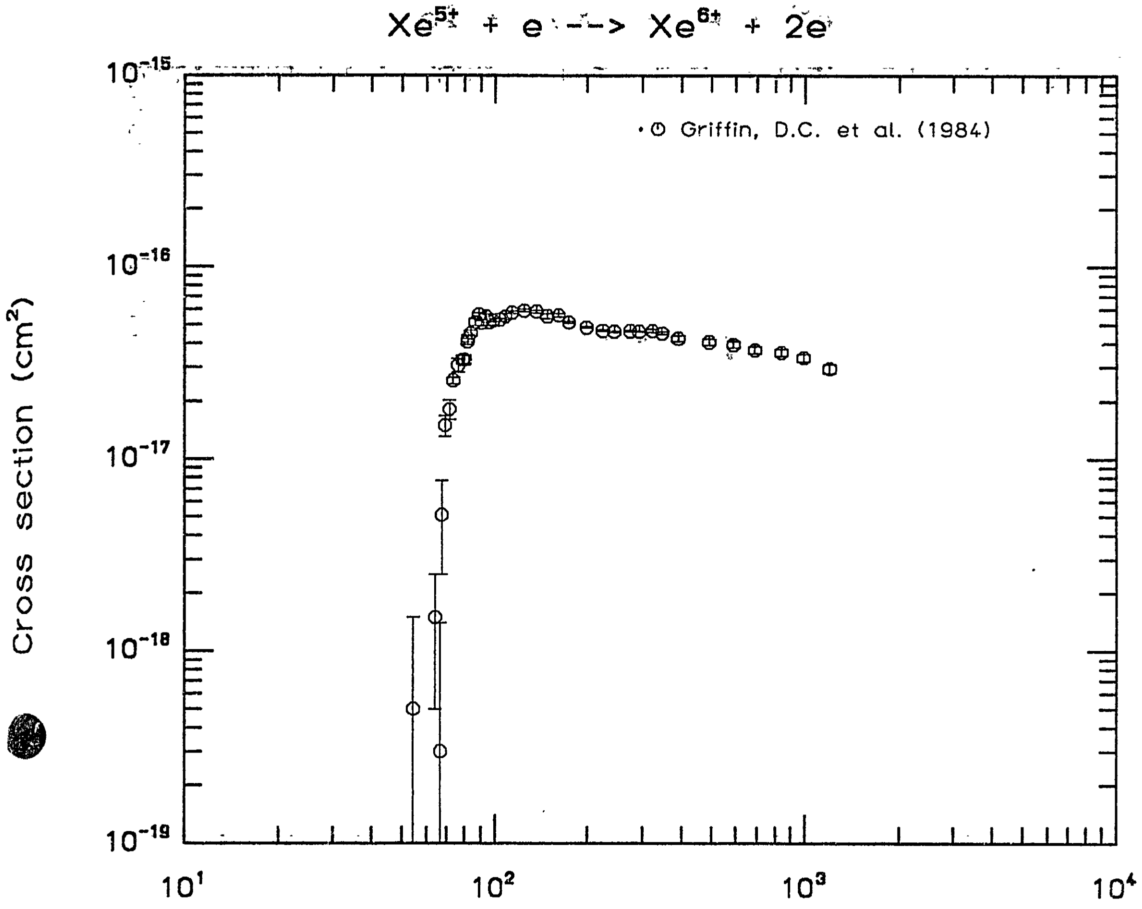


Fig. 252 Electron energy (eV)



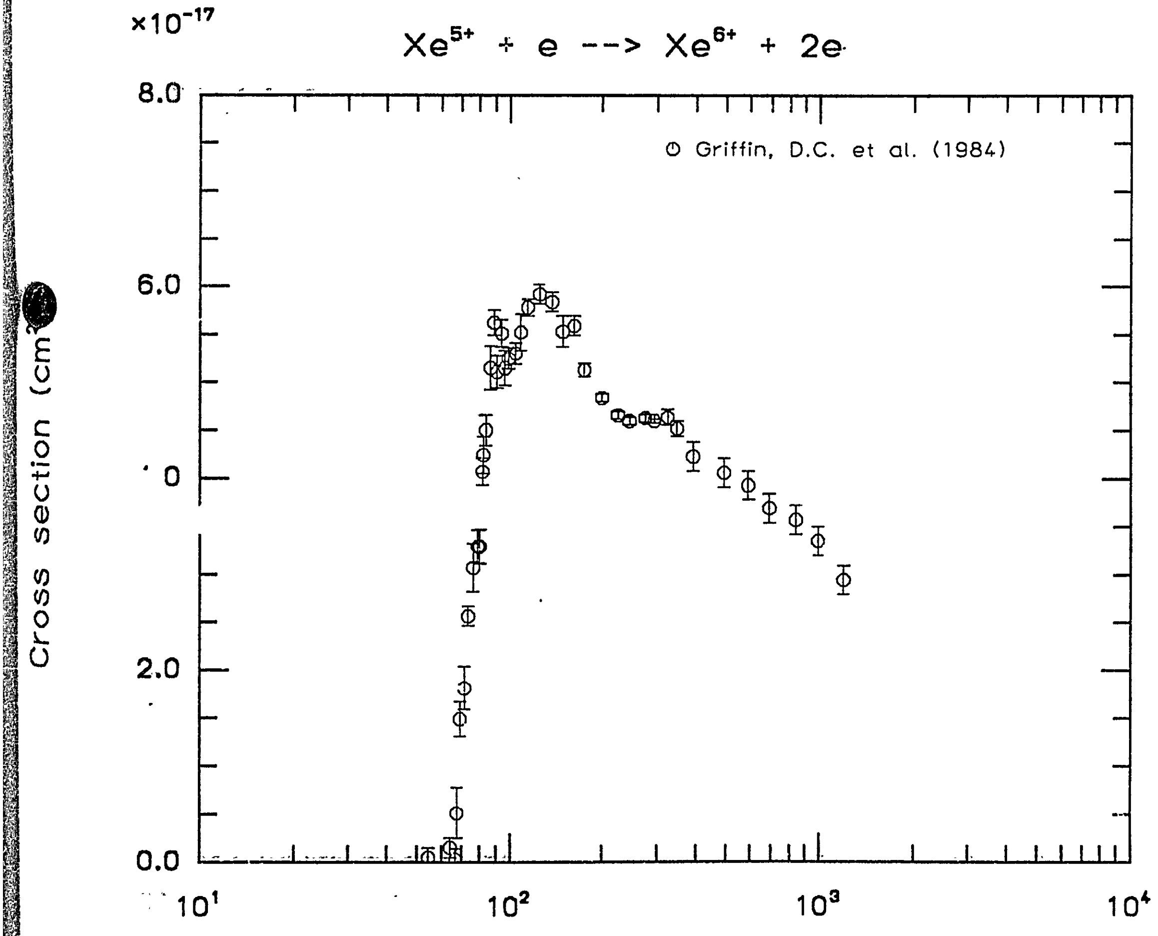
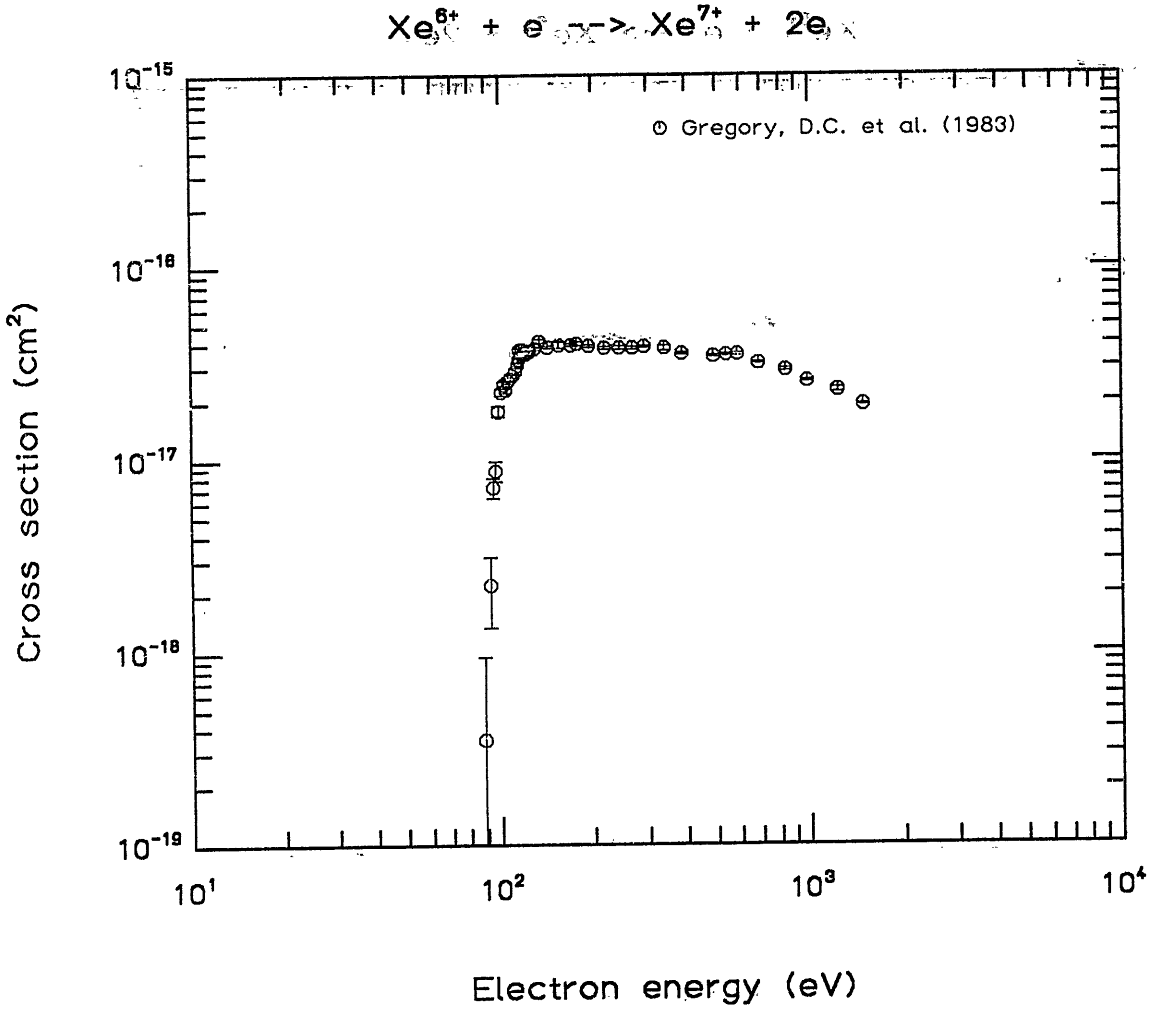
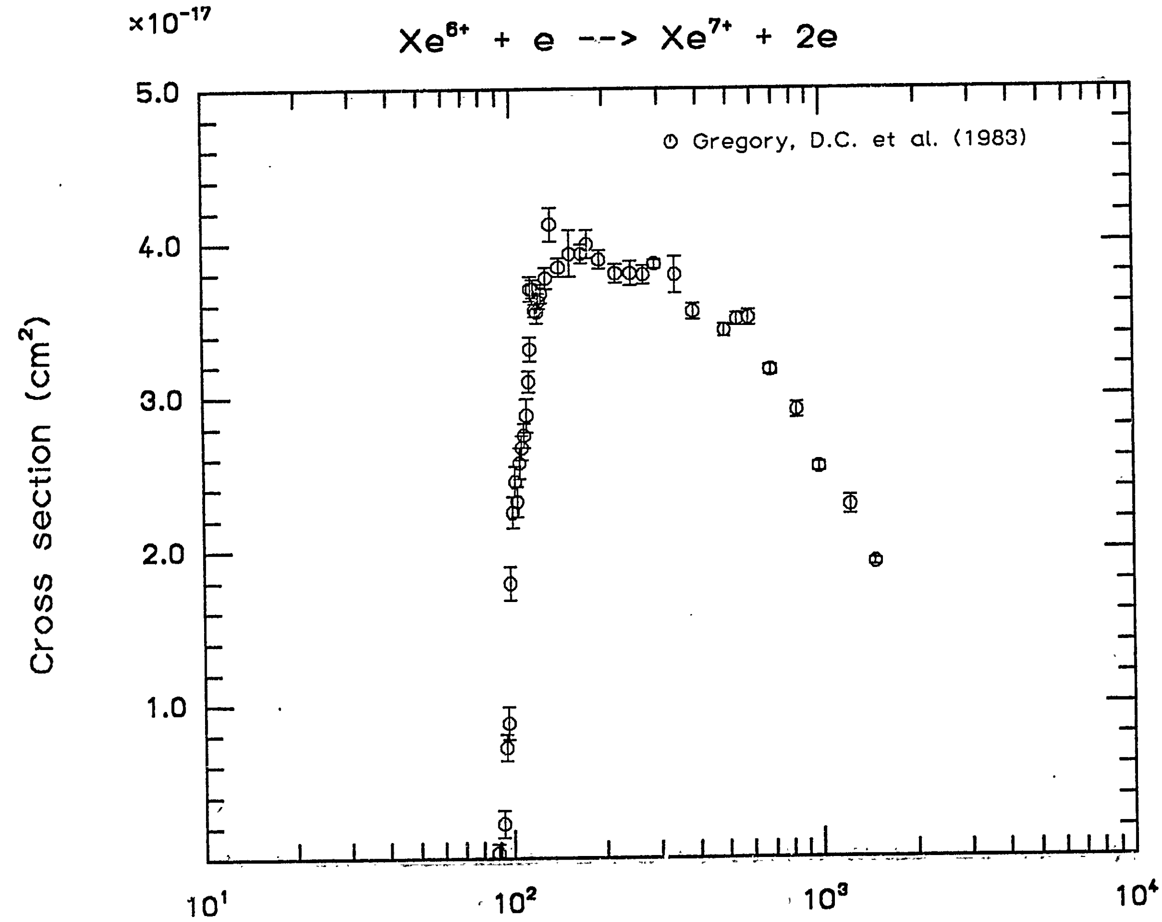


Fig. 253 Electron energy (eV)

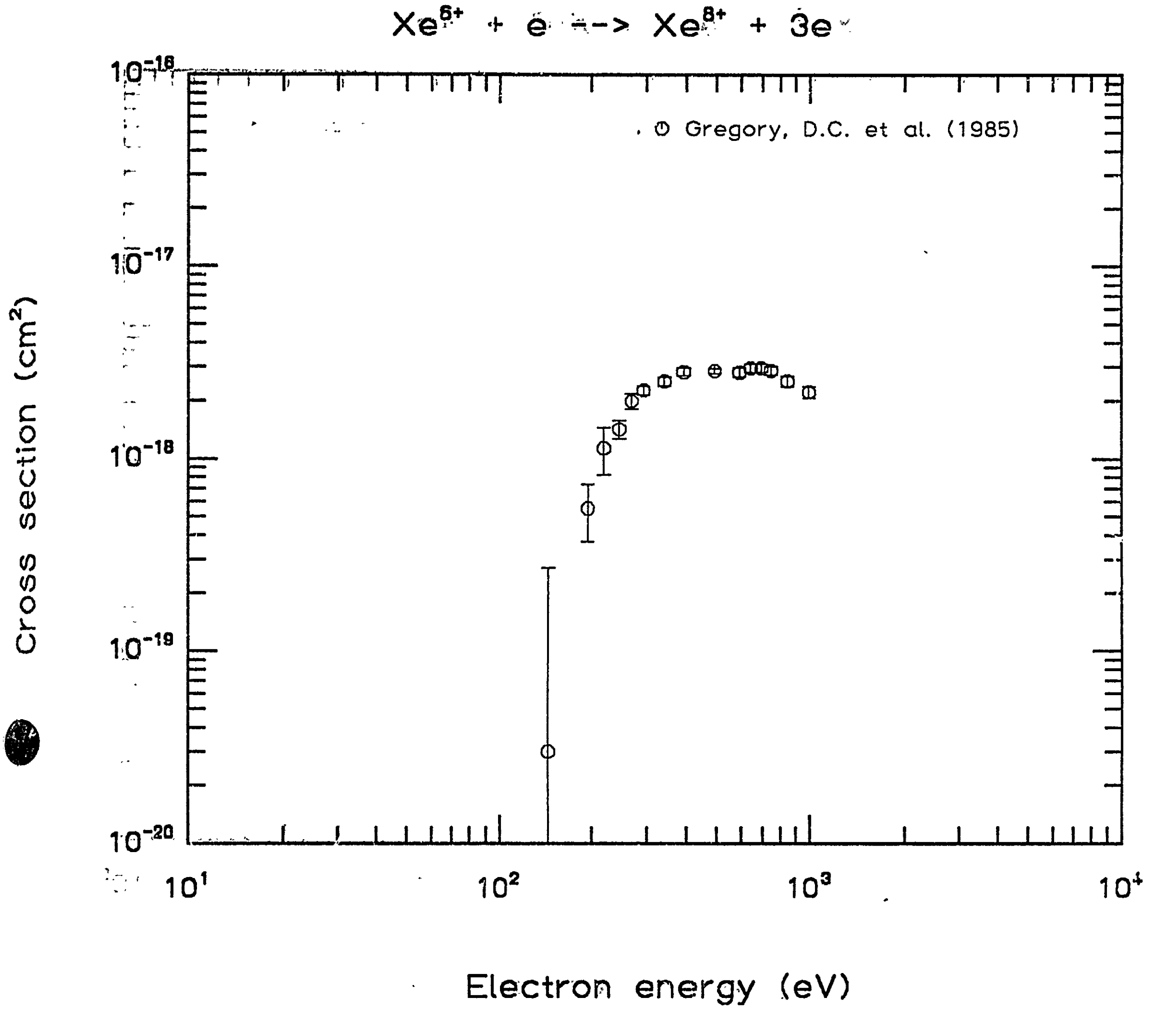


Xe6+ + e --> Xe7+ + 2e
Gregory, D.C. et al. (1983)
Cross section (cm2)
10-15
10-16
10-17
10-18
10-19
101
102
103
104
Electron energy (eV)

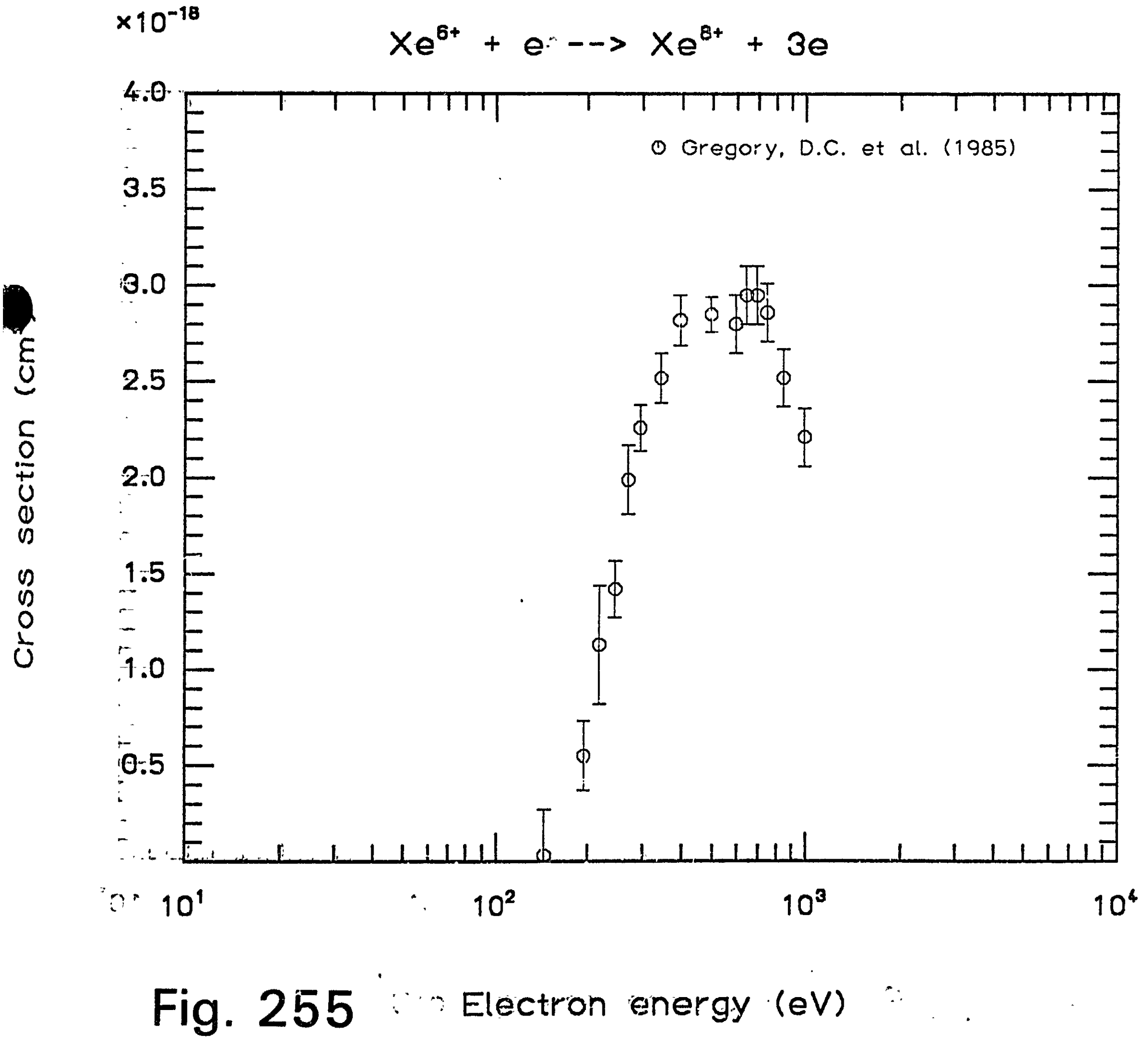


×10-17
Xe6+ + e --> Xe7+ + 2e
Gregory, D.C. et al. (1983)
Cross section (cm2)
5.0
4.0
3.0
2.0
1.0
101
102
103
104
Electron energy (eV)

Fig. 254



Xe6+ + e --> Xe8+ + 3e
Gregory, D.C. et al. (1985)
Cross section (cm²)
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10⁻¹⁹
10⁻²⁰
10¹
10²
10³
10⁴
Electron energy (eV)



×10⁻¹⁸
Xe6+ + e --> Xe8+ + 3e
Gregory, D.C. et al. (1985)
Cross section (cm²)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 255

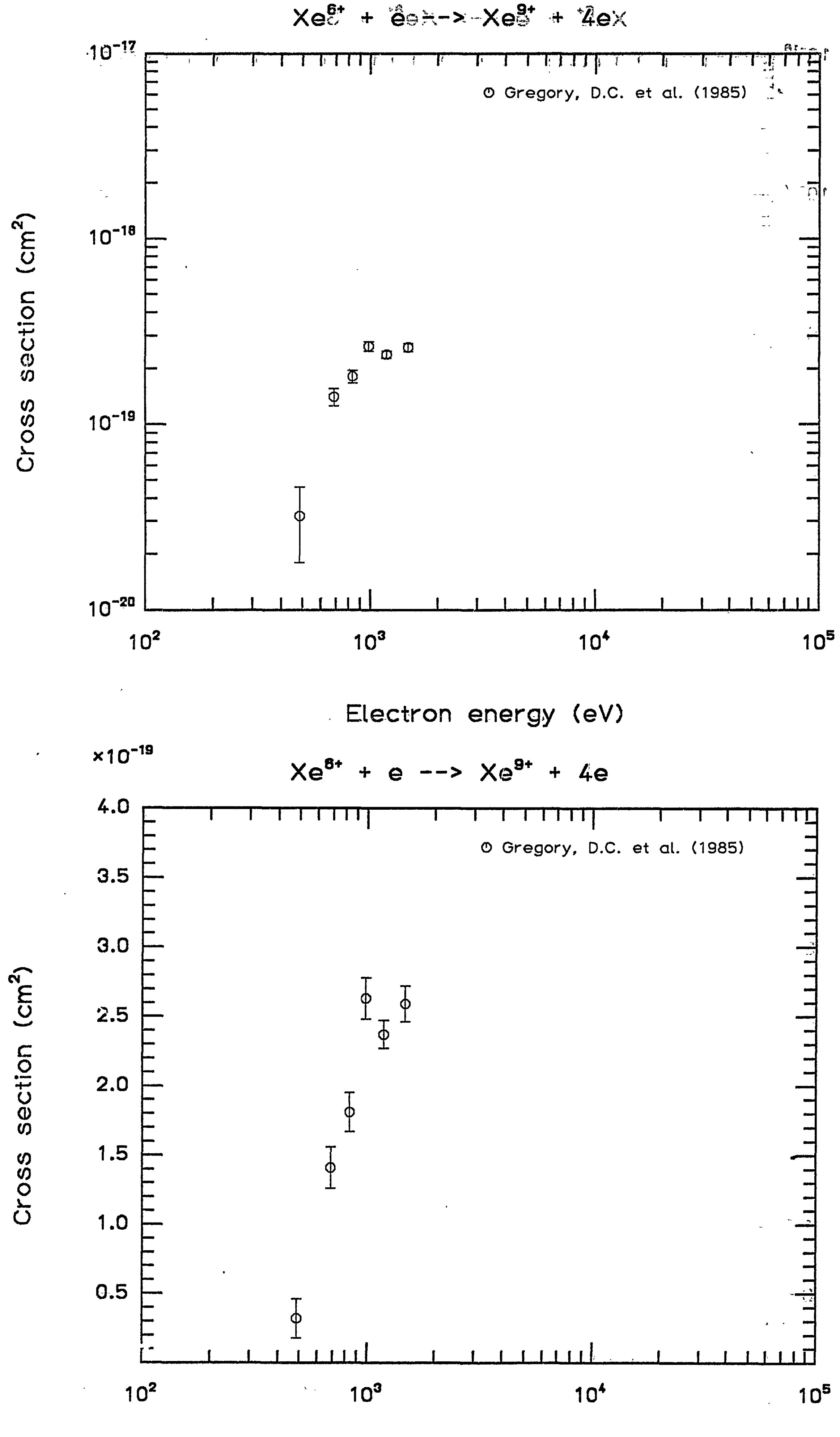
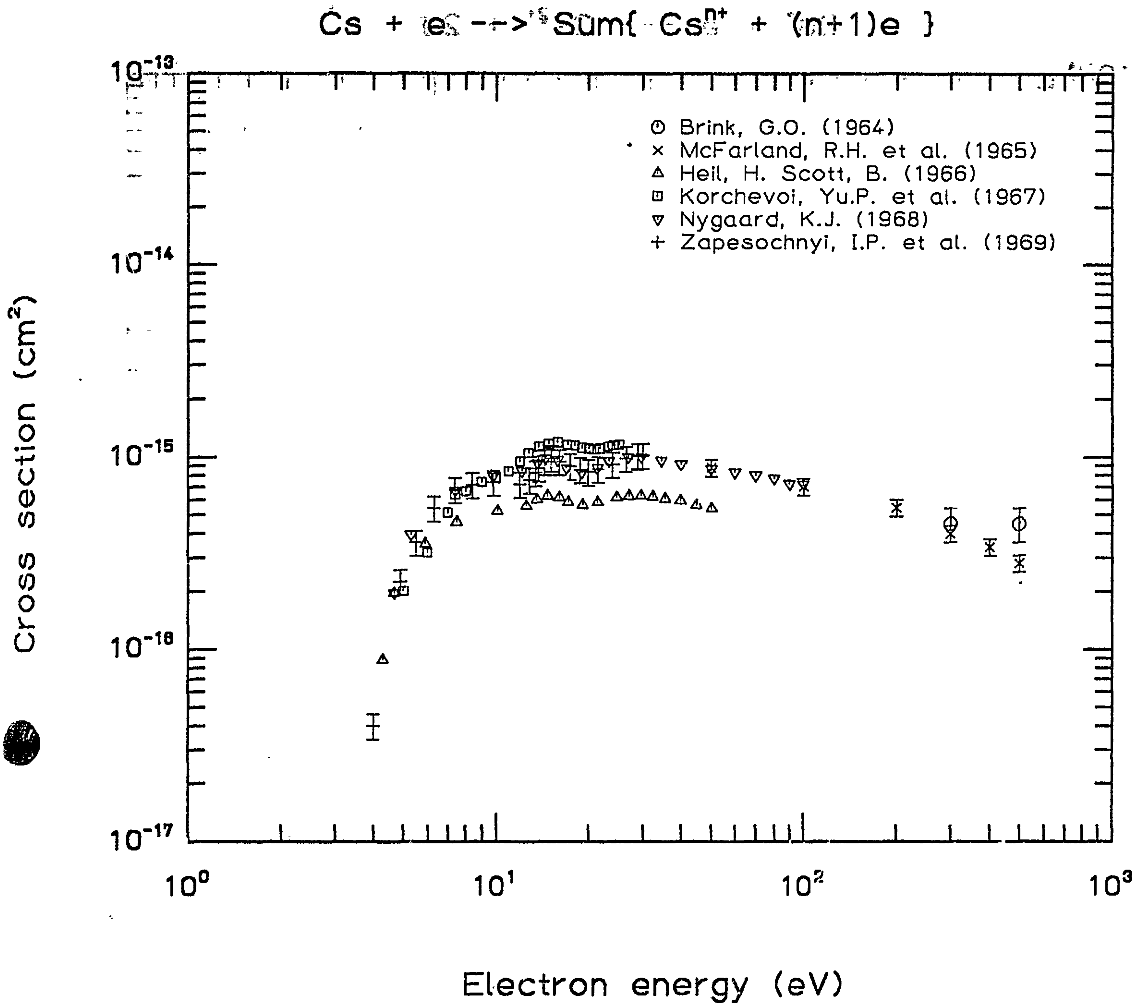
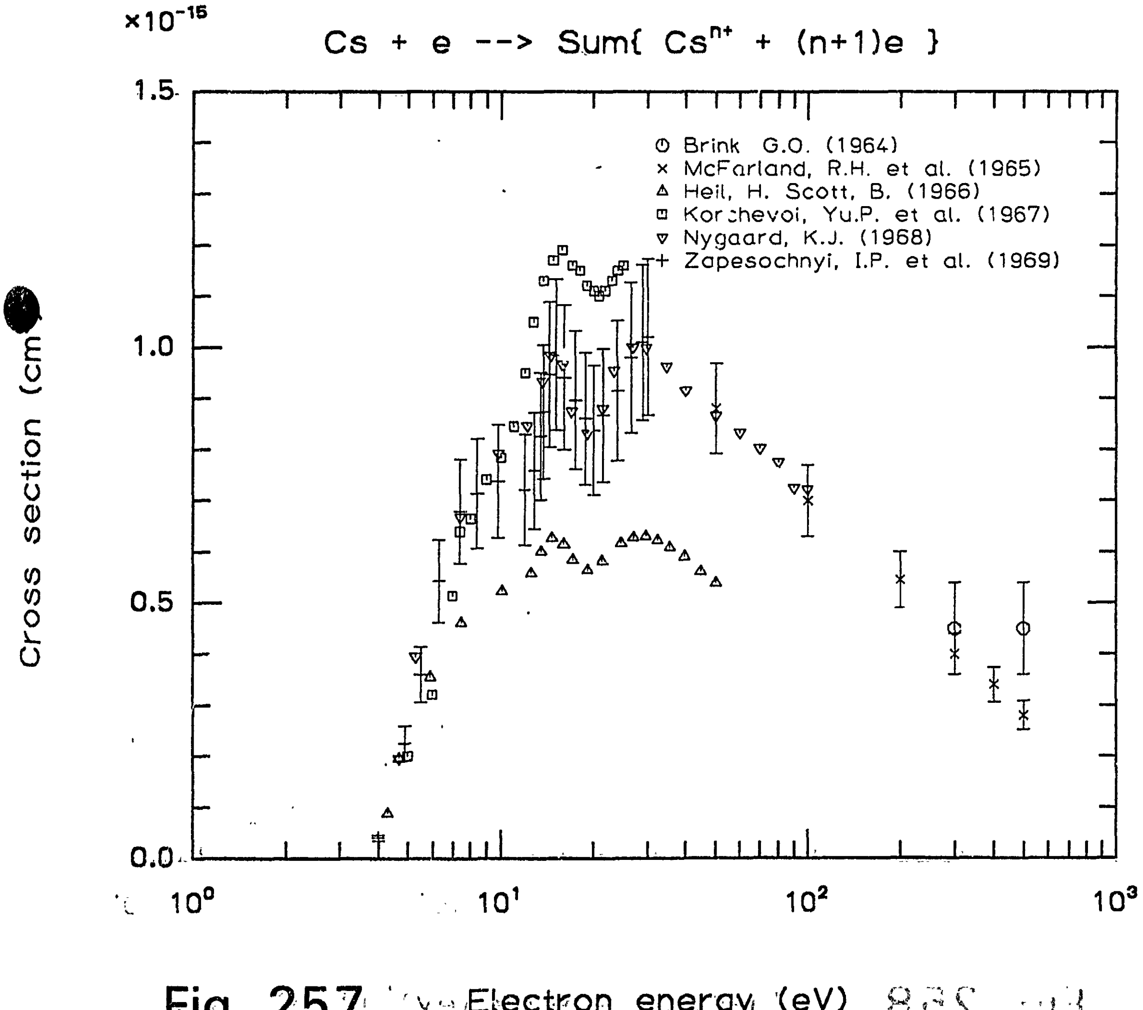

Xe^{6+} + e --> Xe^{9+} + 4e
Gregory, D.C. et al. (1985)
Cross section (cm^2)
10^{-17}
10^{-18}
10^{-19}
10^{-20}
10^2
10^3
10^4
10^5
Electron energy (eV)
×10^{-19}
Xe^{6+} + e --> Xe^{9+} + 4e
Gregory, D.C. et al. (1985)
Cross section (cm^2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
10^2
10^3
10^4
10^5
Electron energy (eV)

Fig. 256

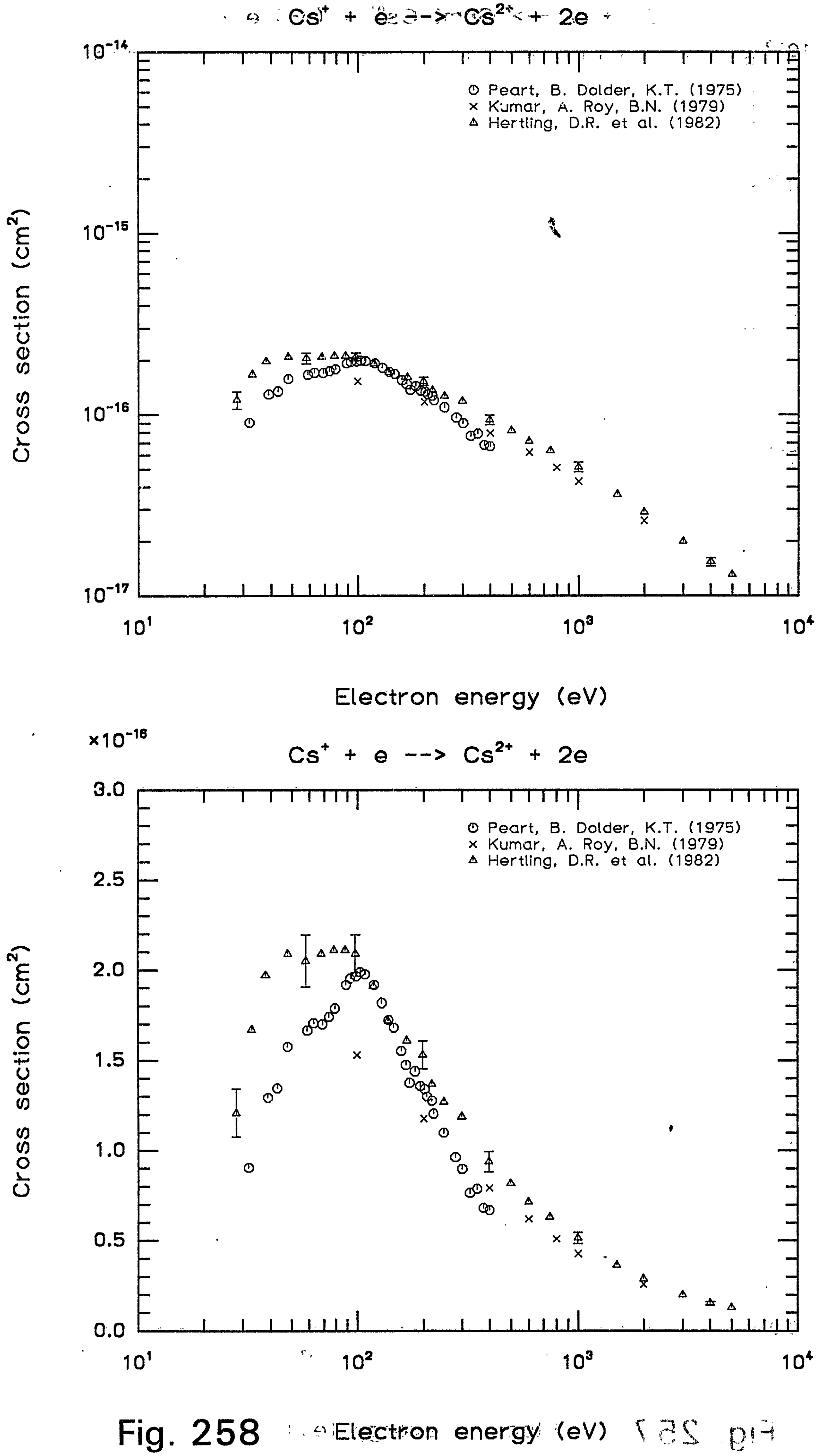


Cs + e --> Sum{ Cs^{n+} + (n+1)e }
Brink, G.O. (1964)
McFarland, R.H. et al. (1965)
Heil, H. Scott, B. (1966)
Korchevoi, Yu.P. et al. (1967)
Nygaard, K.J. (1968)
Zapesochnyi, I.P. et al. (1969)
Cross section (cm^2)
Electron energy (eV)



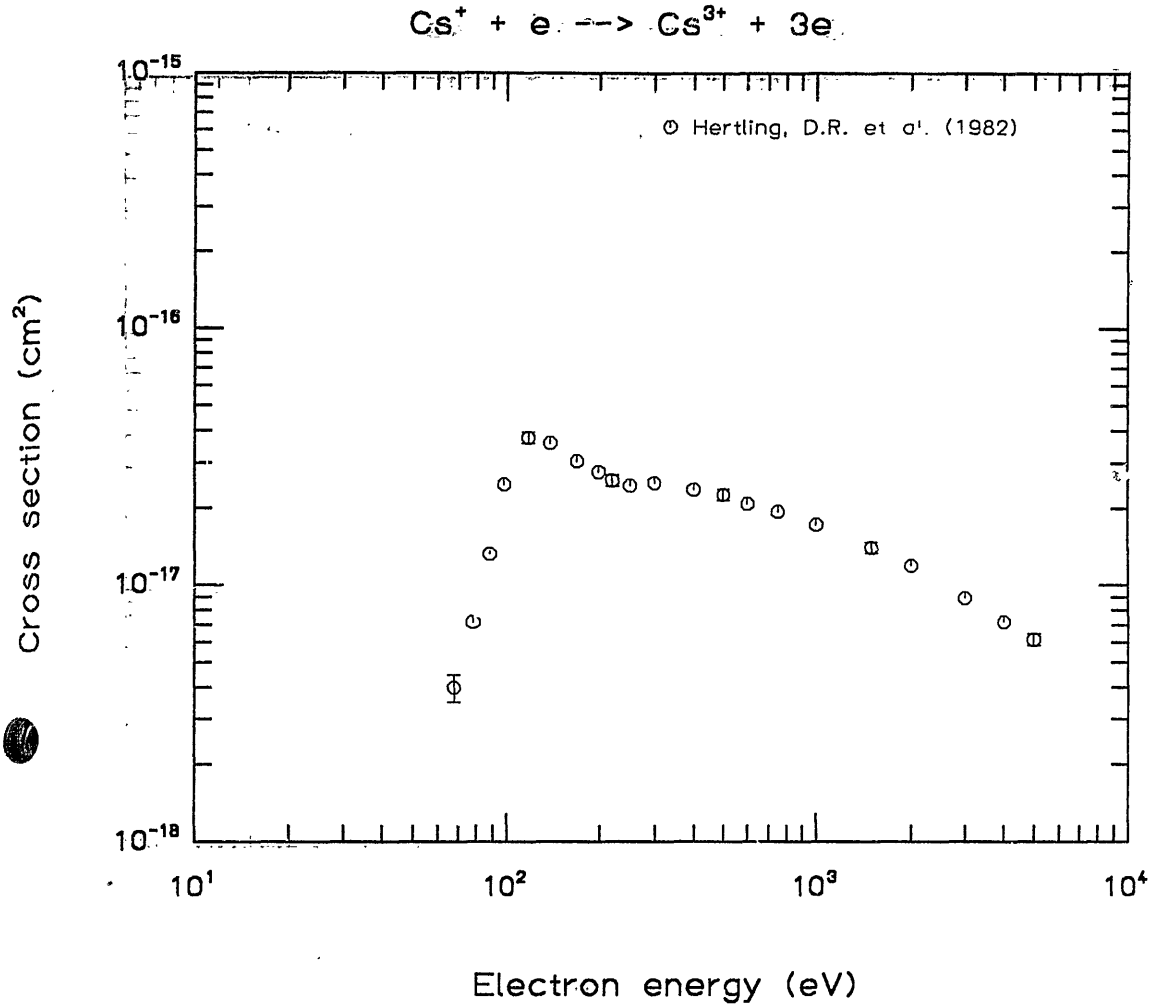
×10^{-15}
Cs + e --> Sum{ Cs^{n+} + (n+1)e }
Brink G.O. (1964)
McFarland, R.H. et al. (1965)
Heil, H. Scott, B. (1966)
Korchevoi, Yu.P. et al. (1967)
Nygaard, K.J. (1968)
Zapesochnyi, I.P. et al. (1969)
Cross section (cm^2)
Electron energy (eV)

Fig. 257



Cs⁺ + e --> Cs²⁺ + 2e
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
Cross section (cm²)
Peart, B. Dolder, K.T. (1975)
Kumar, A. Roy, B.N. (1979)
Hertling, D.R. et al. (1982)
10¹
10²
10³
10⁴
Electron energy (eV)
×10⁻¹⁶
Cs⁺ + e --> Cs²⁺ + 2e
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Cross section (cm²)
Peart, B. Dolder, K.T. (1975)
Kumar, A. Roy, B.N. (1979)
Hertling, D.R. et al. (1982)
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 258


Cs+ + e --> Cs3+ + 3e
Hertling, D.R. et al. (1982)
Cross section (cm2)
10-15
10-16
10-17
10-18
101
102
103
104
Electron energy (eV)

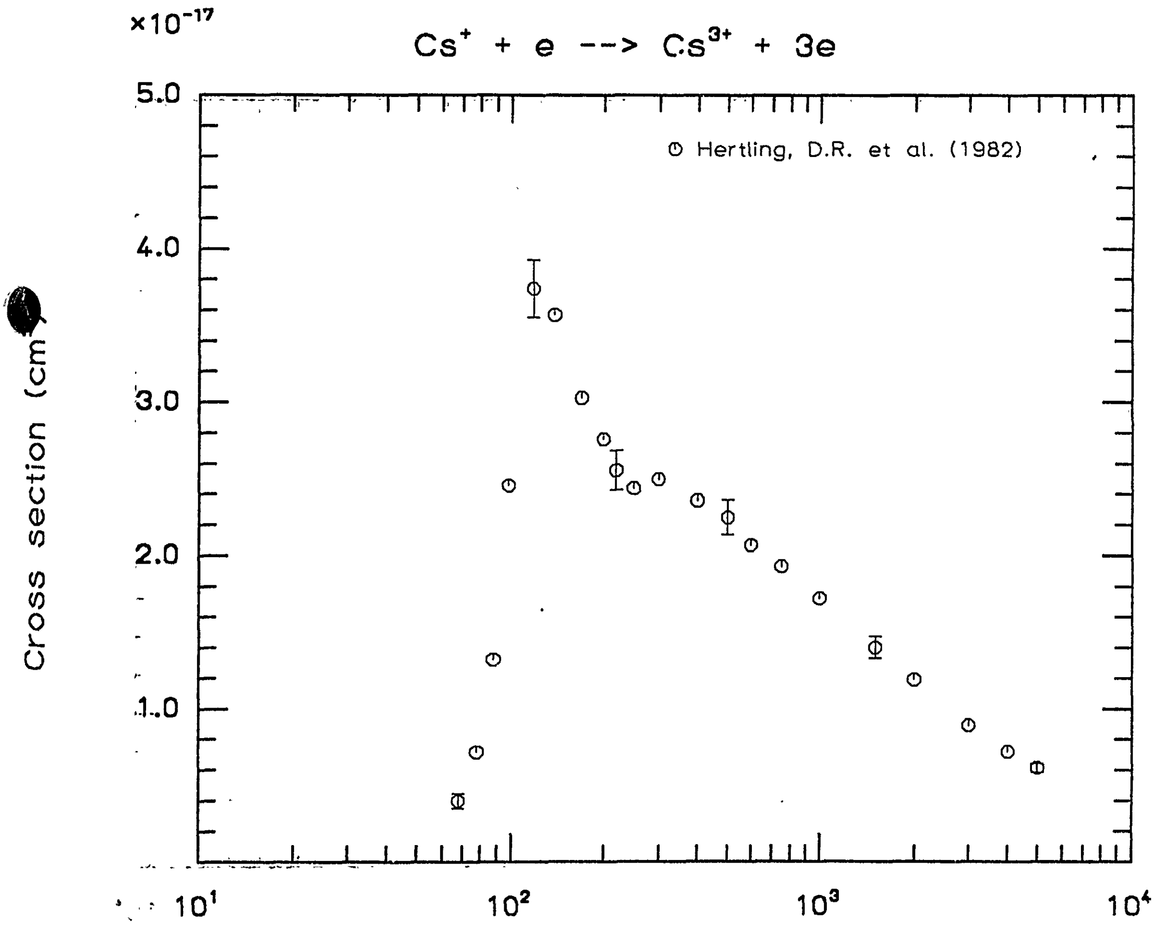
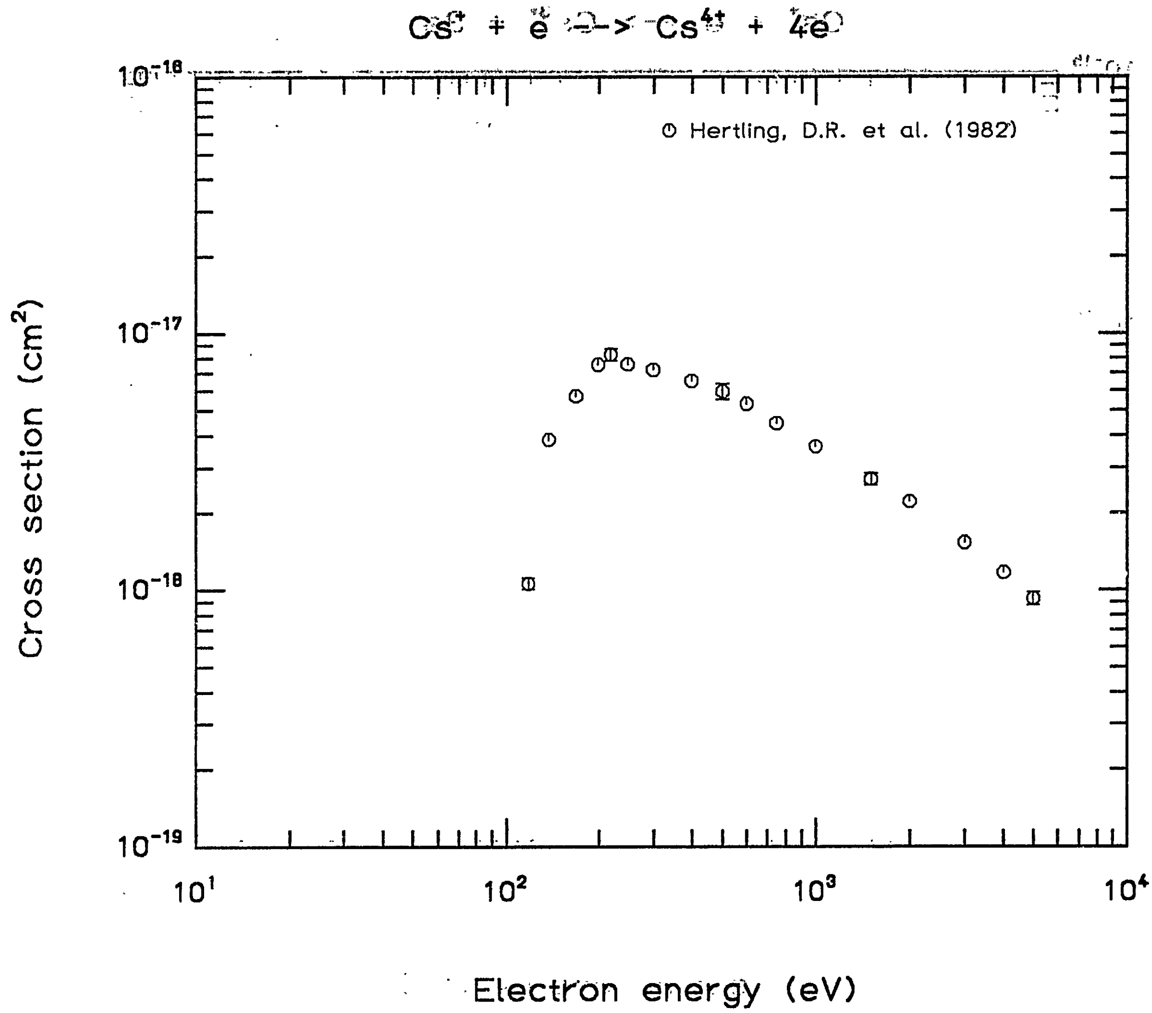

×10-17
Cs+ + e --> Cs3+ + 3e
Hertling, D.R. et al. (1982)
Cross section (cm2)
5.0
4.0
3.0
2.0
1.0
101
102
103
104
Electron energy (eV)

Fig. 259


Cs+ + e --> Cs4+ + 4e
Hertling, D.R. et al. (1982)
Cross section (cm2)
10-16
10-17
10-18
10-19
10¹
10²
10³
10⁴
Electron energy (eV)

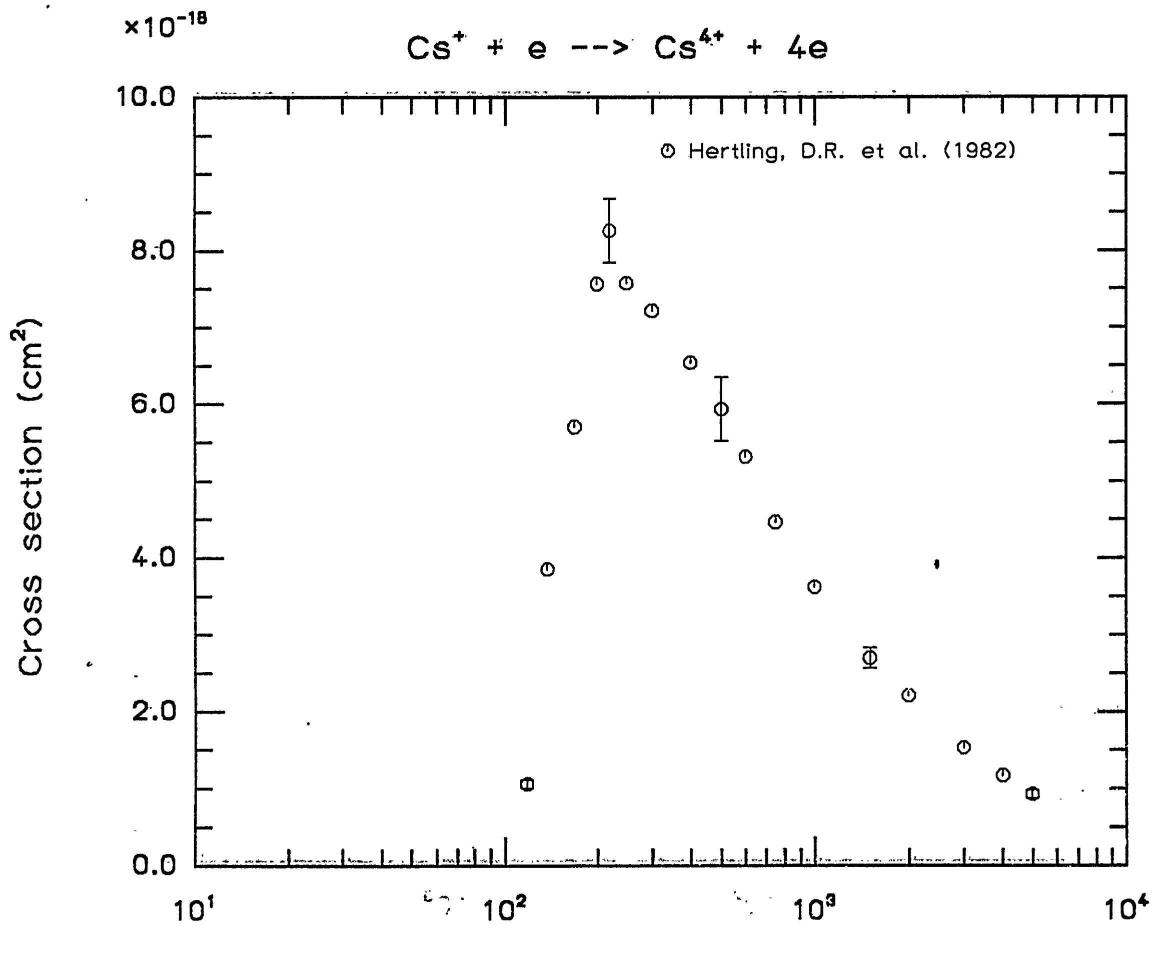
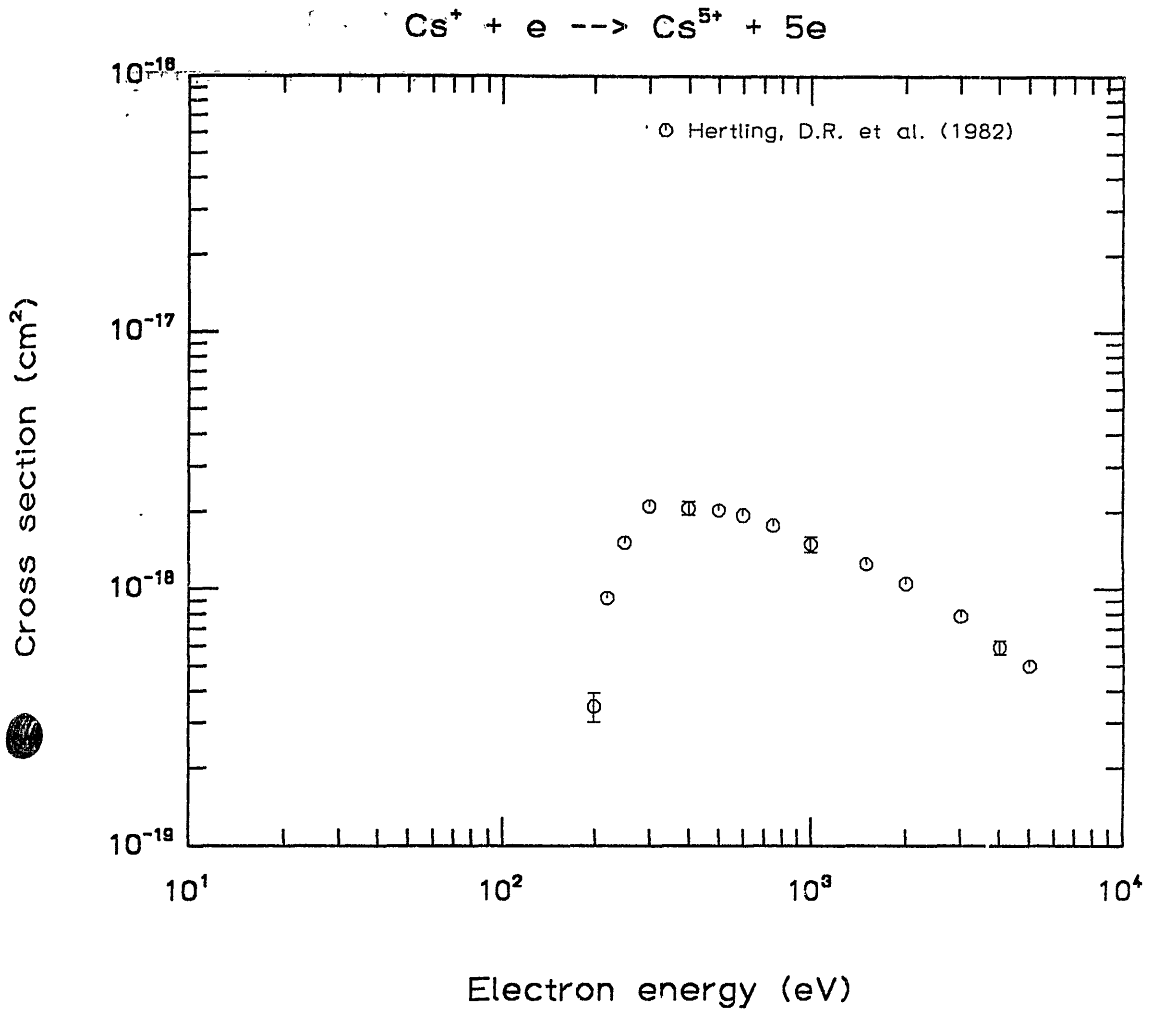

×10-18
Cs+ + e --> Cs4+ + 4e
Hertling, D.R. et al. (1982)
Cross section (cm2)
10.0
8.0
6.0
4.0
2.0
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 260


Cs⁺ + e --> Cs⁵⁺ + 5e
Hertling, D.R. et al. (1982)
Cross section (cm²)
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10⁻¹⁹
10¹
10²
10³
10⁴
Electron energy (eV)

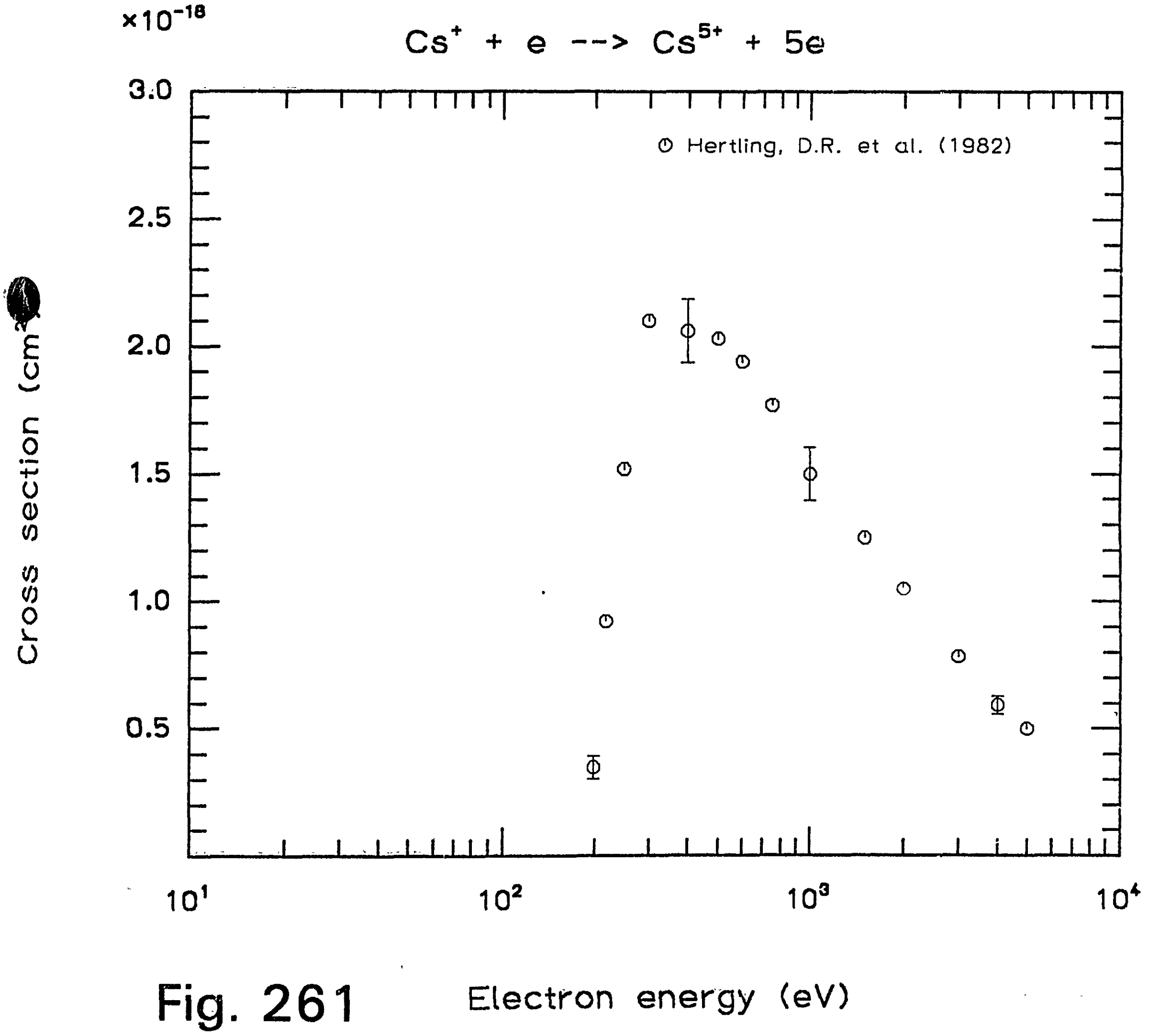
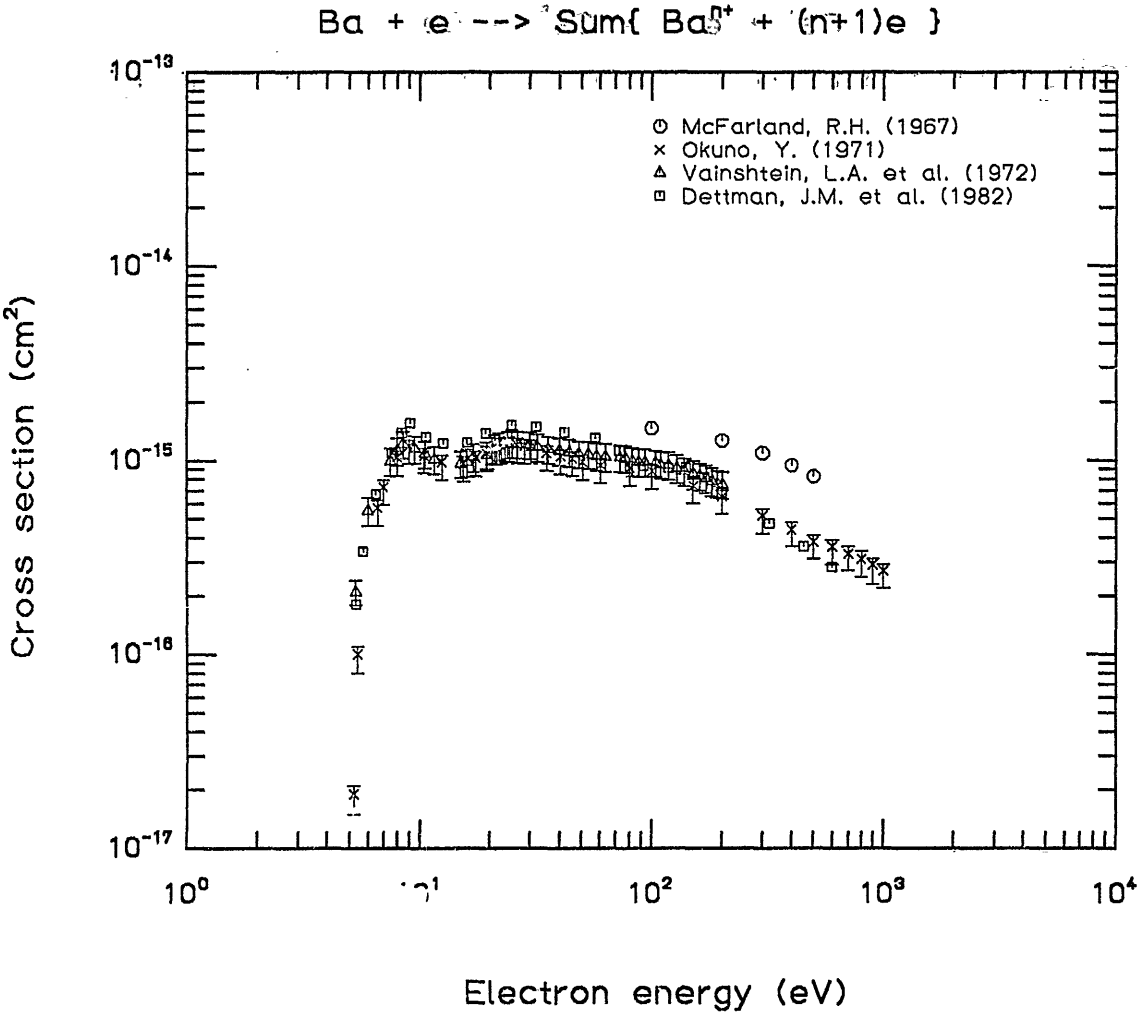
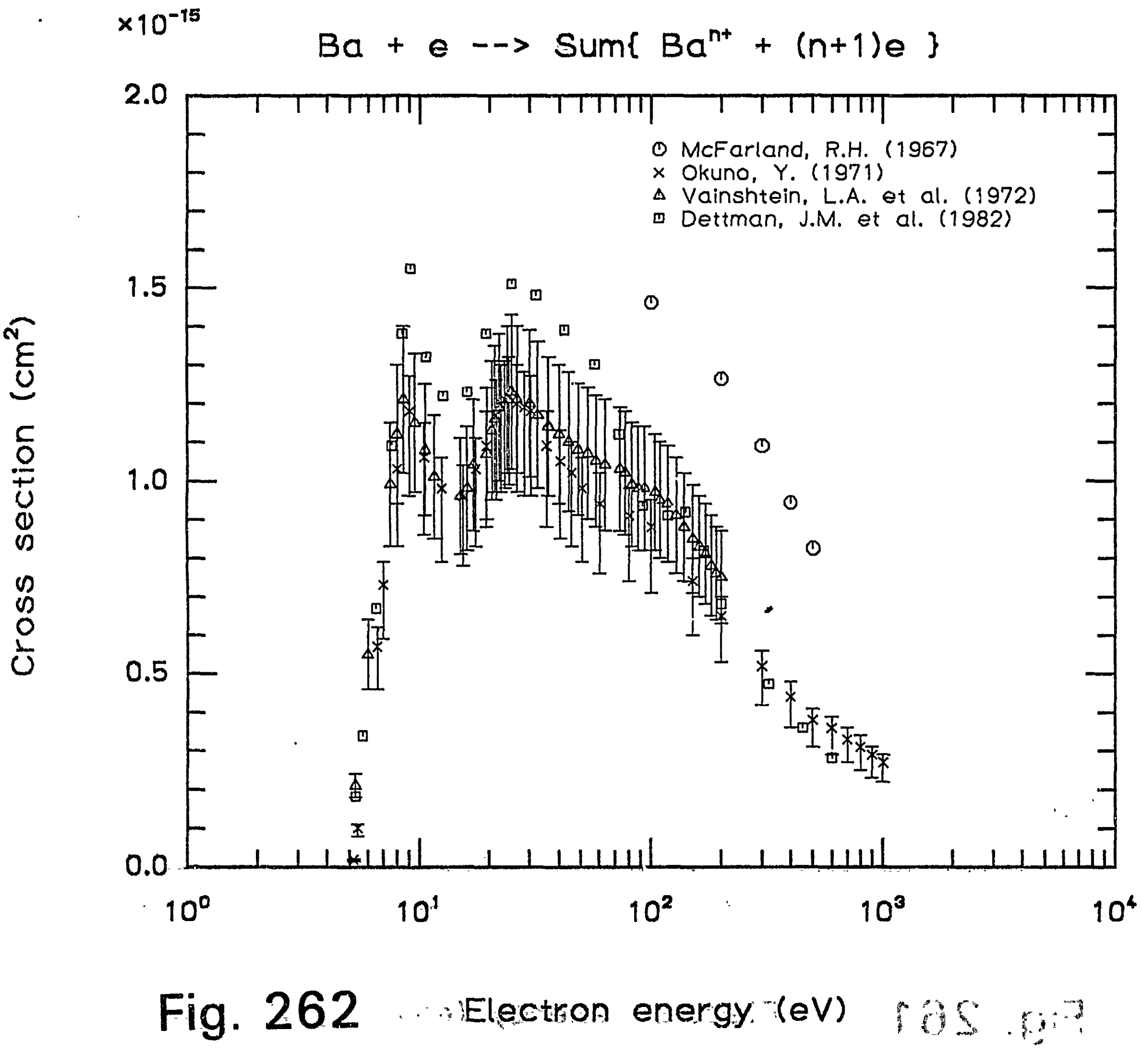

×10⁻¹⁸
Cs⁺ + e --> Cs⁵⁺ + 5e
Hertling, D.R. et al. (1982)
Cross section (cm²)
3.0
2.5
2.0
1.5
1.0
0.5
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 261

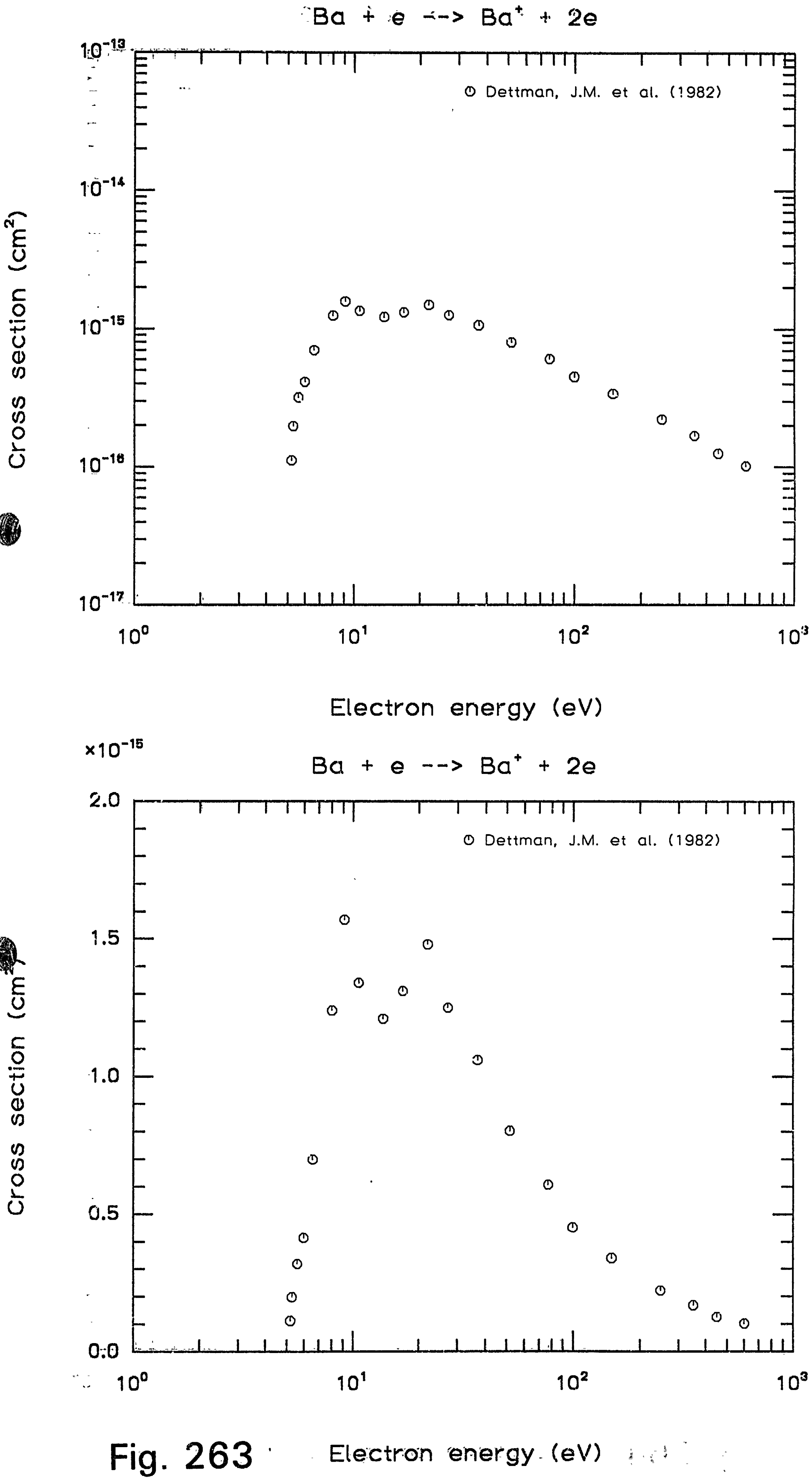


Ba + e --> Sum{ Ba^n+ + (n+1)e }
McFarland, R.H. (1967)
Okuno, Y. (1971)
Vainshtein, L.A. et al. (1972)
Dettman, J.M. et al. (1982)
Cross section (cm²)
10⁻¹³
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁰
10²
10³
10⁴
Electron energy (eV)



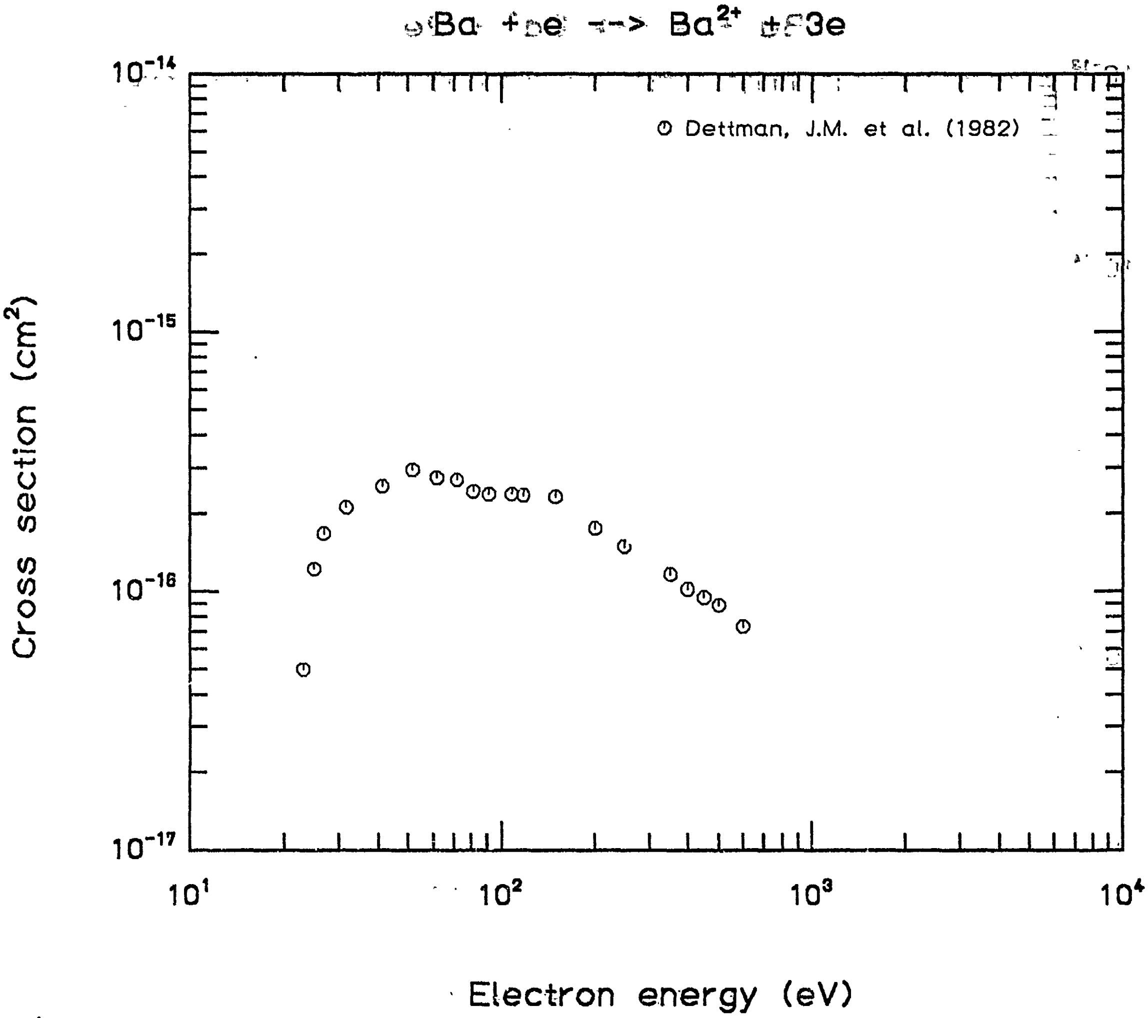
×10⁻¹⁵
Ba + e --> Sum{ Ba^n+ + (n+1)e }
McFarland, R.H. (1967)
Okuno, Y. (1971)
Vainshtein, L.A. et al. (1972)
Dettman, J.M. et al. (1982)
Cross section (cm²)
2.0
1.5
1.0
0.5
0.0
10⁰
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 262



Ba + e --> Ba⁺ + 2e
Dettman, J.M. et al. (1982)
Cross section (cm²)
10⁻¹³
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁰
10¹
10²
10³
Electron energy (eV)
×10⁻¹⁵
Ba + e --> Ba⁺ + 2e
Dettman, J.M. et al. (1982)
Cross section (cm²)
2.0
1.5
1.0
0.5
0.0
10⁰
10¹
10²
10³
Electron energy (eV)

Fig. 263


Ba + e --> Ba2+ + 3e
Dettman, J.M. et al. (1982)
Cross section (cm2)
Electron energy (eV)
10-14
10-15
10-16
10-17
101
102
103
104

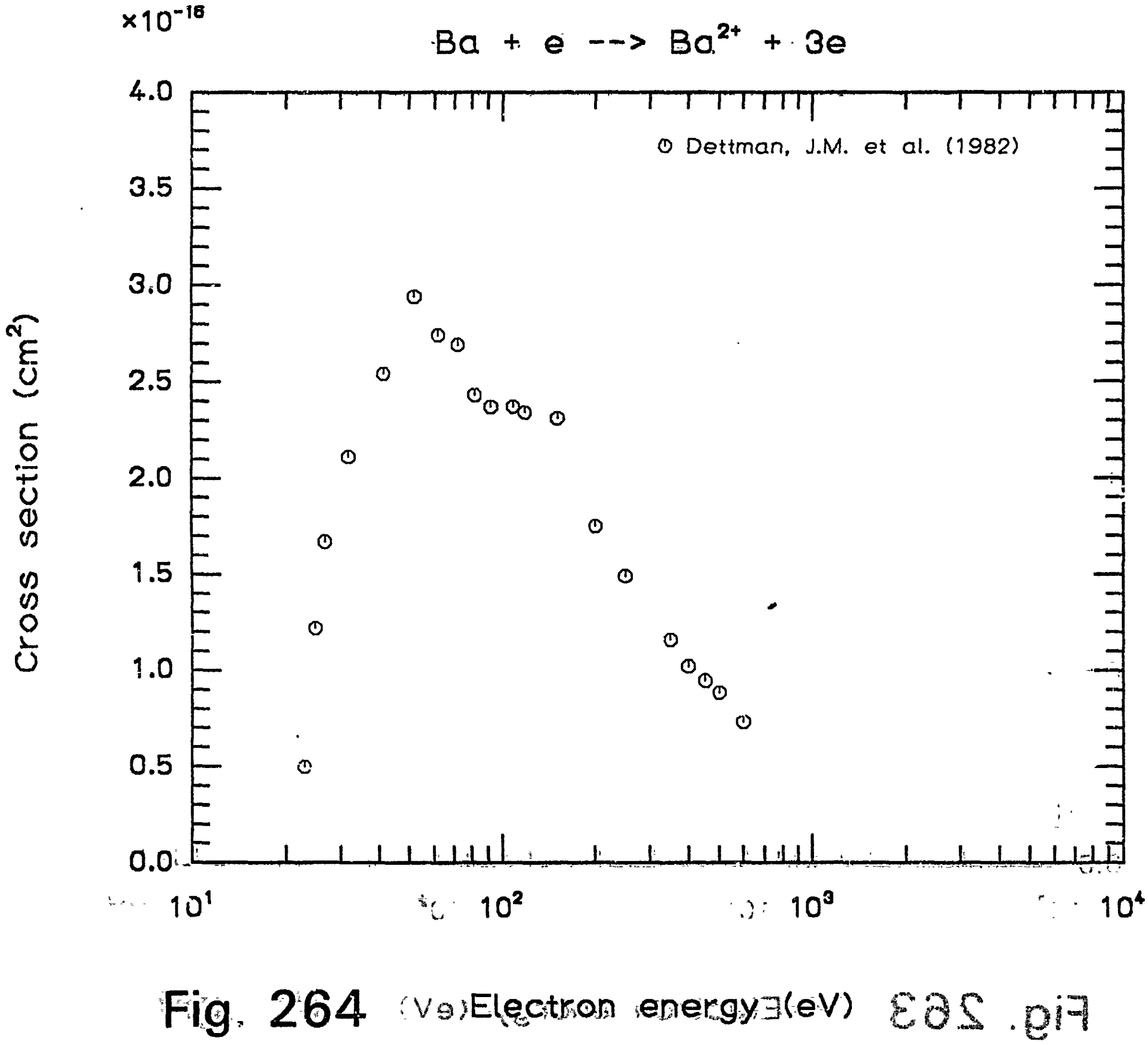
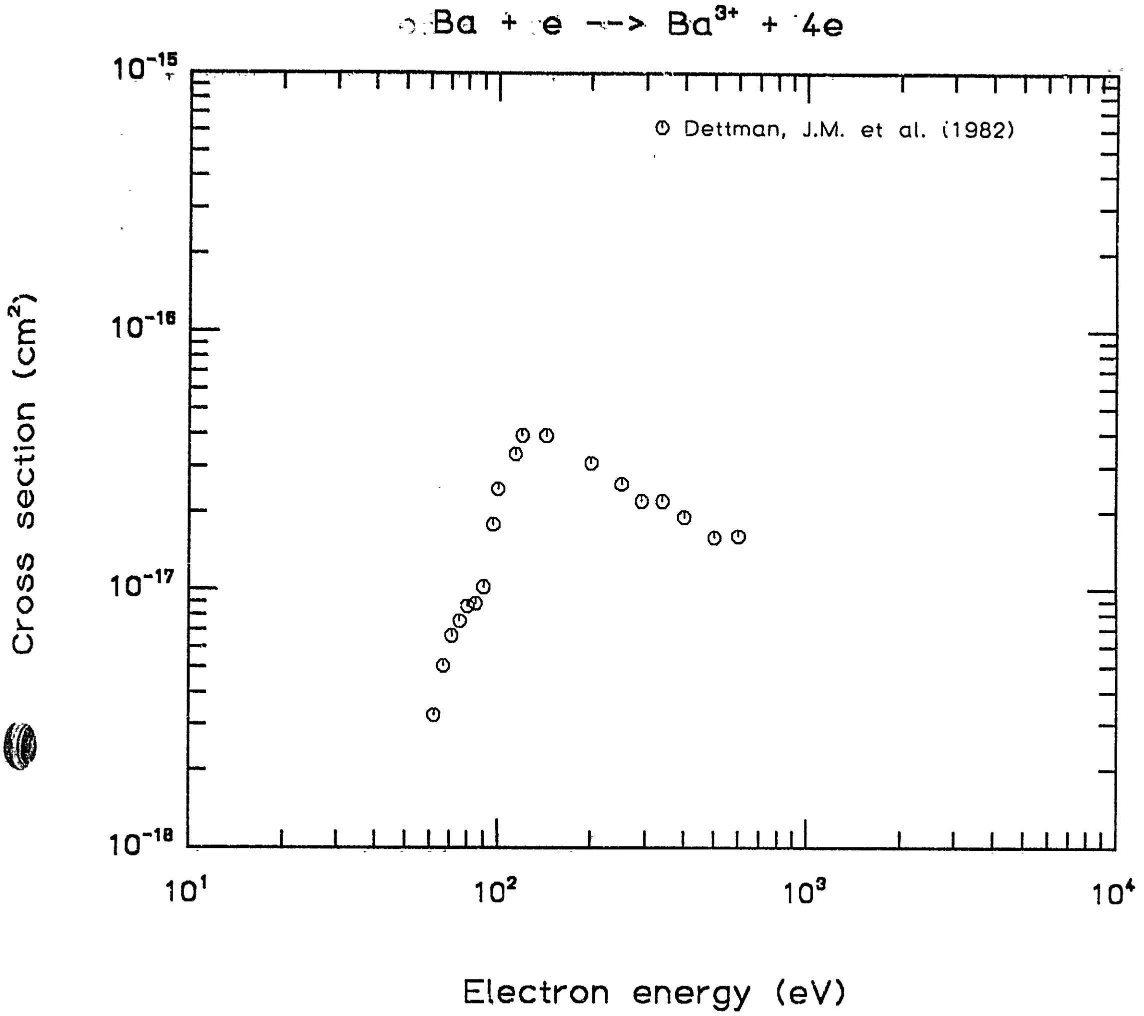

×10-16
Ba + e --> Ba2+ + 3e
Dettman, J.M. et al. (1982)
Cross section (cm2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
101
102
103
104
Electron energy (eV)

Fig. 264



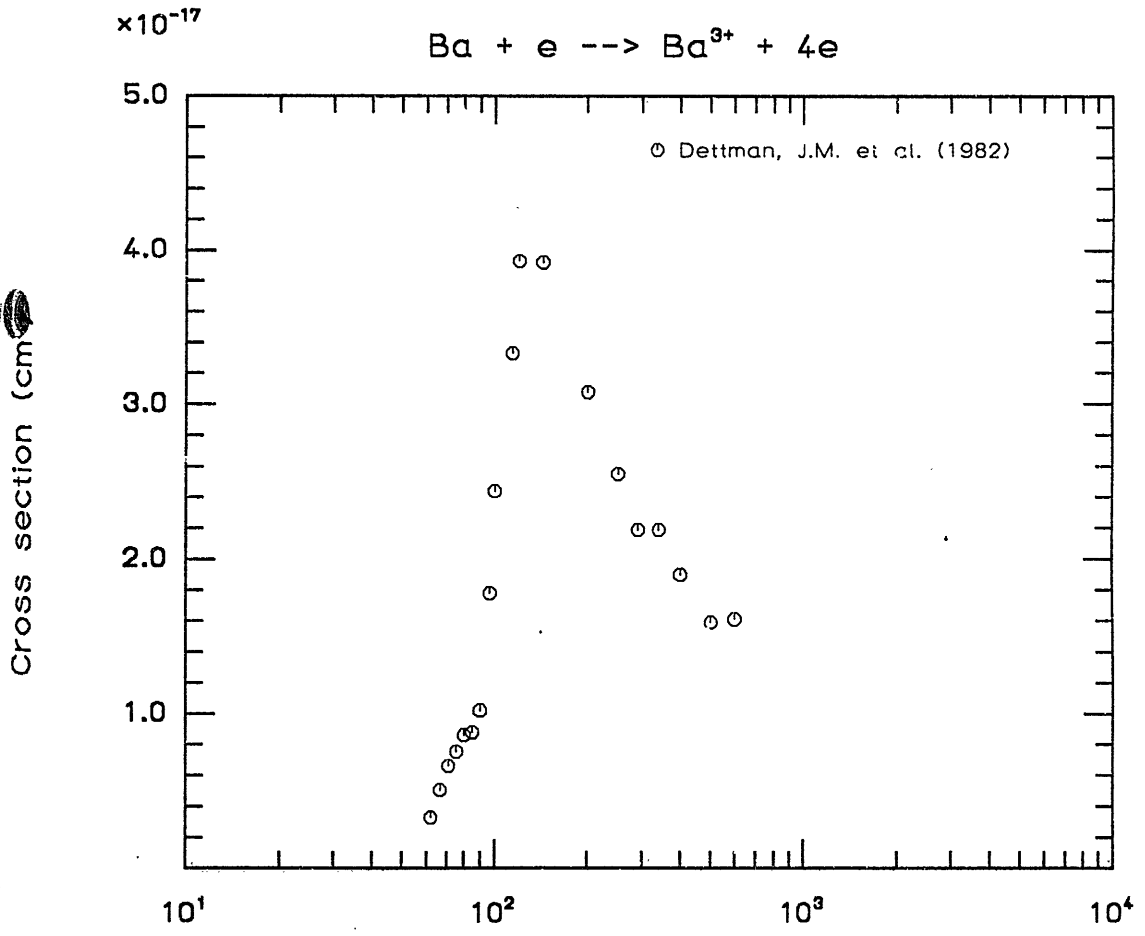
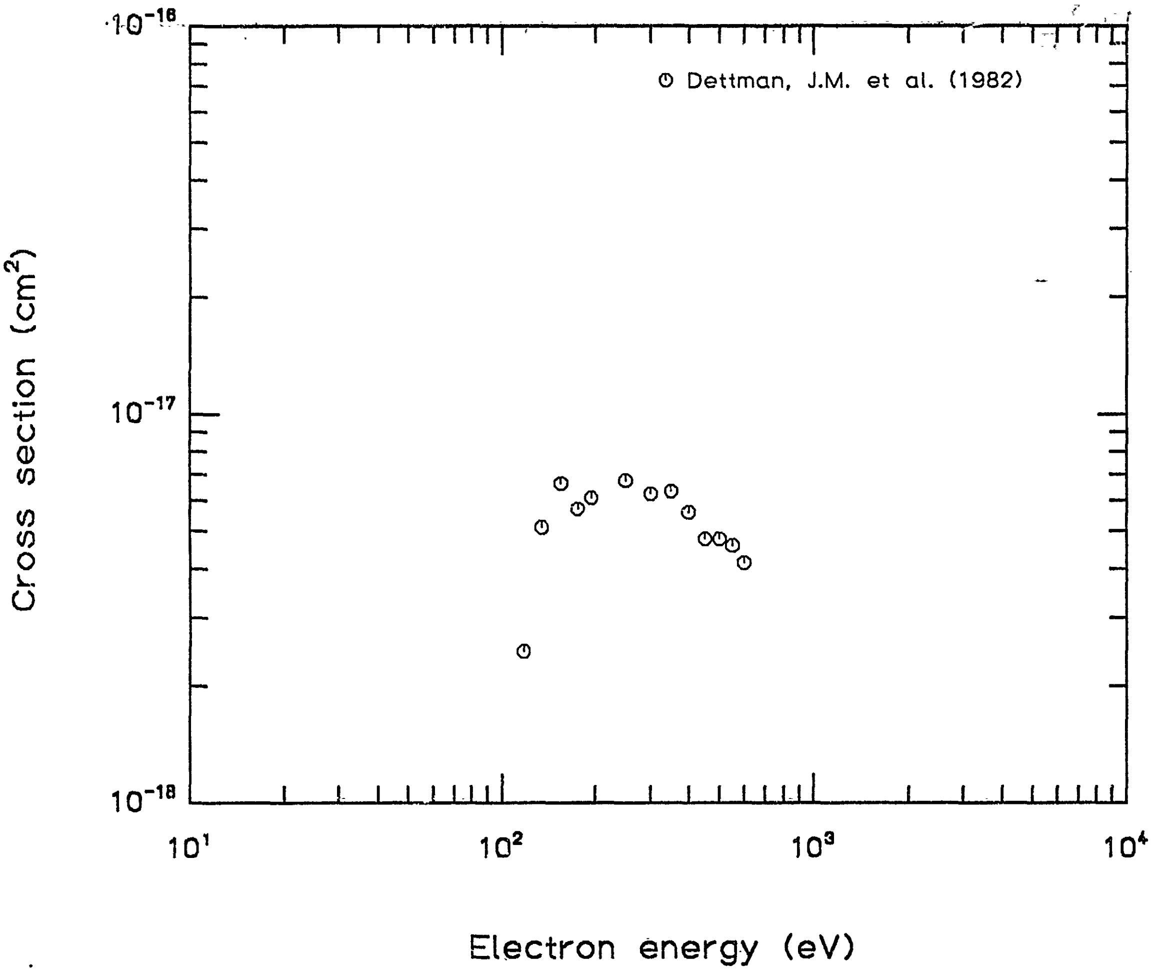


Fig. 265 Electron energy (eV)

Ba + e --> Ba^{4+} + 5e



Ba + e --> Ba^{4+} + 5e

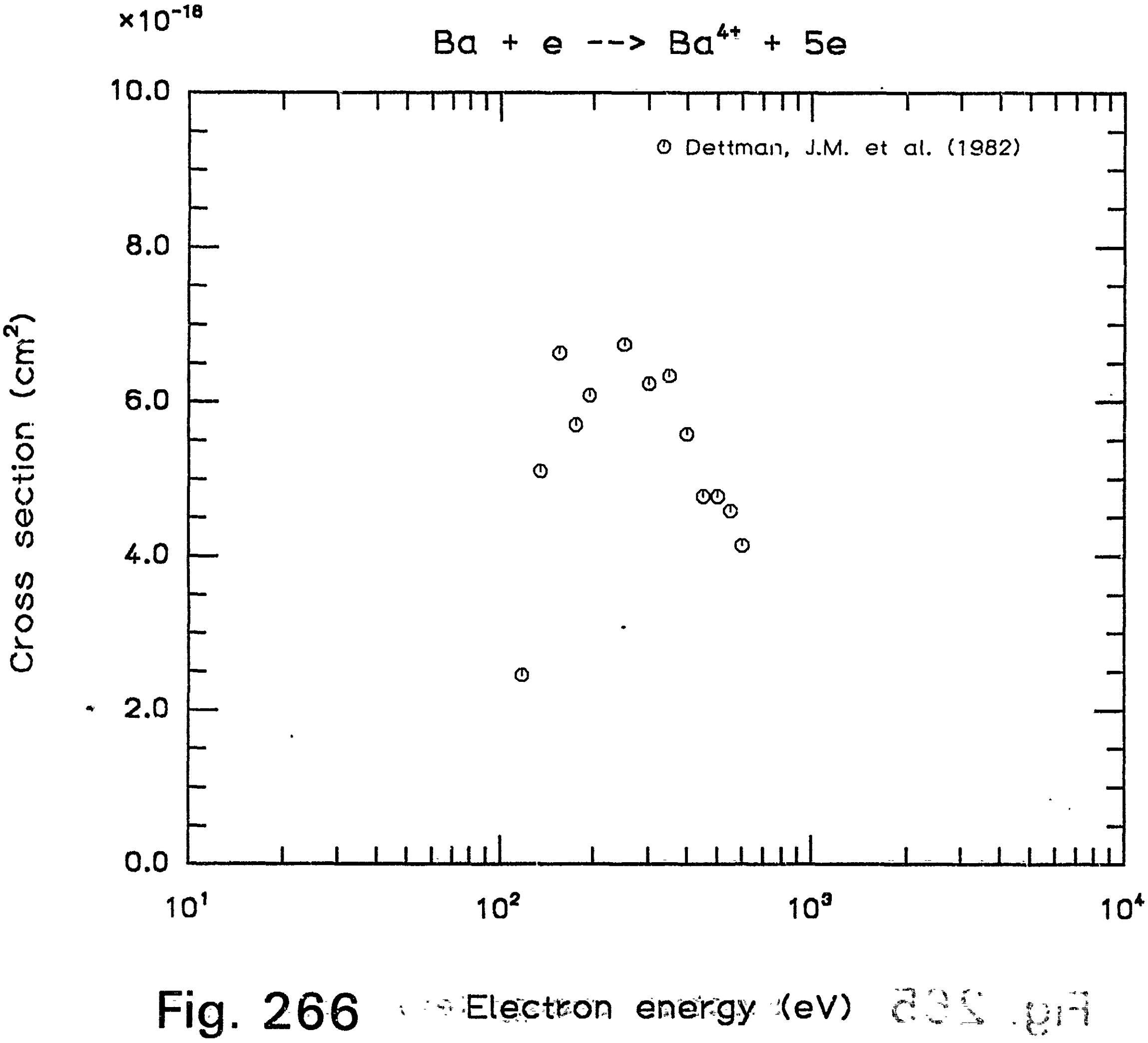
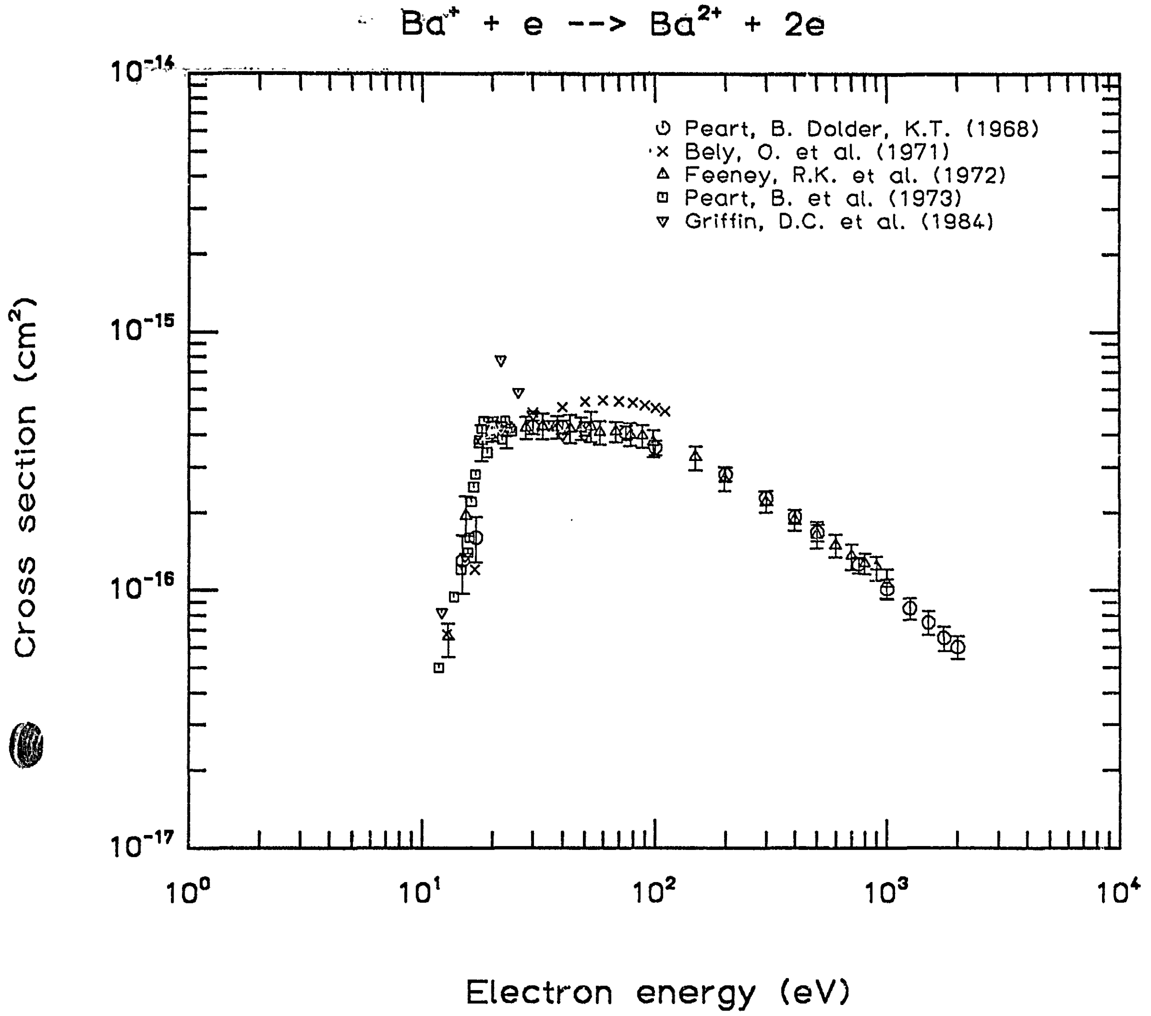


Fig. 266


Ba⁺ + e --> Ba²⁺ + 2e
Peart, B. Dolder, K.T. (1968)
Bely, O. et al. (1971)
Feeney, R.K. et al. (1972)
Peart, B. et al. (1973)
Griffin, D.C. et al. (1984)
Cross section (cm²)
Electron energy (eV)

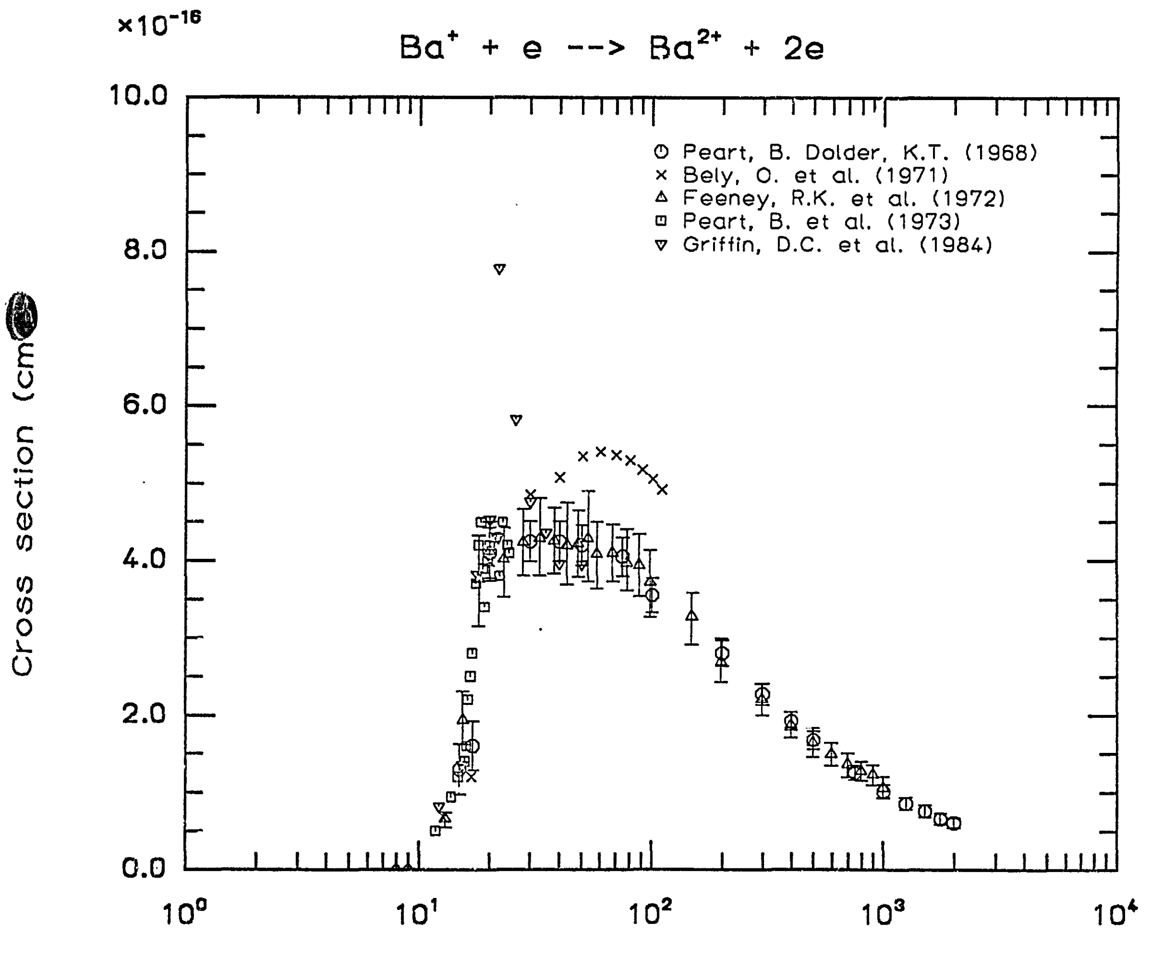
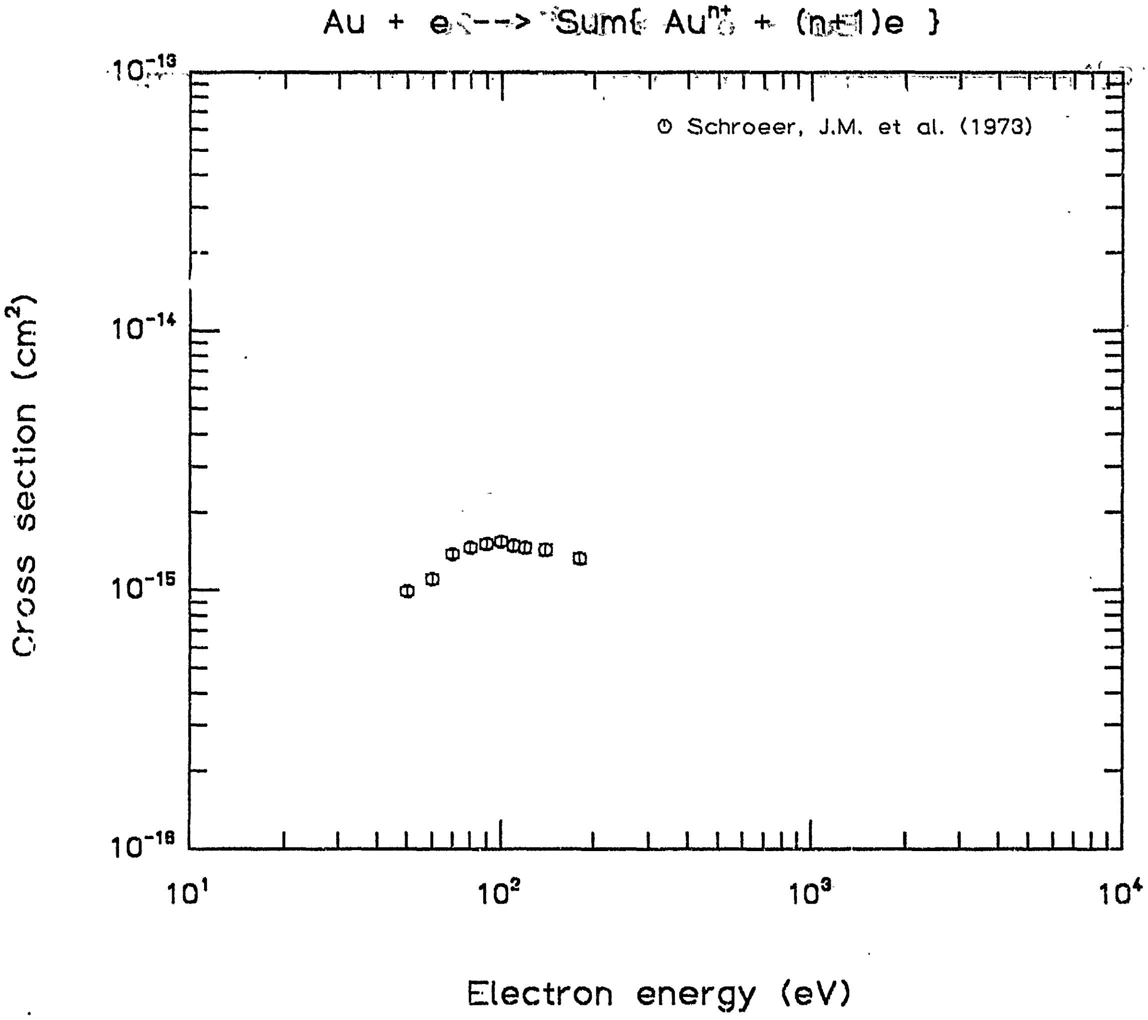

×10⁻¹⁶
Ba⁺ + e --> Ba²⁺ + 2e
Peart, B. Dolder, K.T. (1968)
Bely, O. et al. (1971)
Feeney, R.K. et al. (1972)
Peart, B. et al. (1973)
Griffin, D.C. et al. (1984)
Cross section (cm²)
Electron energy (eV)

Fig. 267



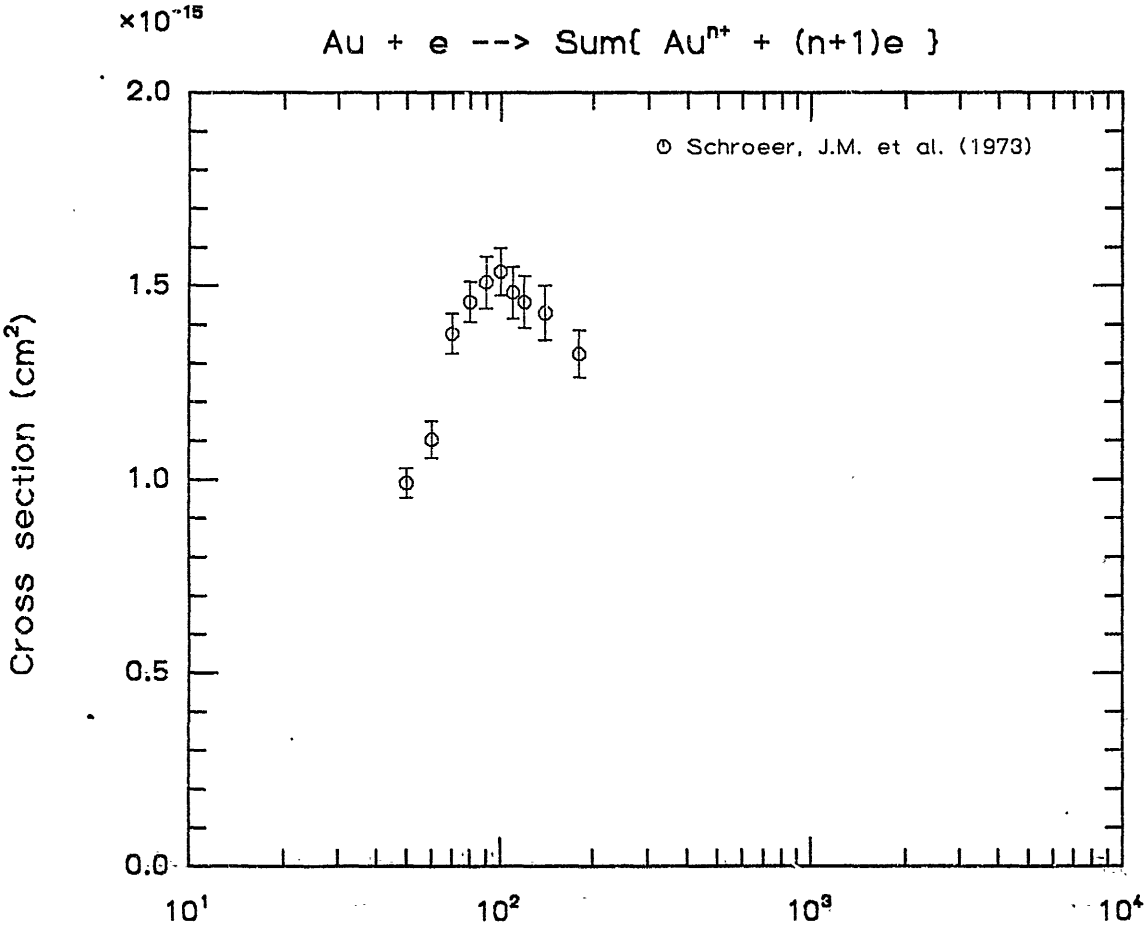
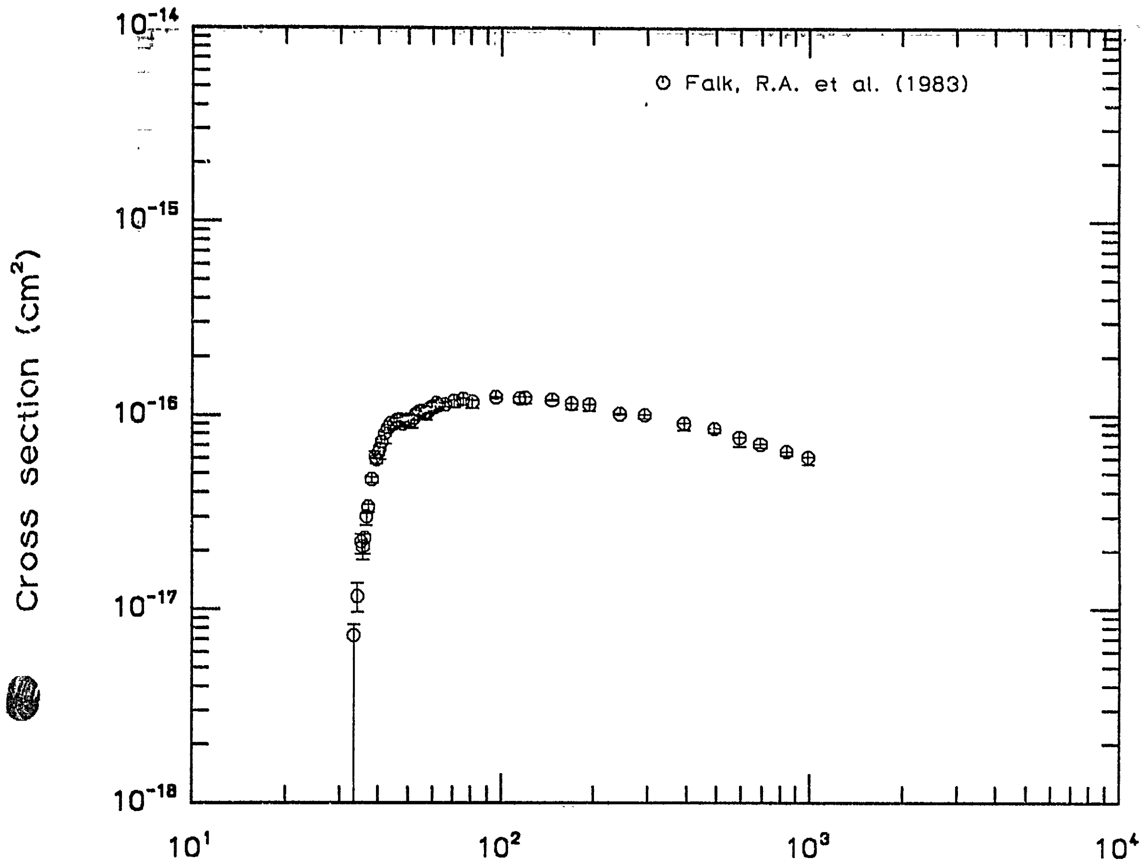


Fig. 268 Electron energy (eV)



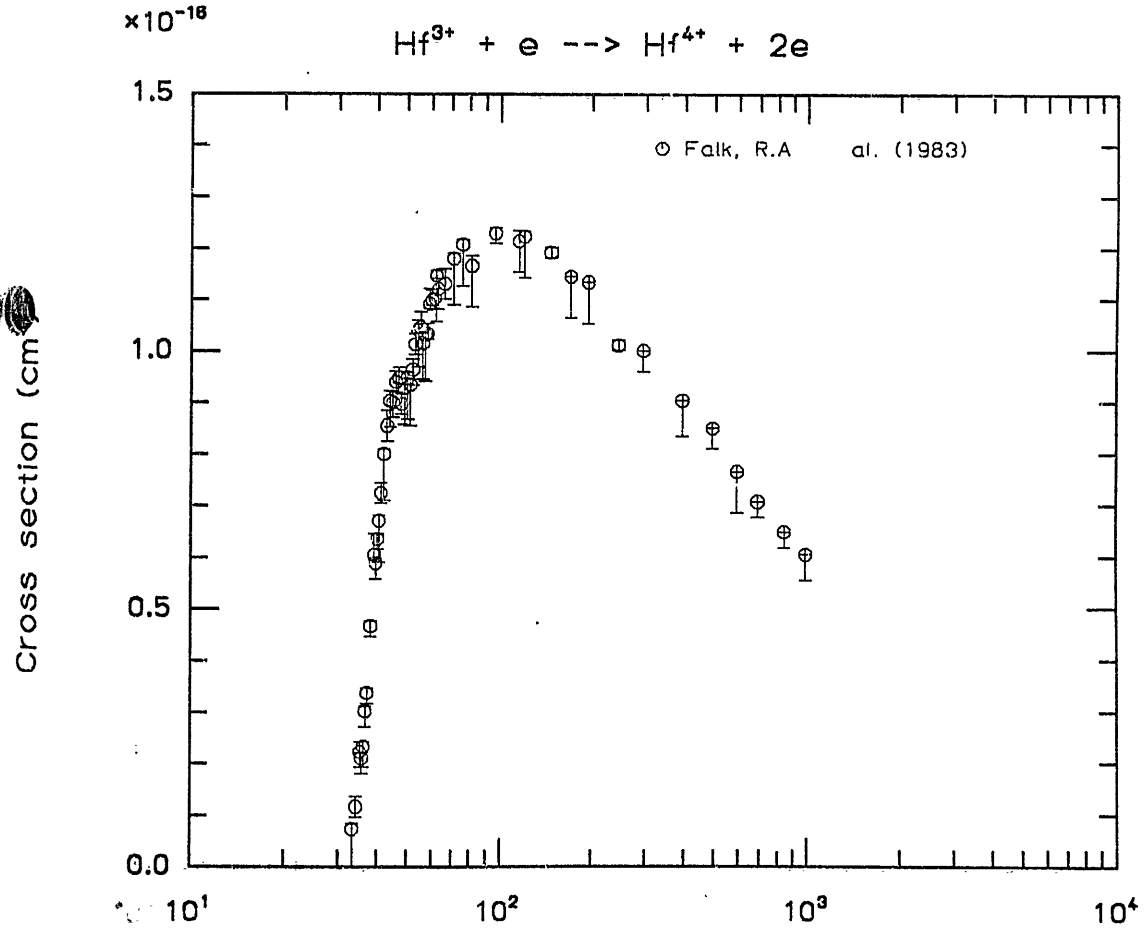
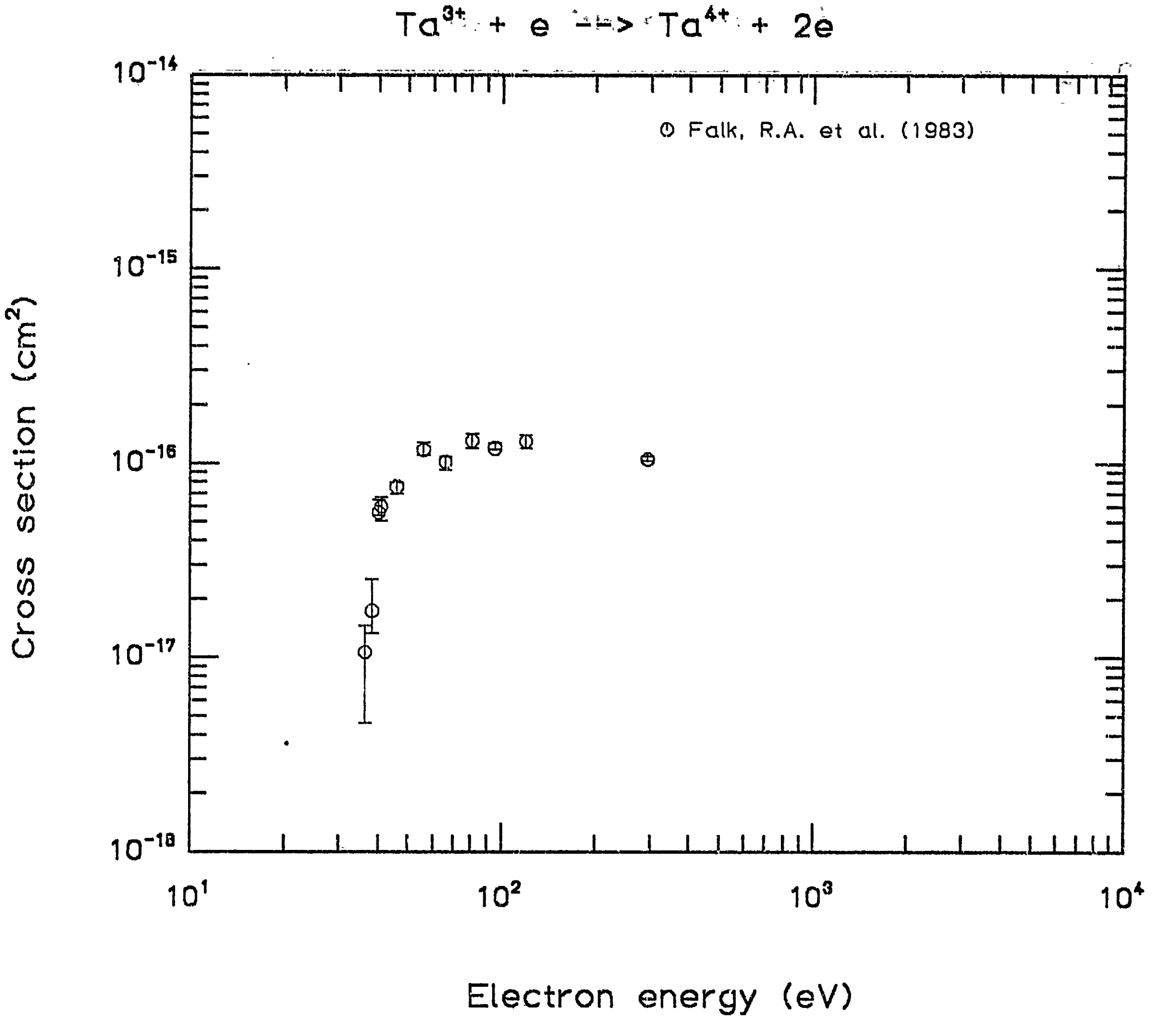
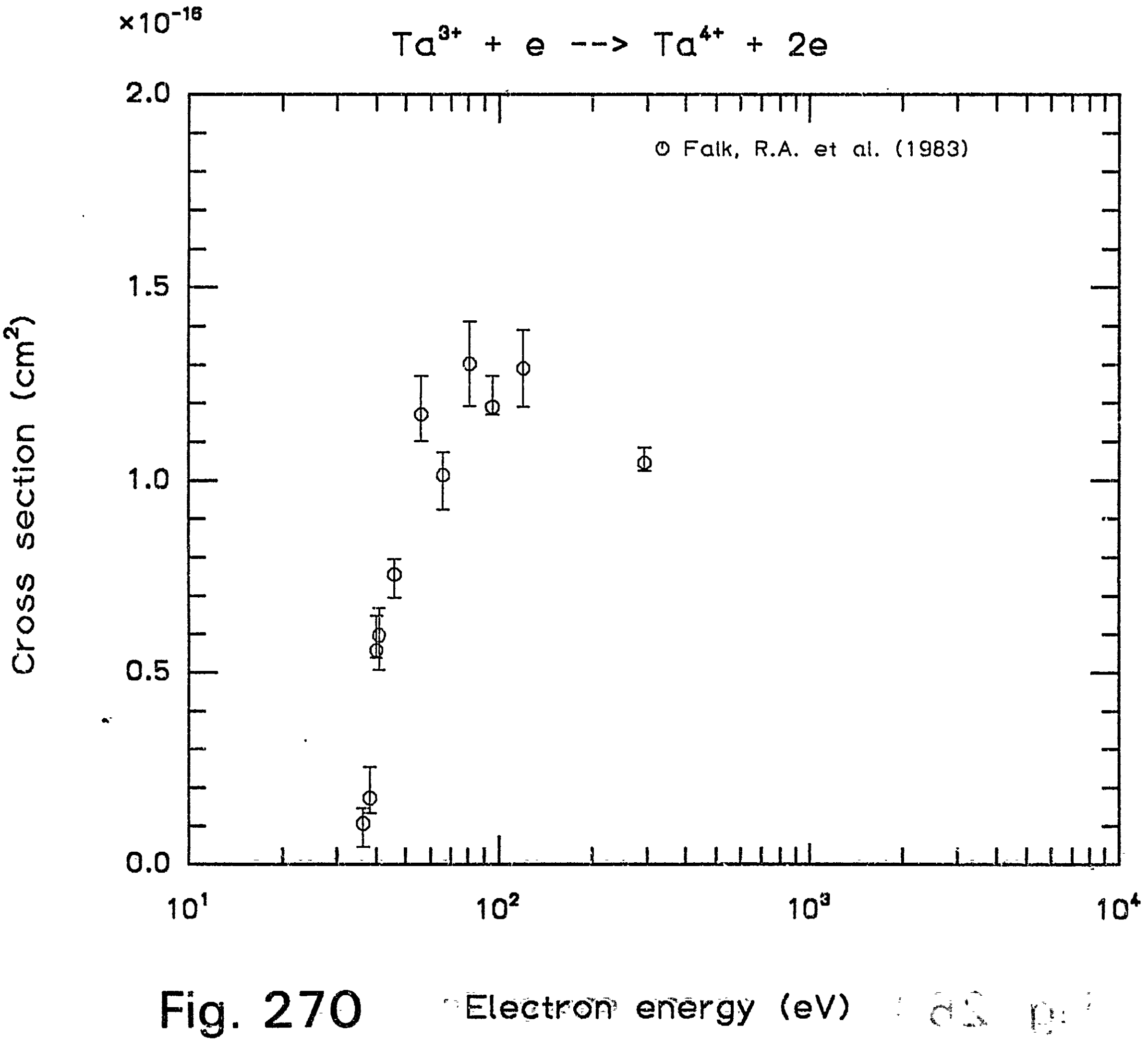


Fig. 269 Electron energy (eV)

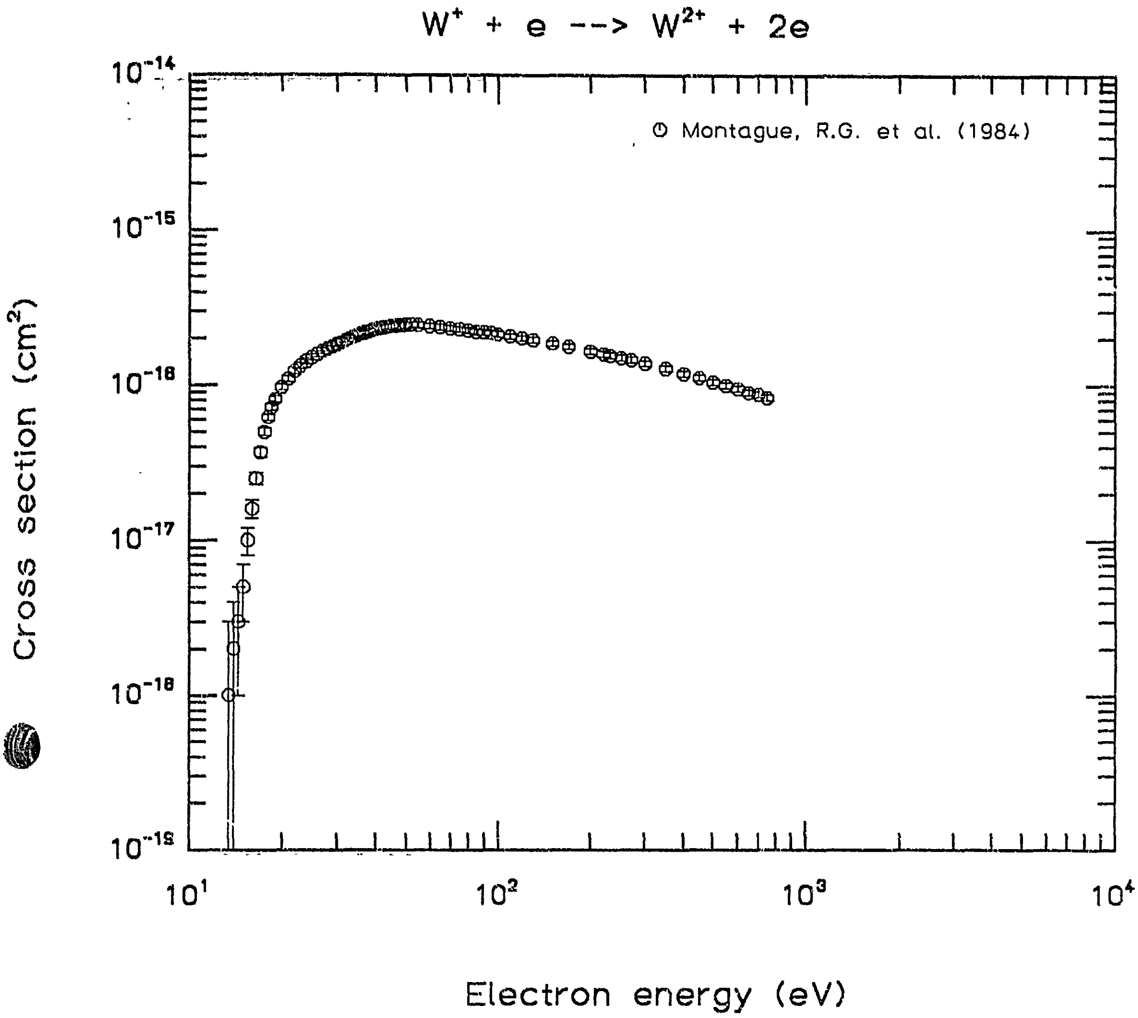


Ta3+ + e --> Ta4+ + 2e
Falk, R.A. et al. (1983)
Cross section (cm2)
10-14
10-15
10-16
10-17
10-18
10^1
10^2
10^3
10^4
Electron energy (eV)



×10-16
Ta3+ + e --> Ta4+ + 2e
Falk, R.A. et al. (1983)
Cross section (cm2)
2.0
1.5
1.0
0.5
0.0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 270


W^{+} + e --> W^{2+} + 2e
Montague, R.G. et al. (1984)
Cross section (cm^{2})
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^{1}
10^{2}
10^{3}
10^{4}
Electron energy (eV)

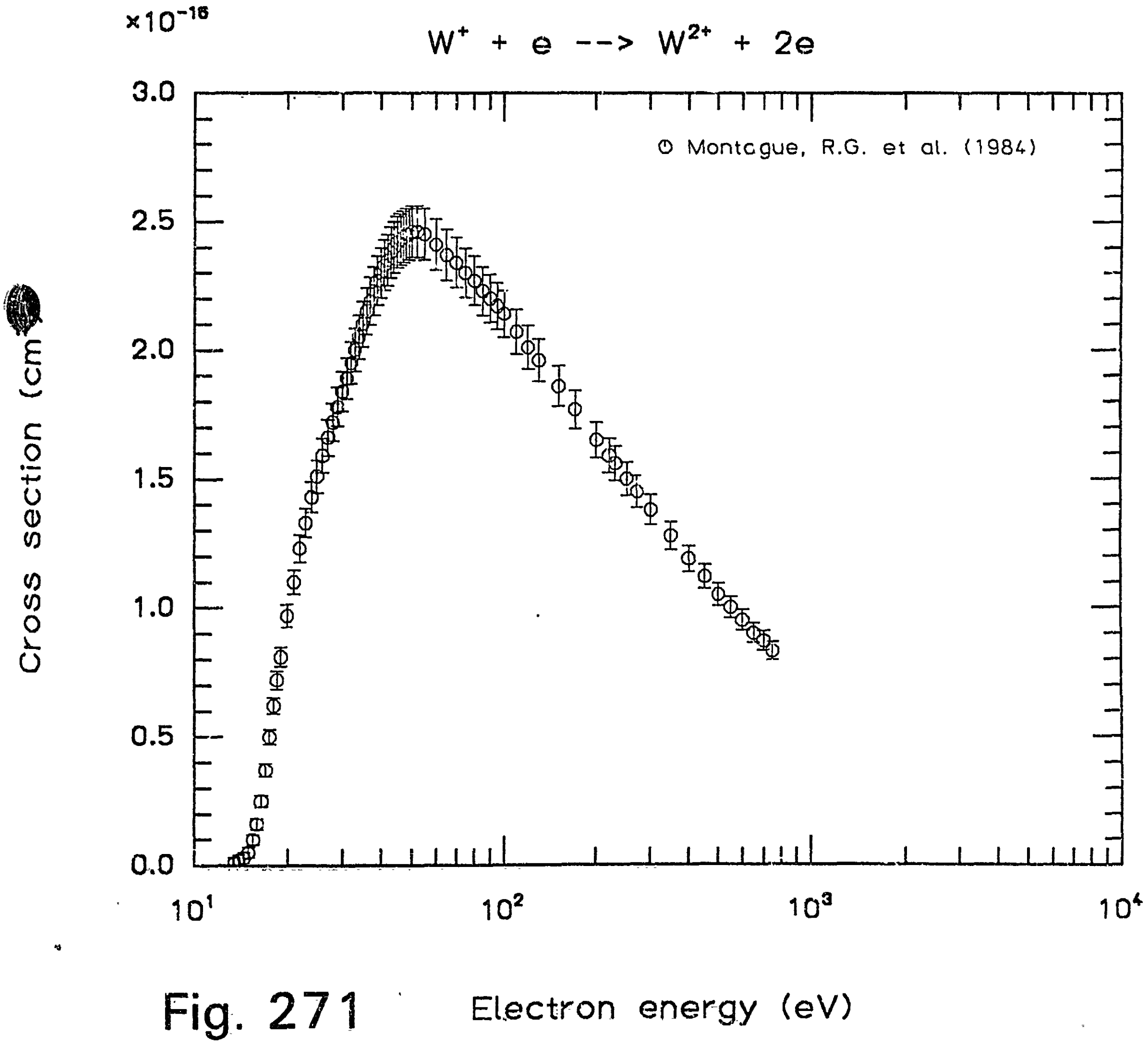
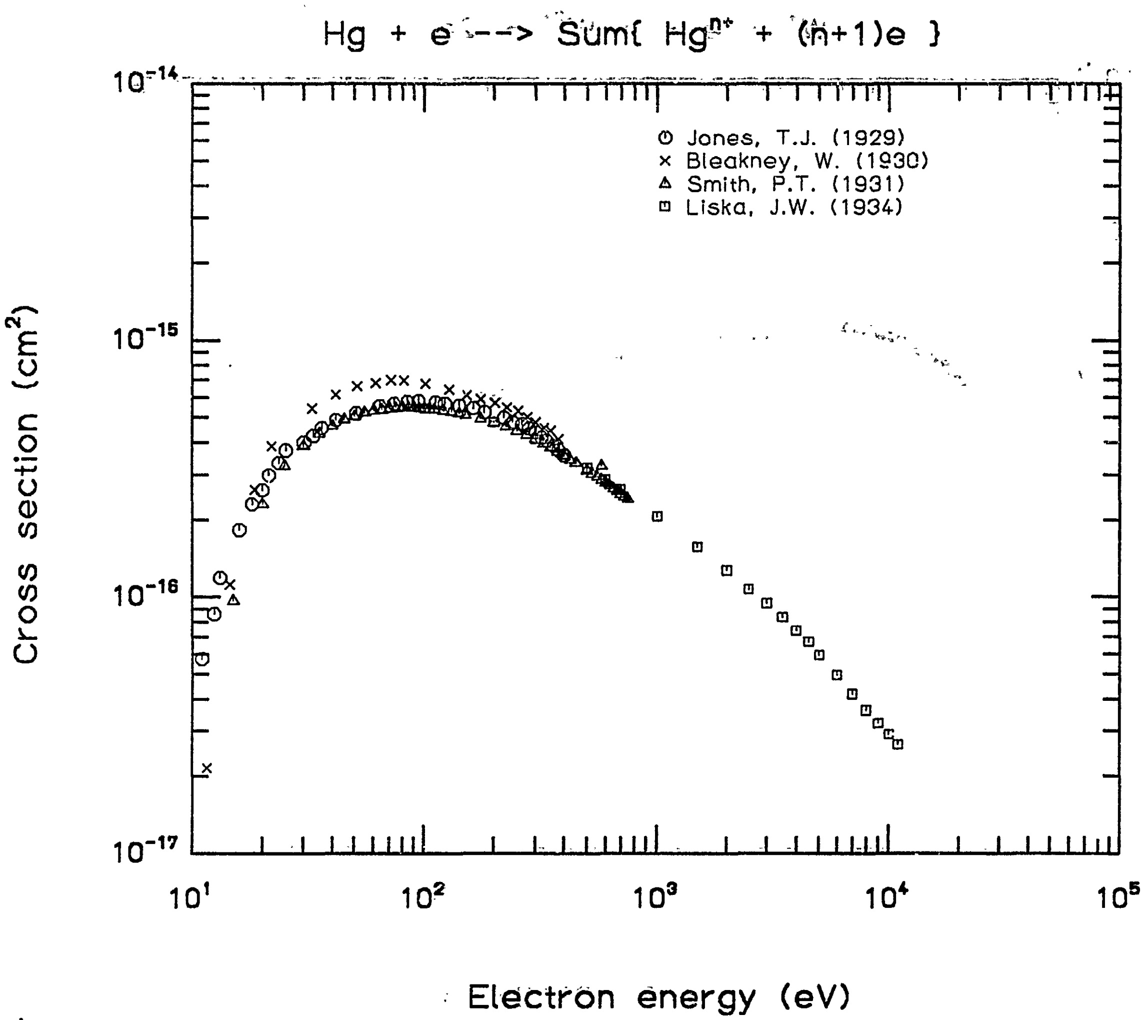
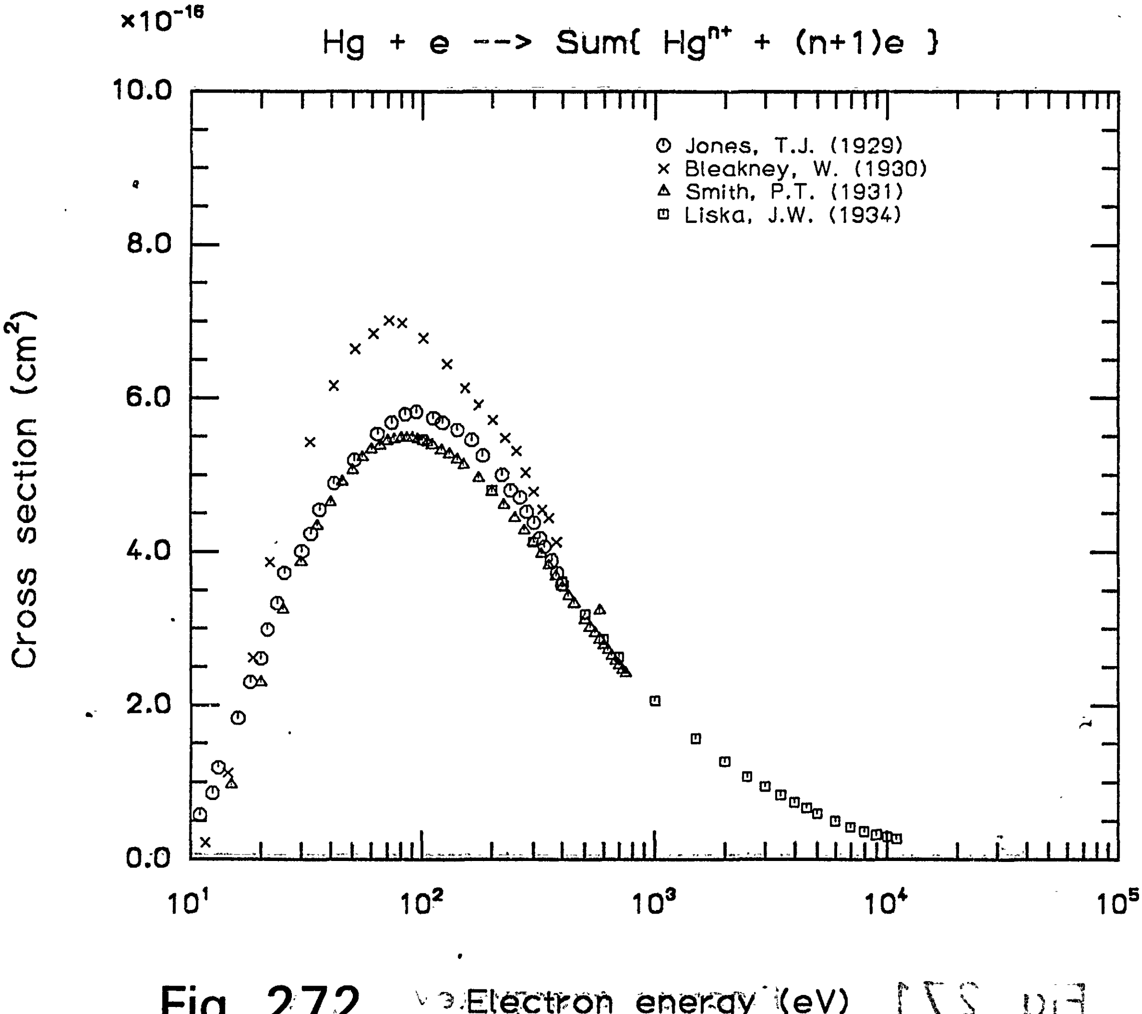

×10^{-16}
W^{+} + e --> W^{2+} + 2e
Montague, R.G. et al. (1984)
Cross section (cm^{2})
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10^{1}
10^{2}
10^{3}
10^{4}
Electron energy (eV)

Fig. 271

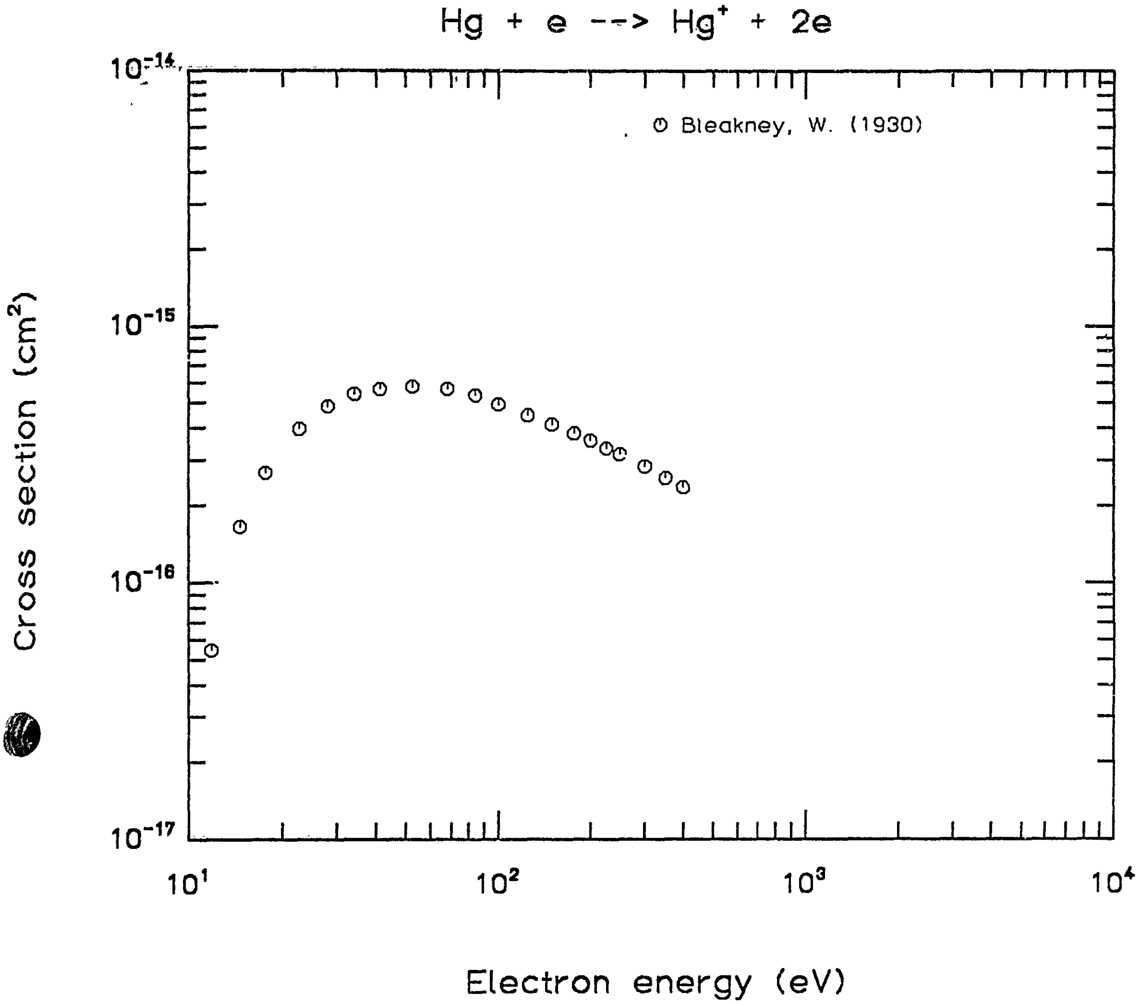


Hg + e --> Sum{ Hg^n+ + (n+1)e }
Jones, T.J. (1929)
Bleakney, W. (1930)
Smith, P.T. (1931)
Liska, J.W. (1934)
Cross section (cm²)
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10¹
10²
10³
10⁴
10⁵
Electron energy (eV)



×10⁻¹⁶
Hg + e --> Sum{ Hg^n+ + (n+1)e }
Jones, T.J. (1929)
Bleakney, W. (1930)
Smith, P.T. (1931)
Liska, J.W. (1934)
Cross section (cm²)
10.0
8.0
6.0
4.0
2.0
0.0
10¹
10²
10³
10⁴
10⁵
Electron energy (eV)

Fig. 272



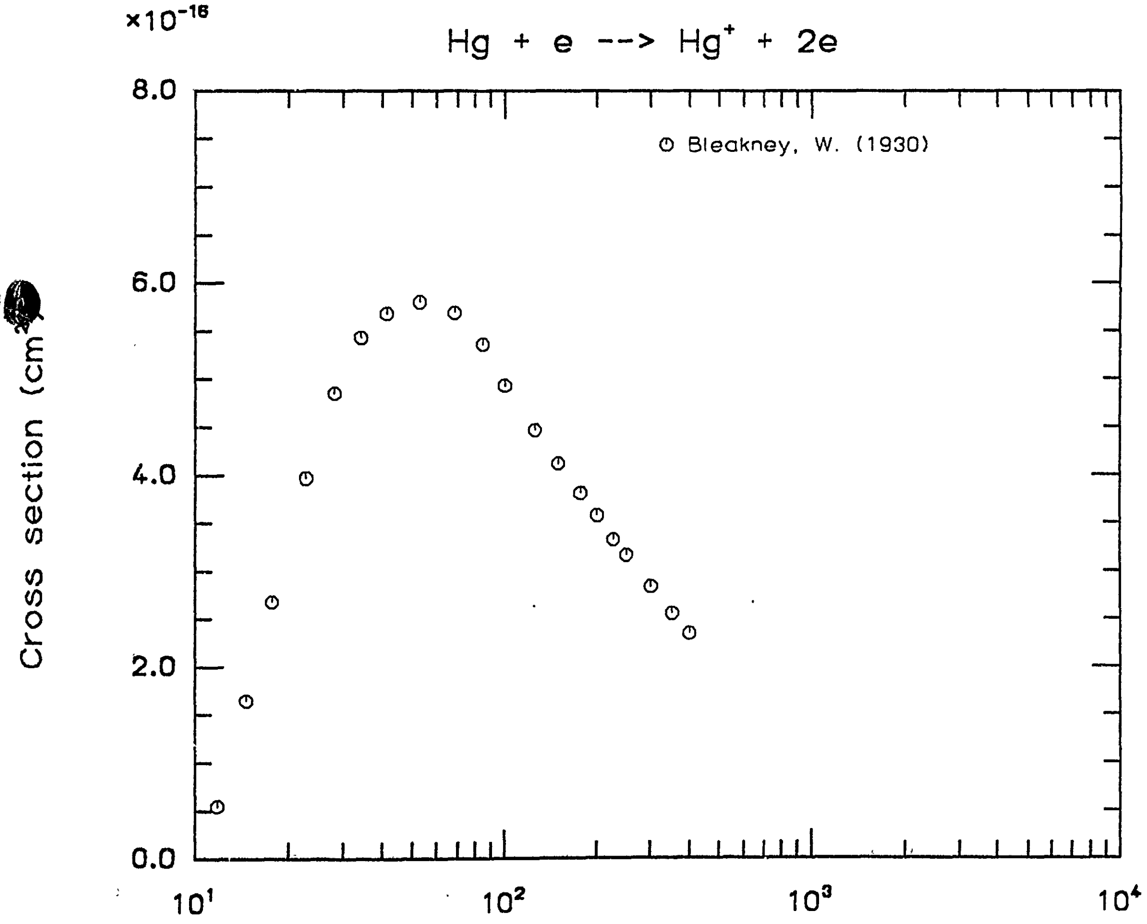


Fig. 273 Electron energy (eV)

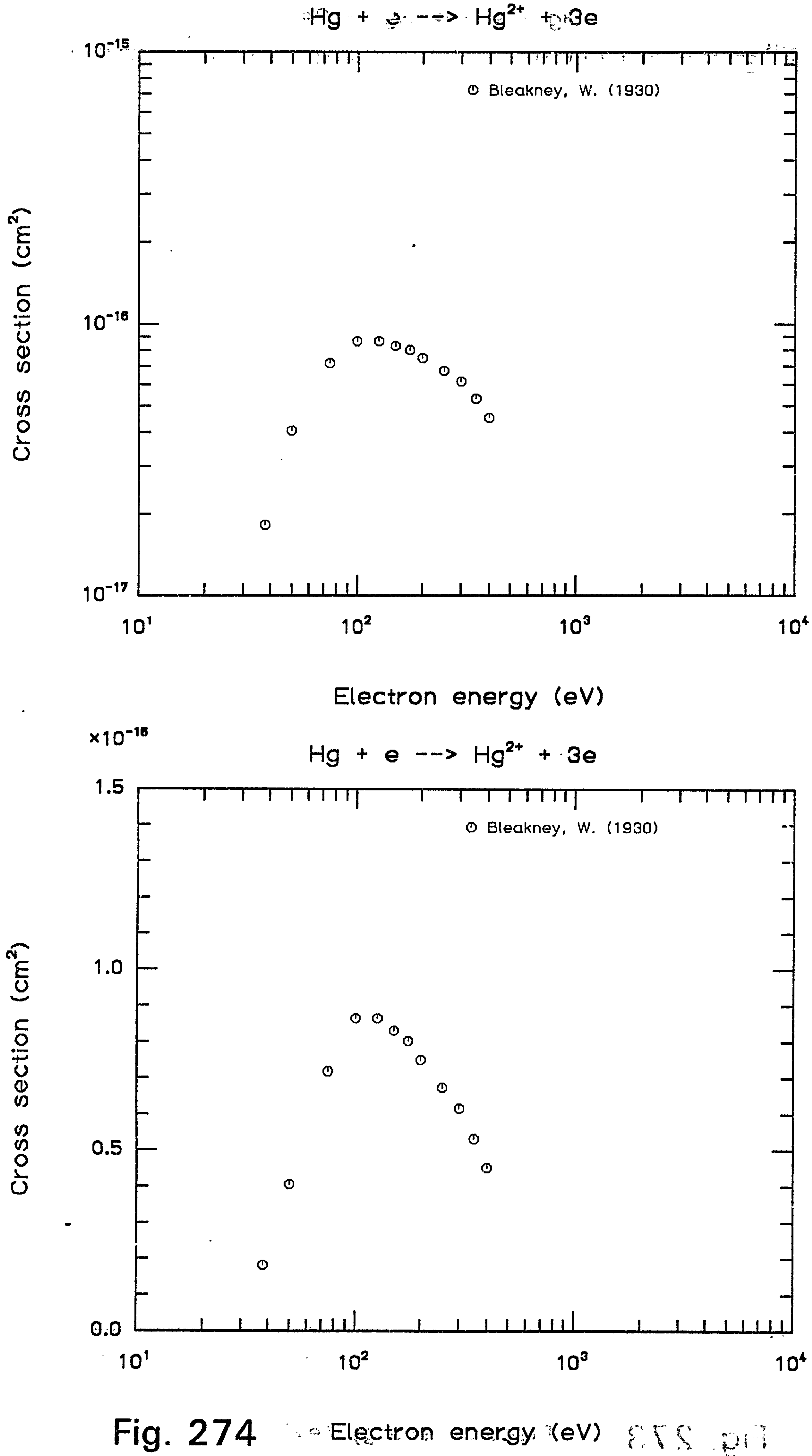
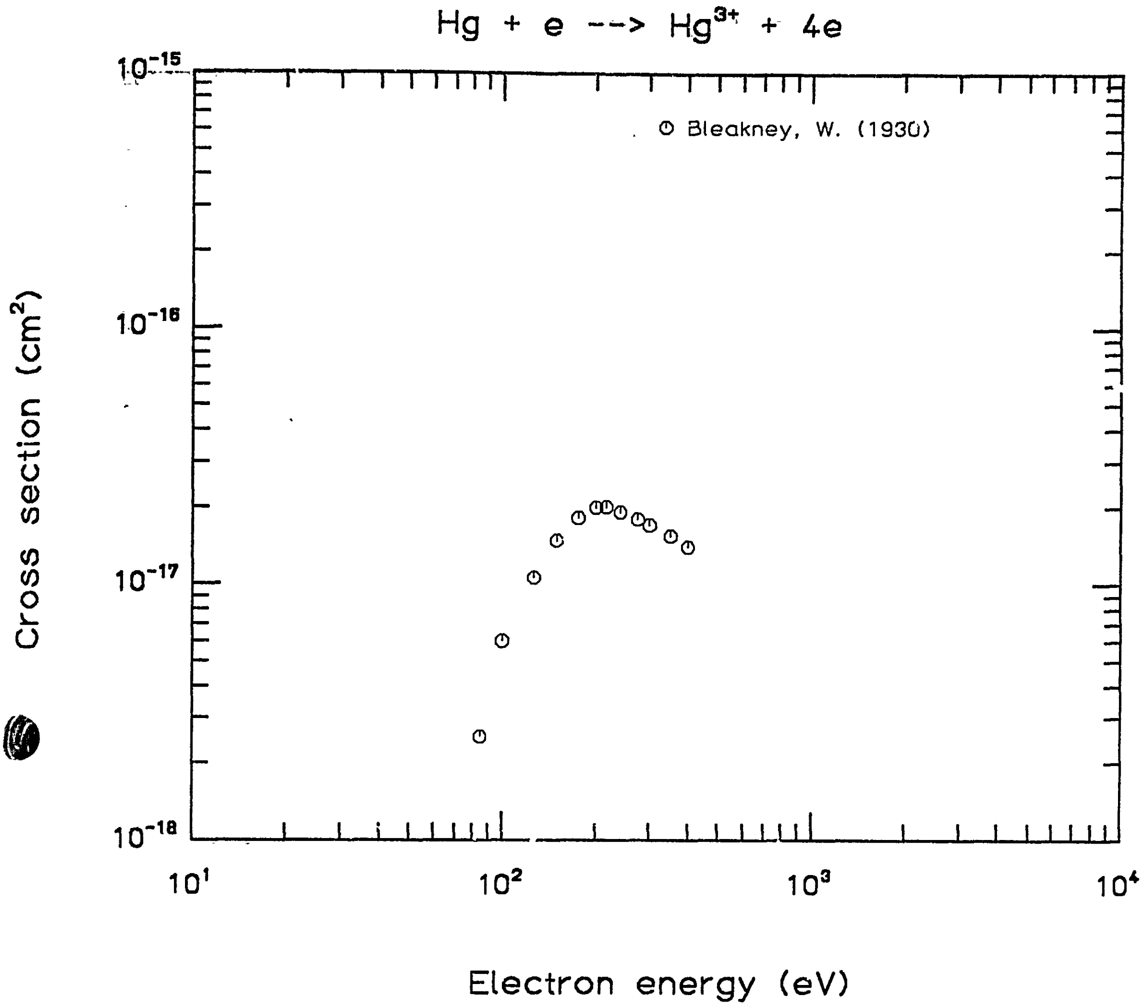

Hg + e --> Hg2+ + 3e
Bleakney, W. (1930)
Cross section (cm2)
10-15
10-16
10-17
101
102
103
104
Electron energy (eV)
×10-16
Hg + e --> Hg2+ + 3e
Bleakney, W. (1930)
Cross section (cm2)
1.5
1.0
0.5
0.0
101
102
103
104
Electron energy (eV)

Fig. 274



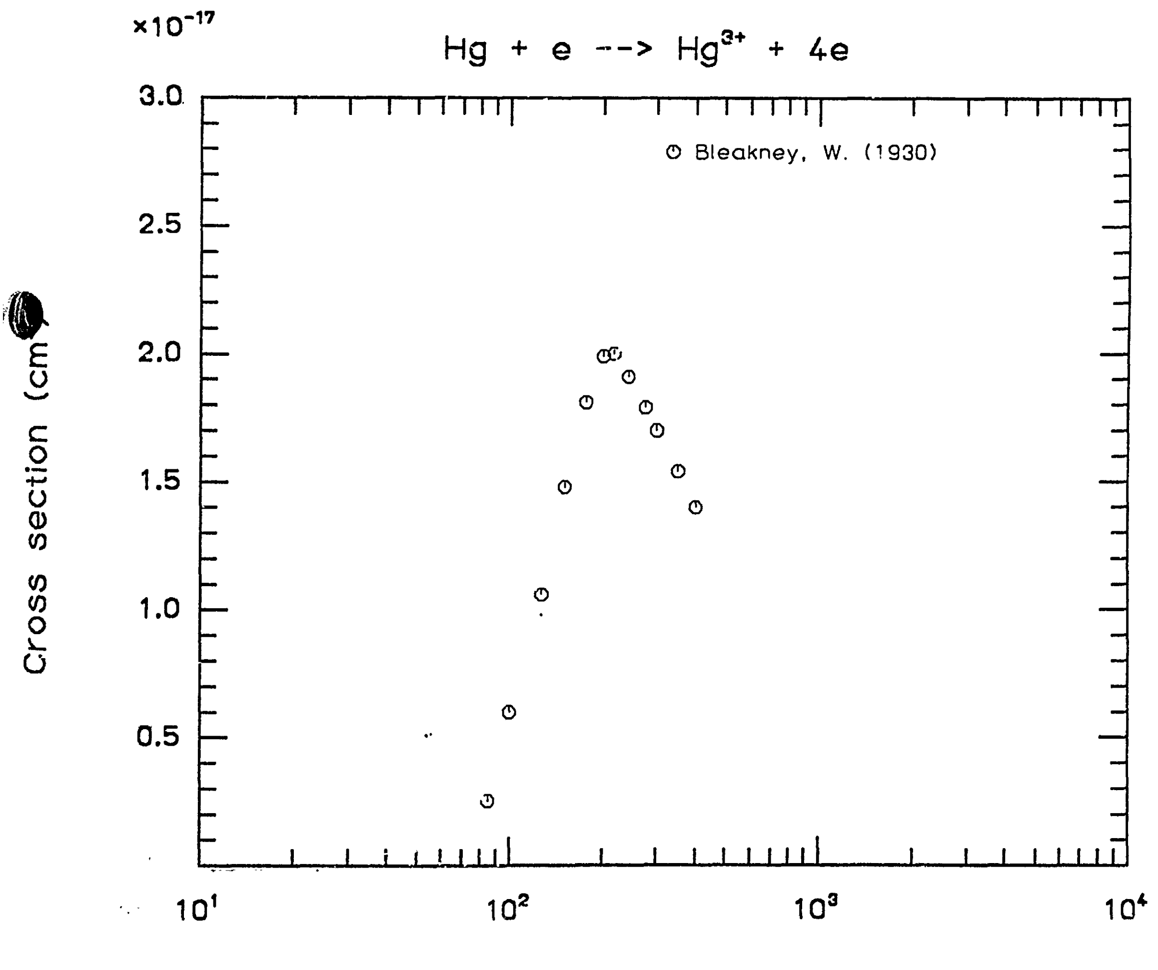
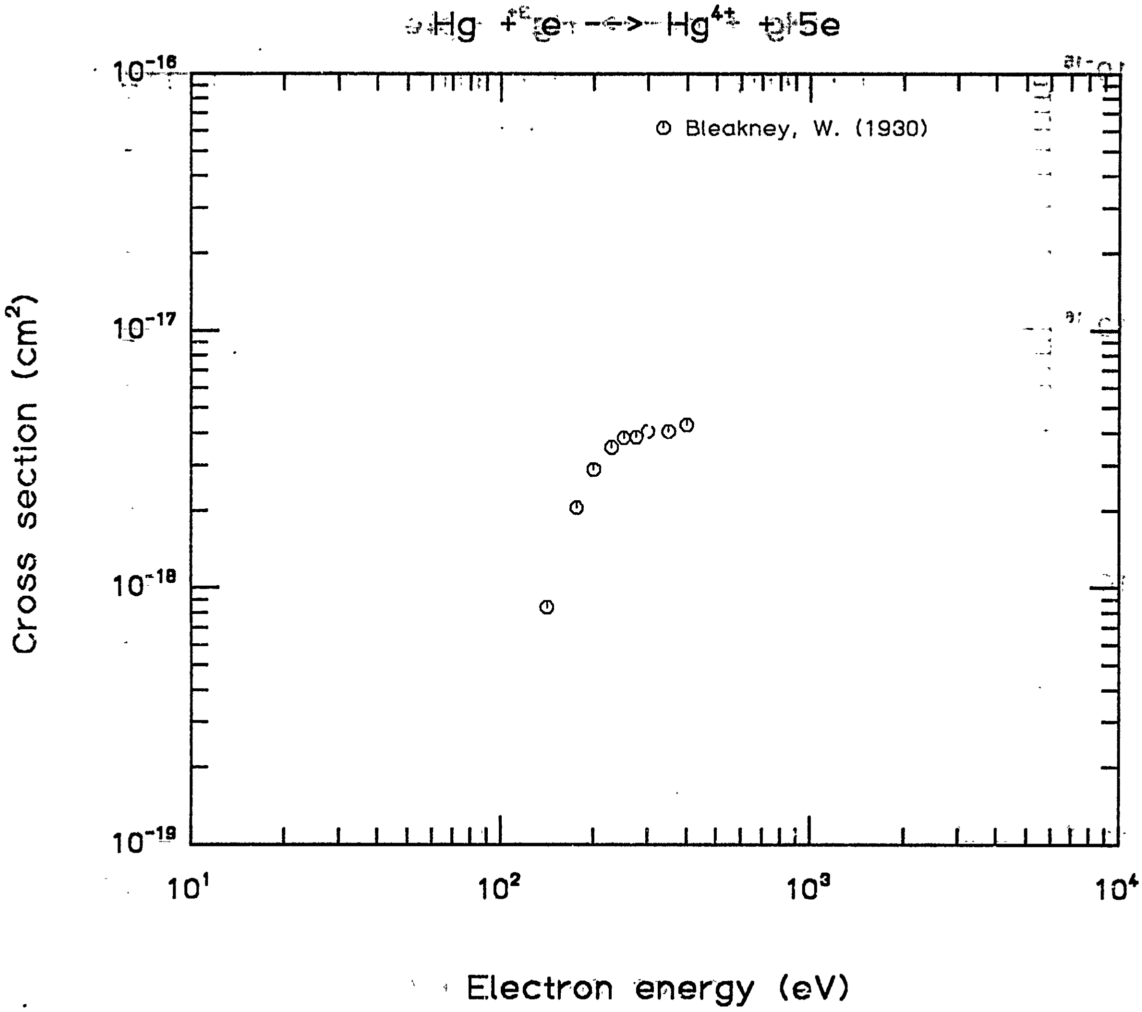


Fig. 275 Electron energy (eV)


Hg + e --> Hg4+ + 5e
Bleakney, W. (1930)
Cross section (cm2)
10-16
10-17
10-18
10-19
101
102
103
104
Electron energy (eV)

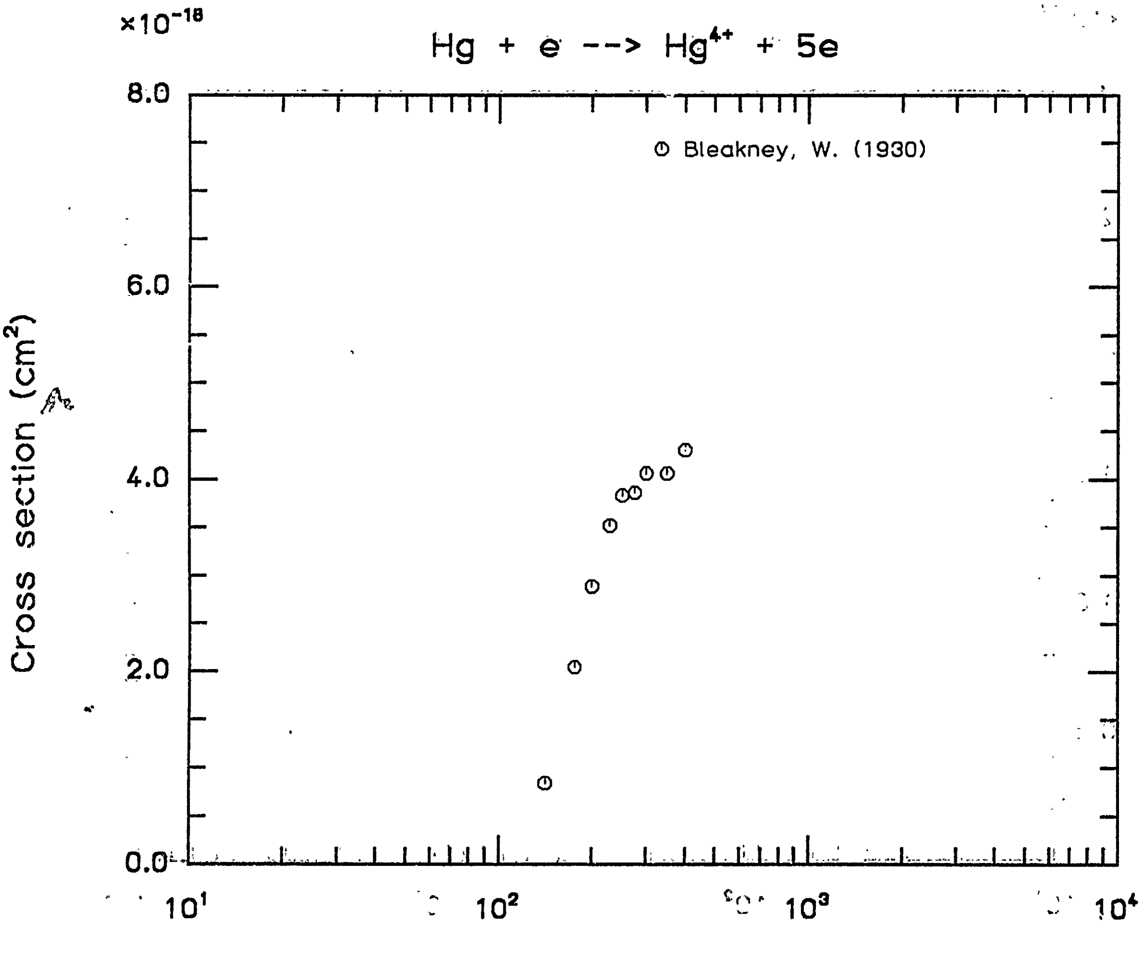
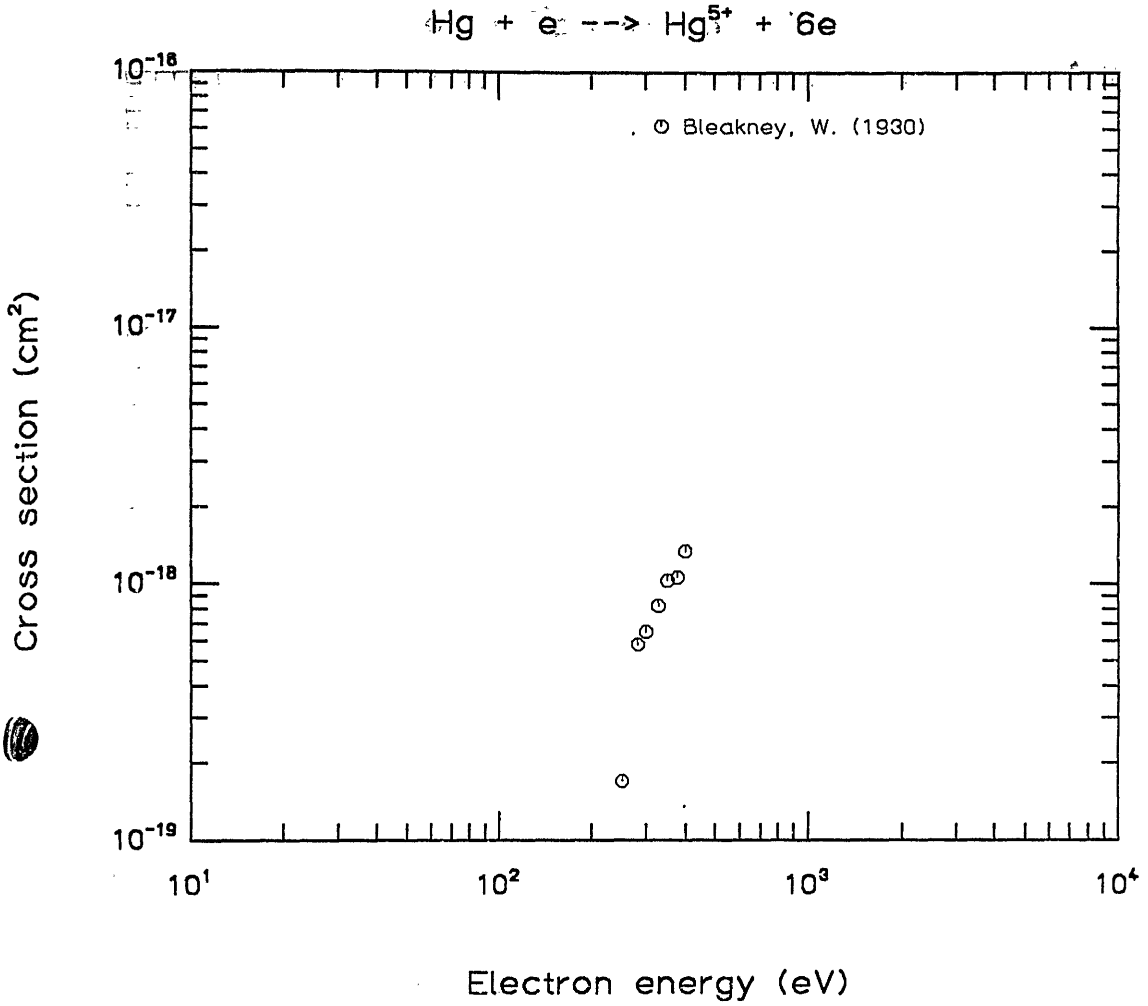

×10-18
Hg + e --> Hg4+ + 5e
Bleakney, W. (1930)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
101
102
103
104
Electron energy (eV)

Fig. 276


Hg + e --> Hg^{5+} + 6e
Bleakney, W. (1930)
Cross section (cm^2)
10^{-16}
10^{-17}
10^{-18}
10^{-19}
10^1
10^2
10^3
10^4
Electron energy (eV)

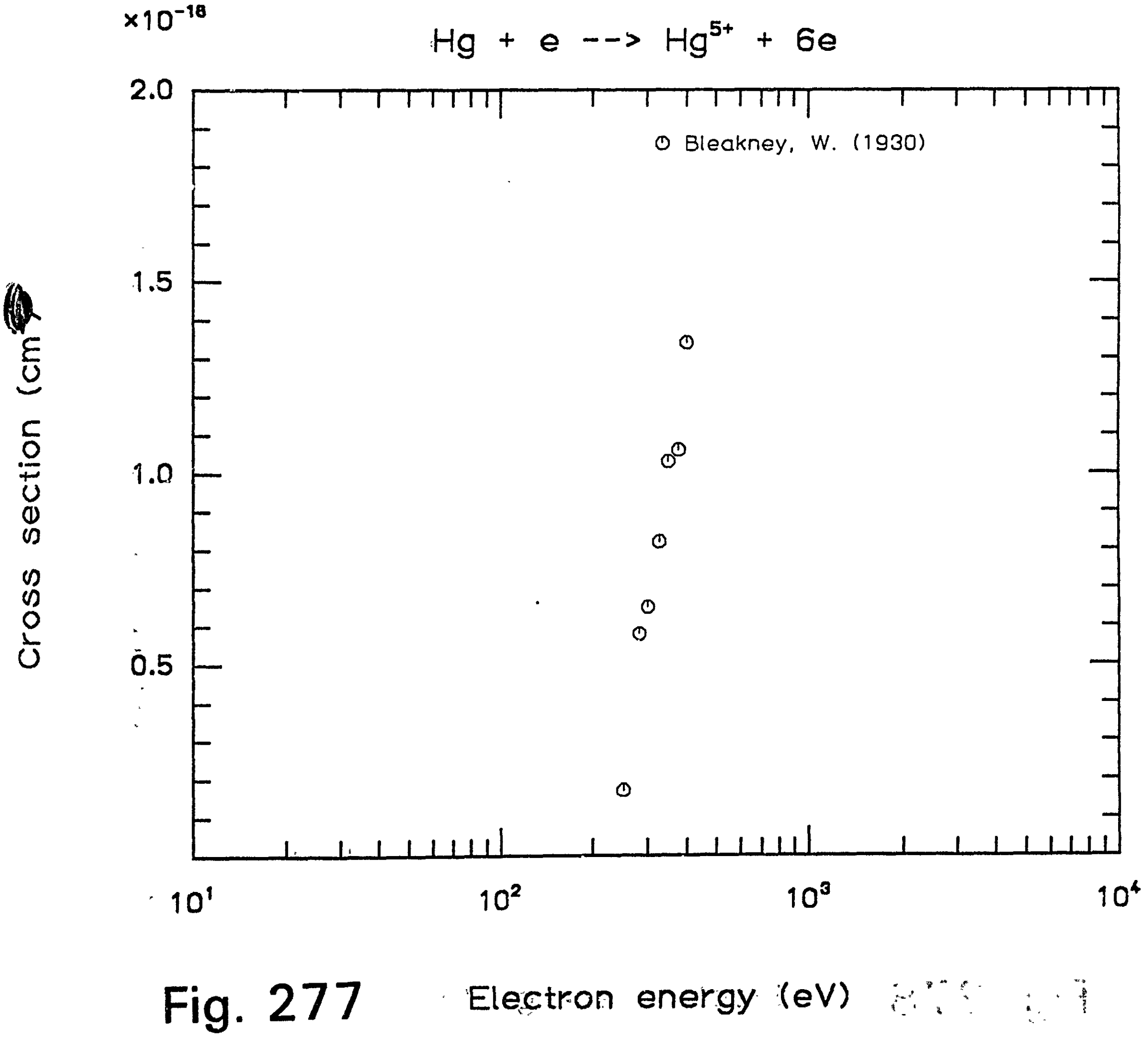
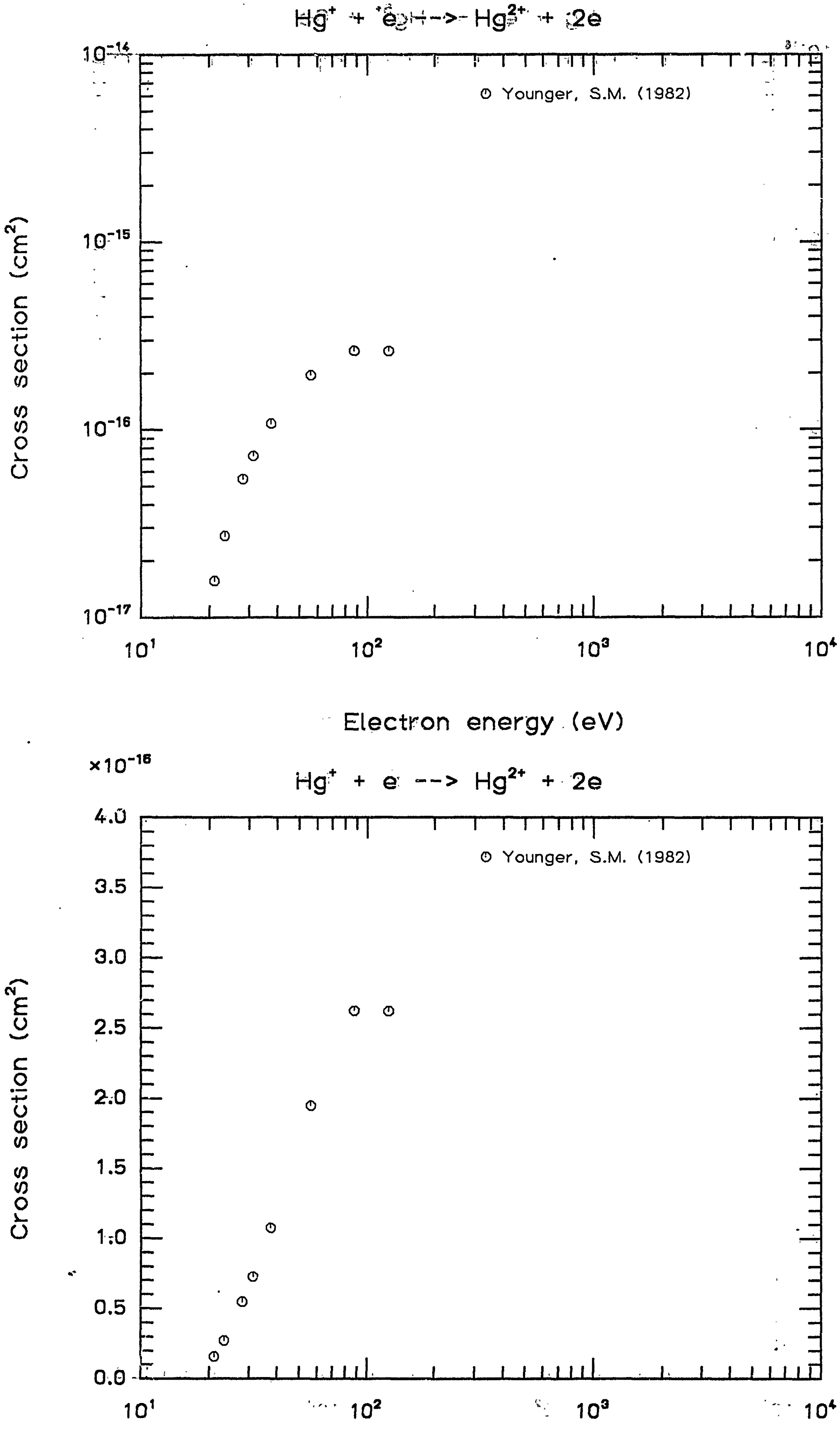
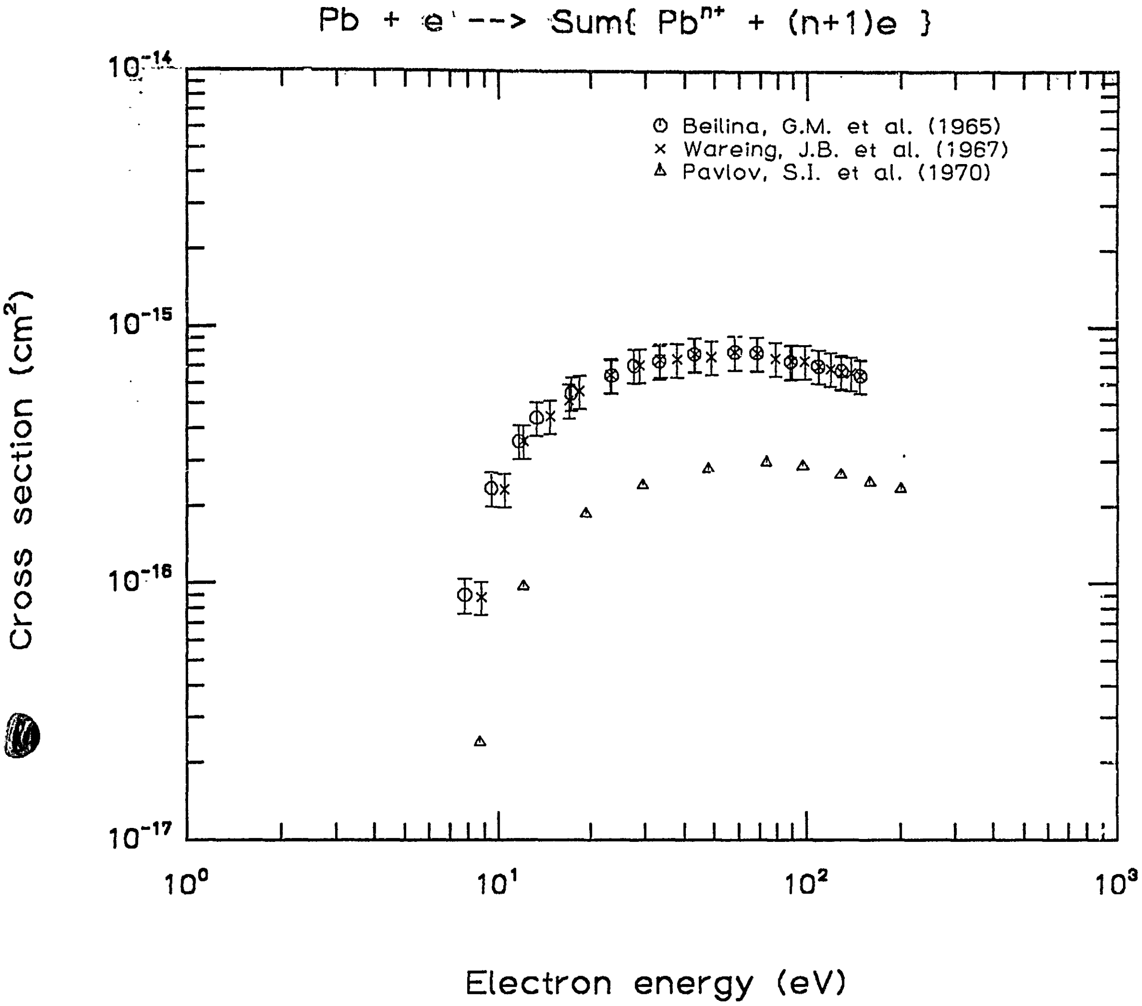

$\times 10^{-18}$
Hg + e --> Hg^{5+} + 6e
Bleakney, W. (1930)
Cross section (cm
2.0
1.5
1.0
0.5
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 277



Hg⁺ + e --> Hg²⁺ + 2e
Younger, S.M. (1982)
Cross section (cm²)
Electron energy (eV)
×10⁻¹⁶
Hg⁺ + e --> Hg²⁺ + 2e
Younger, S.M. (1982)
Cross section (cm²)
Electron energy (eV)

Fig. 278



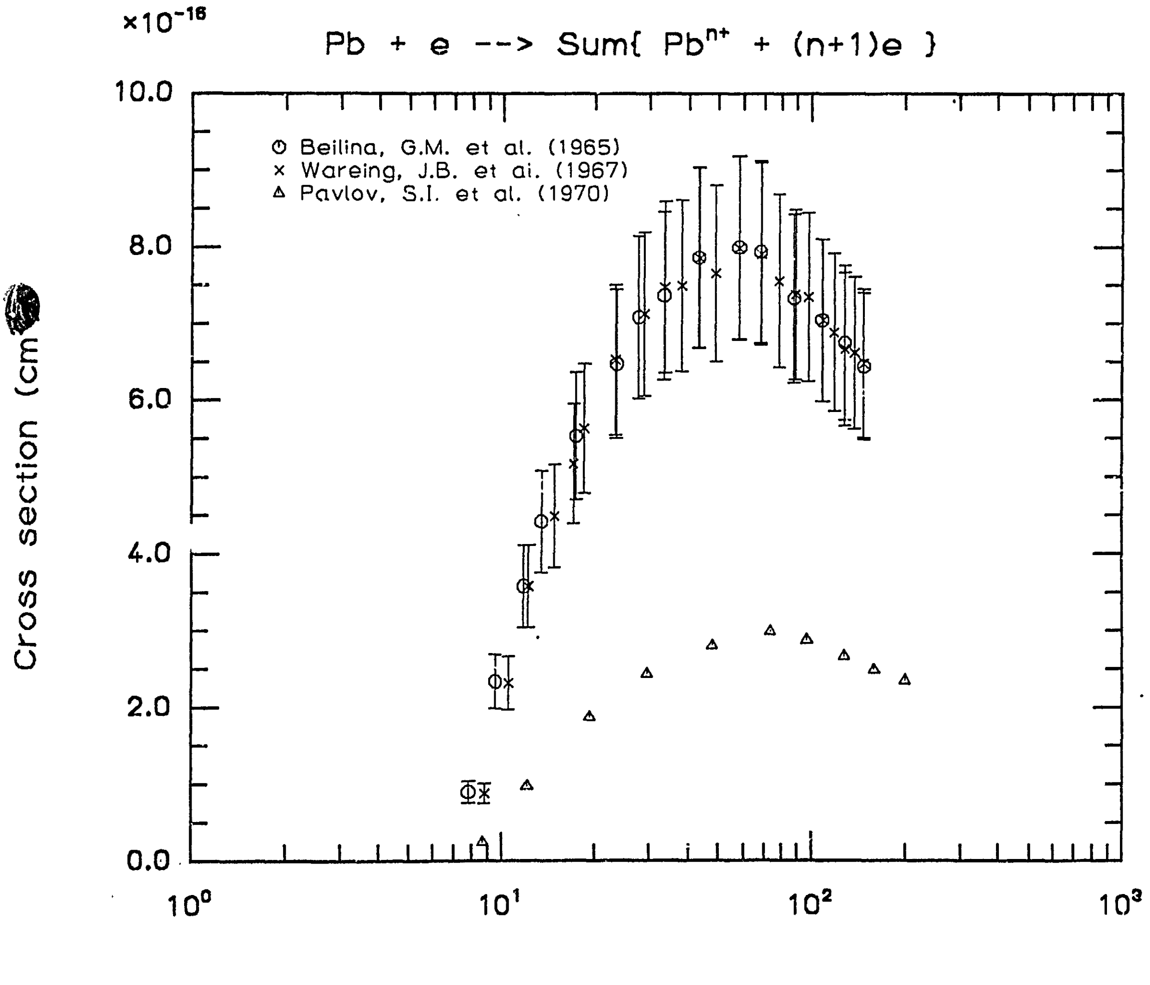
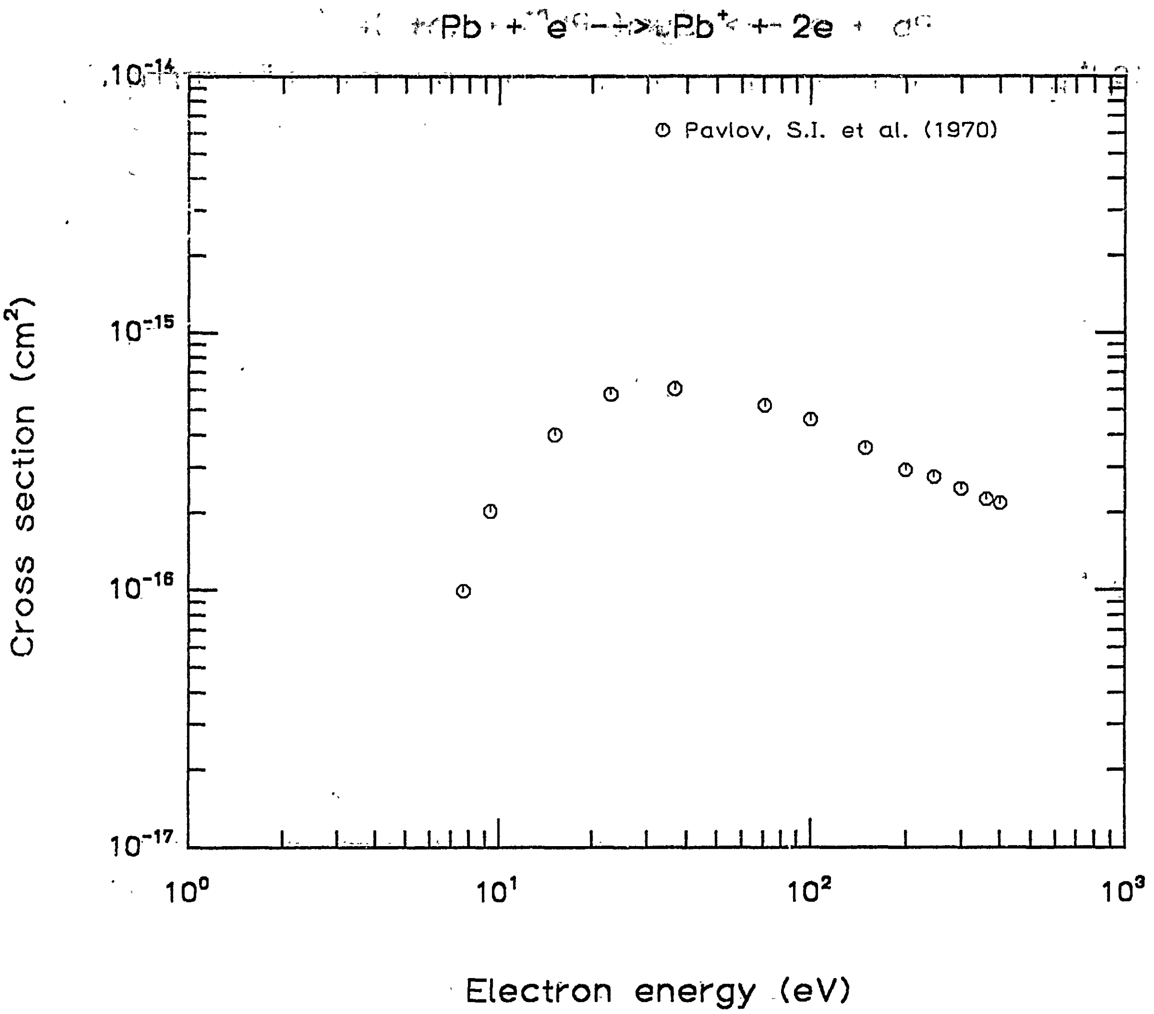


Fig. 279 Electron energy (eV)


Pb + e --> Pb+ + 2e
Pavlov, S.I. et al. (1970)
Cross section (cm2)
10-14
10-15
10-16
10-17
100
101
102
103
Electron energy (eV)

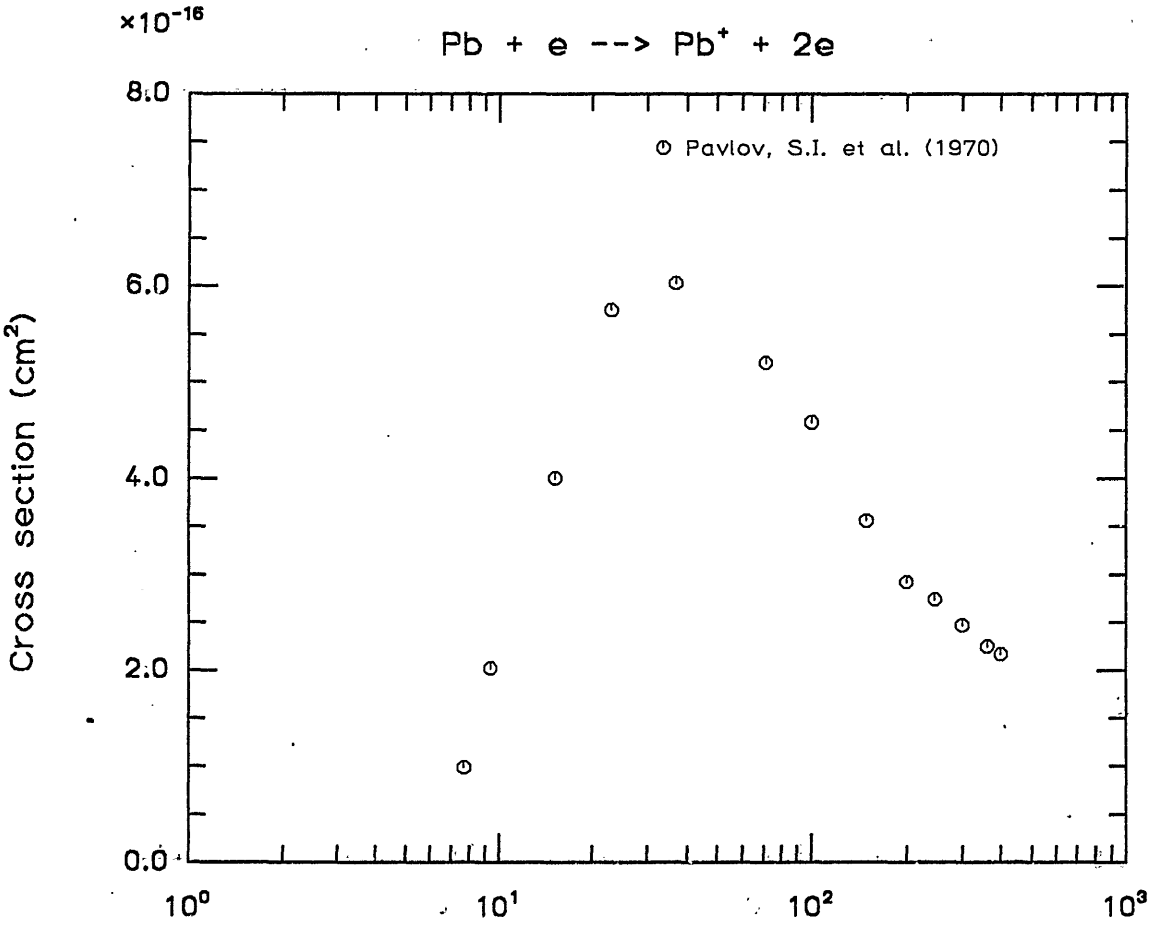
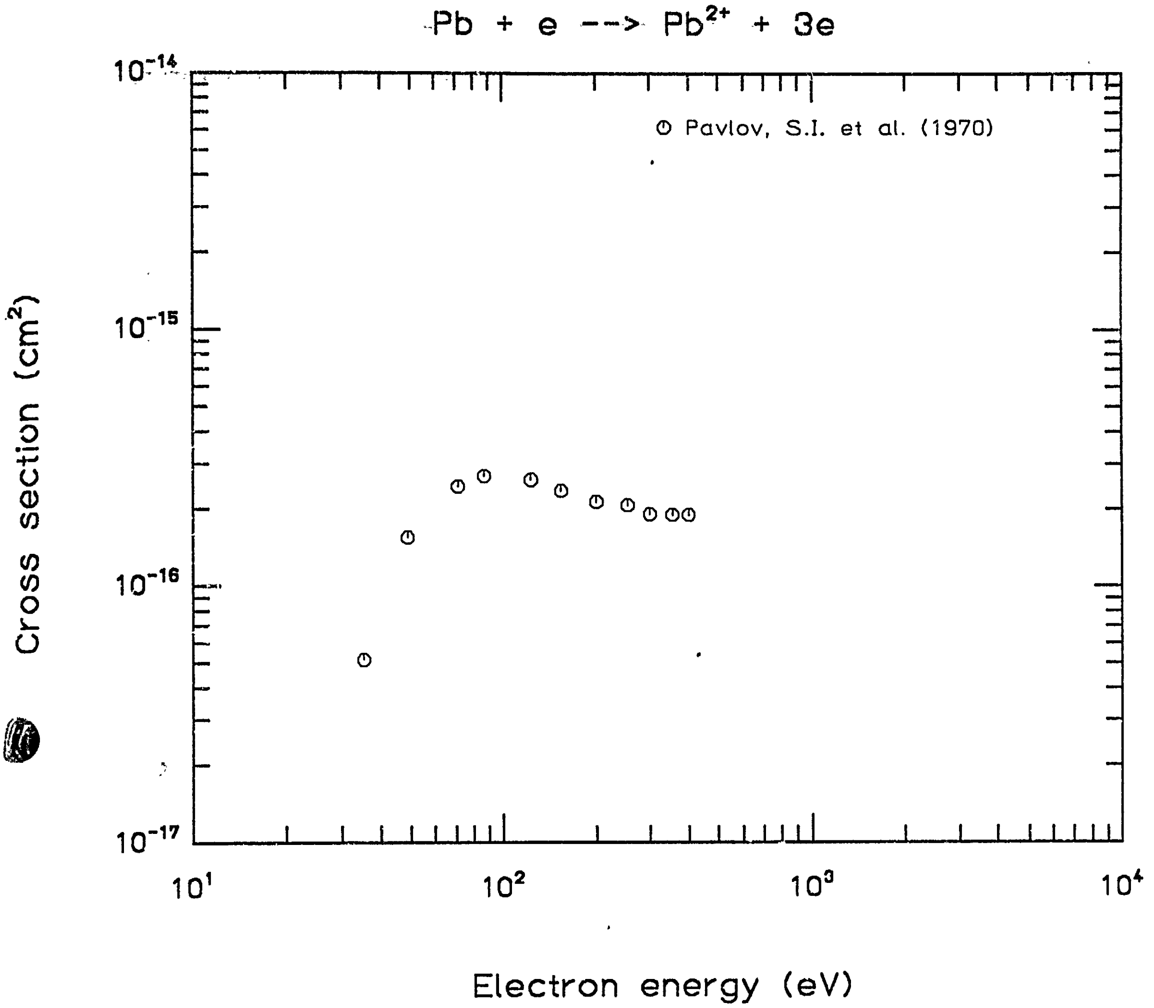
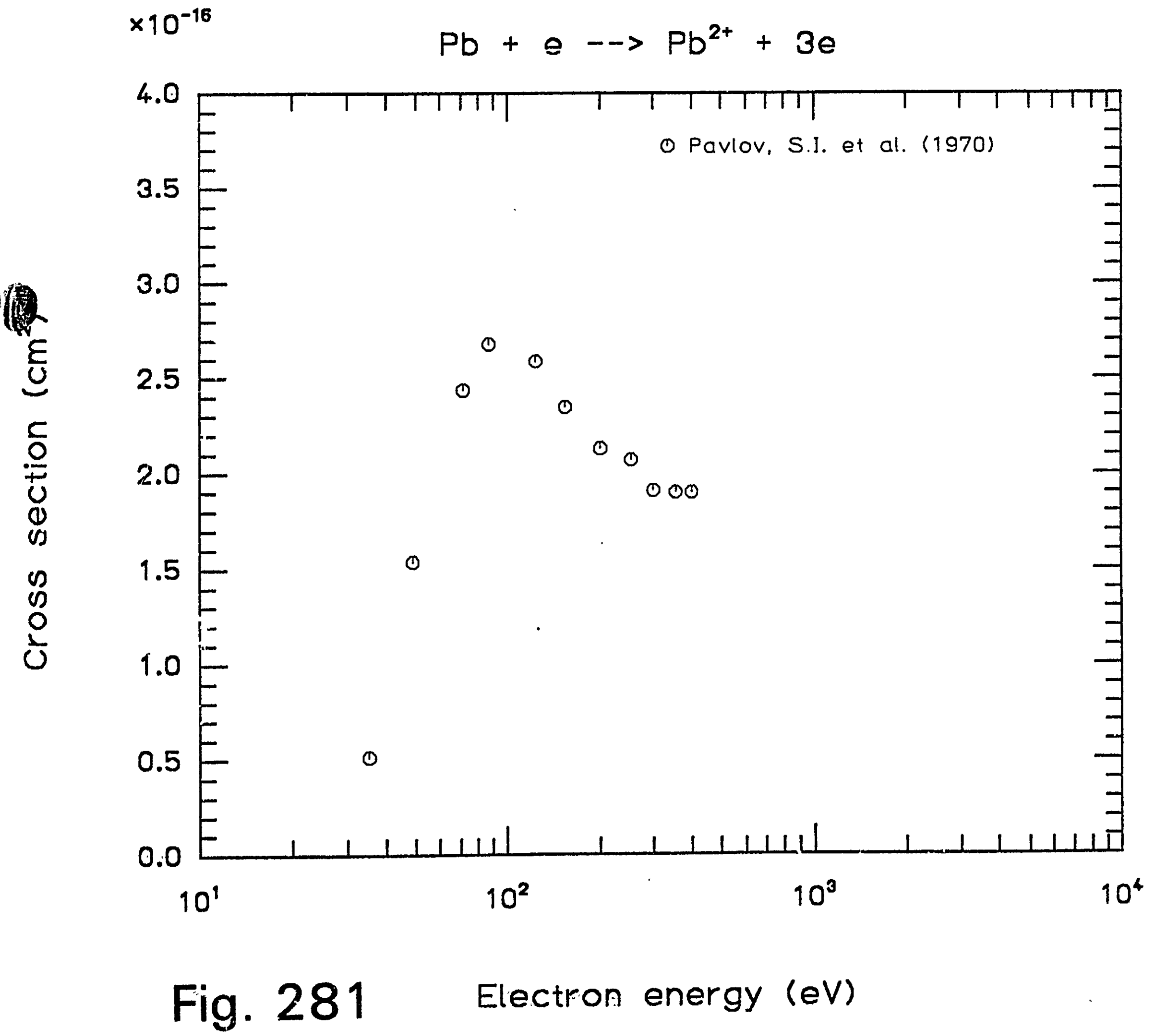

×10-16
Pb + e --> Pb+ + 2e
Pavlov, S.I. et al. (1970)
Cross section (cm2)
8.0
6.0
4.0
2.0
0.0
100
101
102
103
Electron energy (eV)

Fig. 280



Pb + e --> Pb^{2+} + 3e
Pavlov, S.I. et al. (1970)
Cross section (cm^2)
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^1
10^2
10^3
10^4
Electron energy (eV)



×10^{-16}
Pb + e --> Pb^{2+} + 3e
Pavlov, S.I. et al. (1970)
Cross section (cm^2)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10^1
10^2
10^3
10^4
Electron energy (eV)

Fig. 281

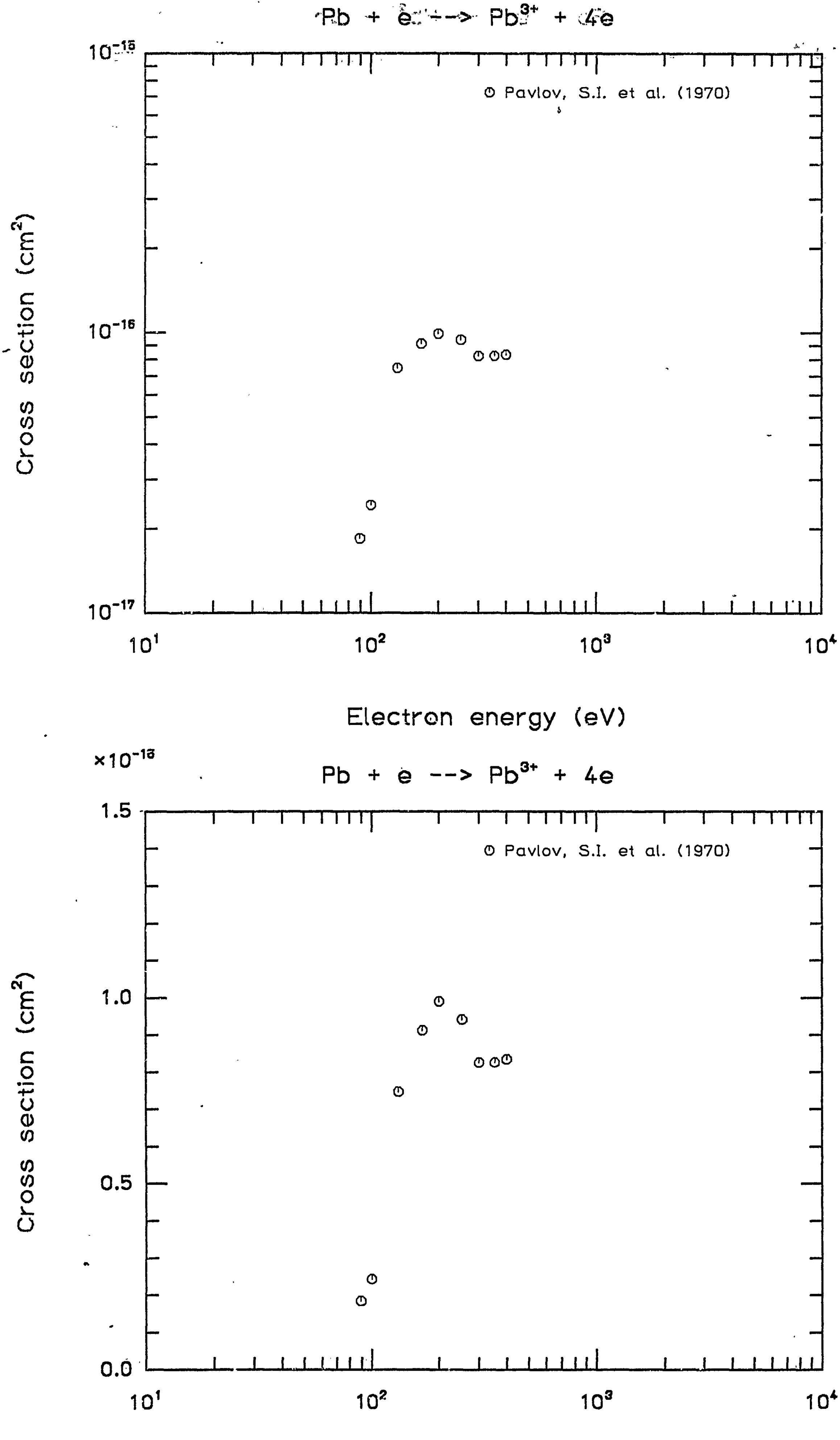
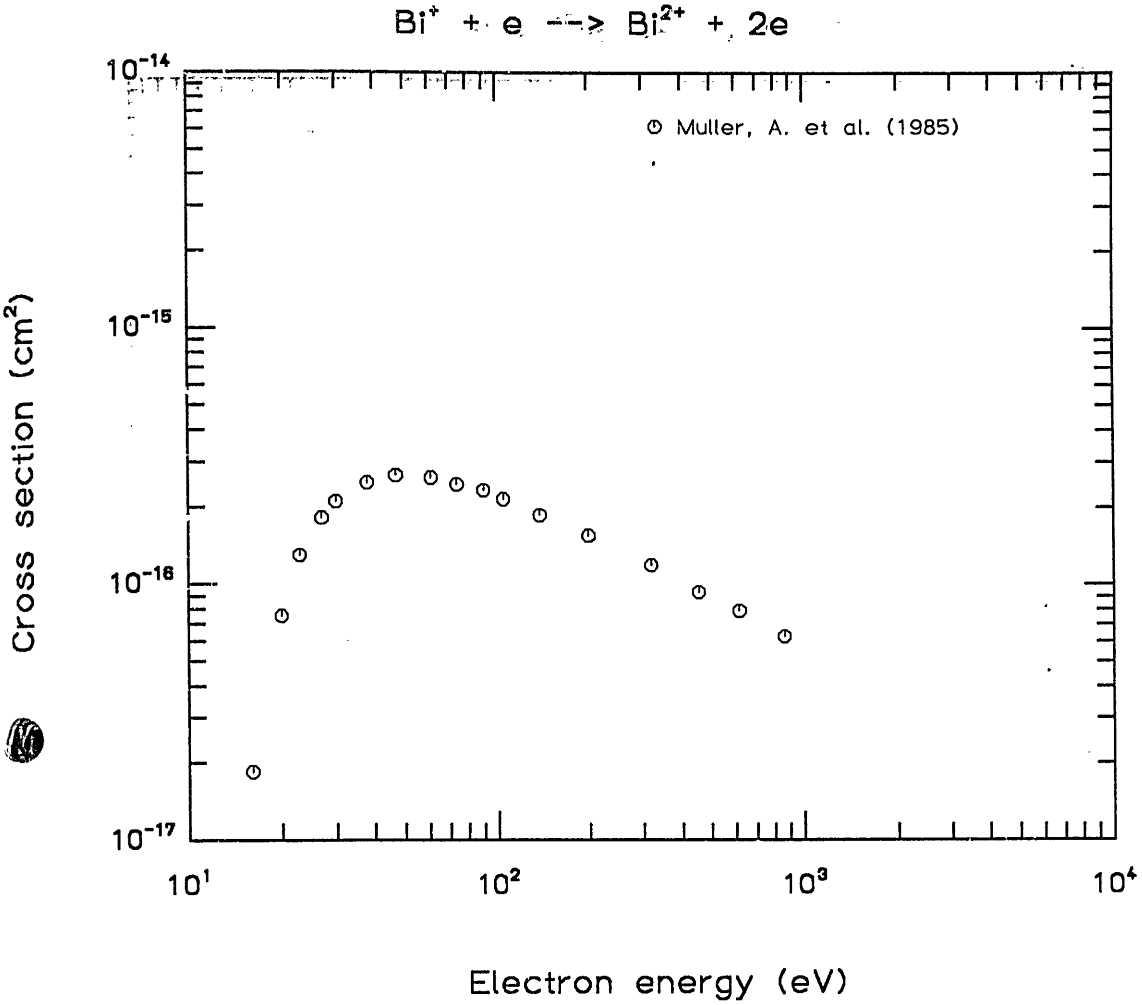


Fig. 282 Electron energy (eV)



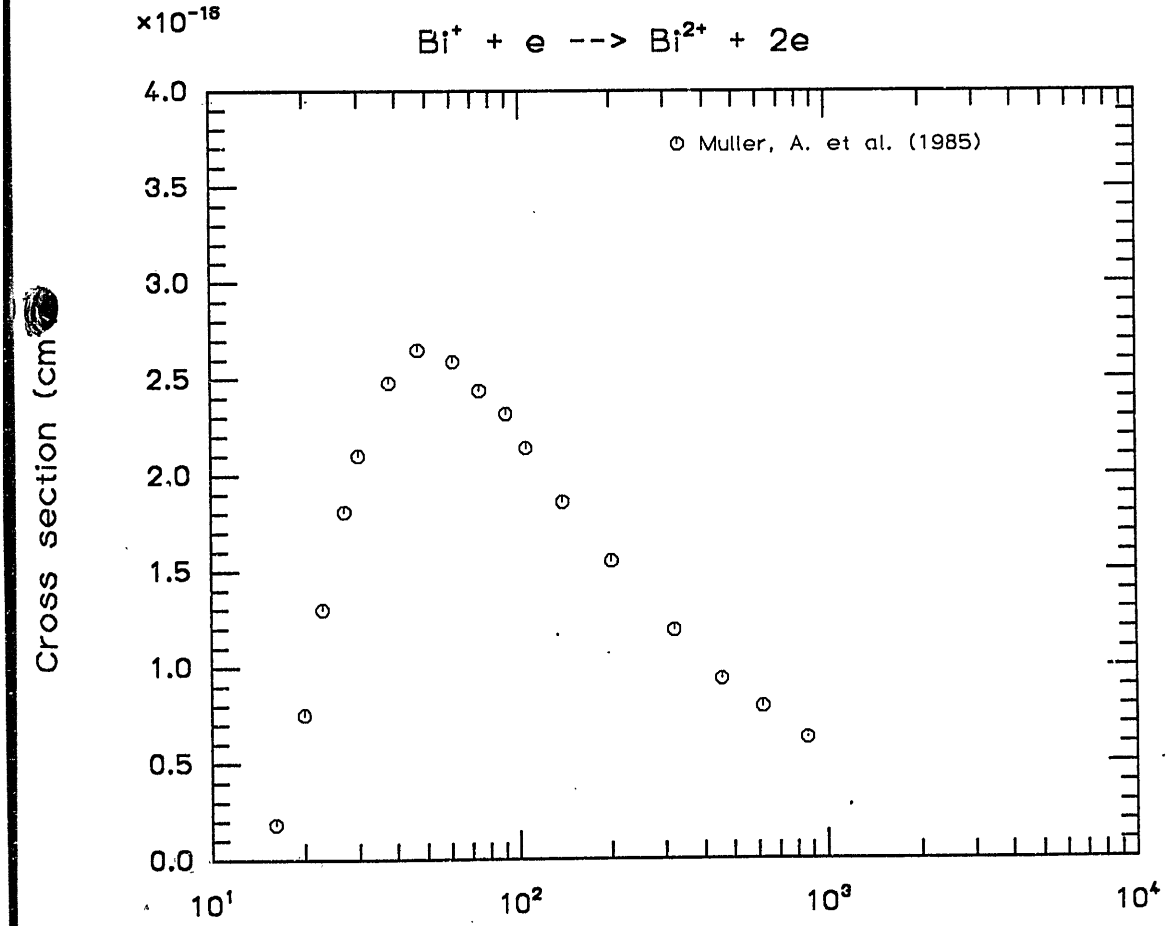
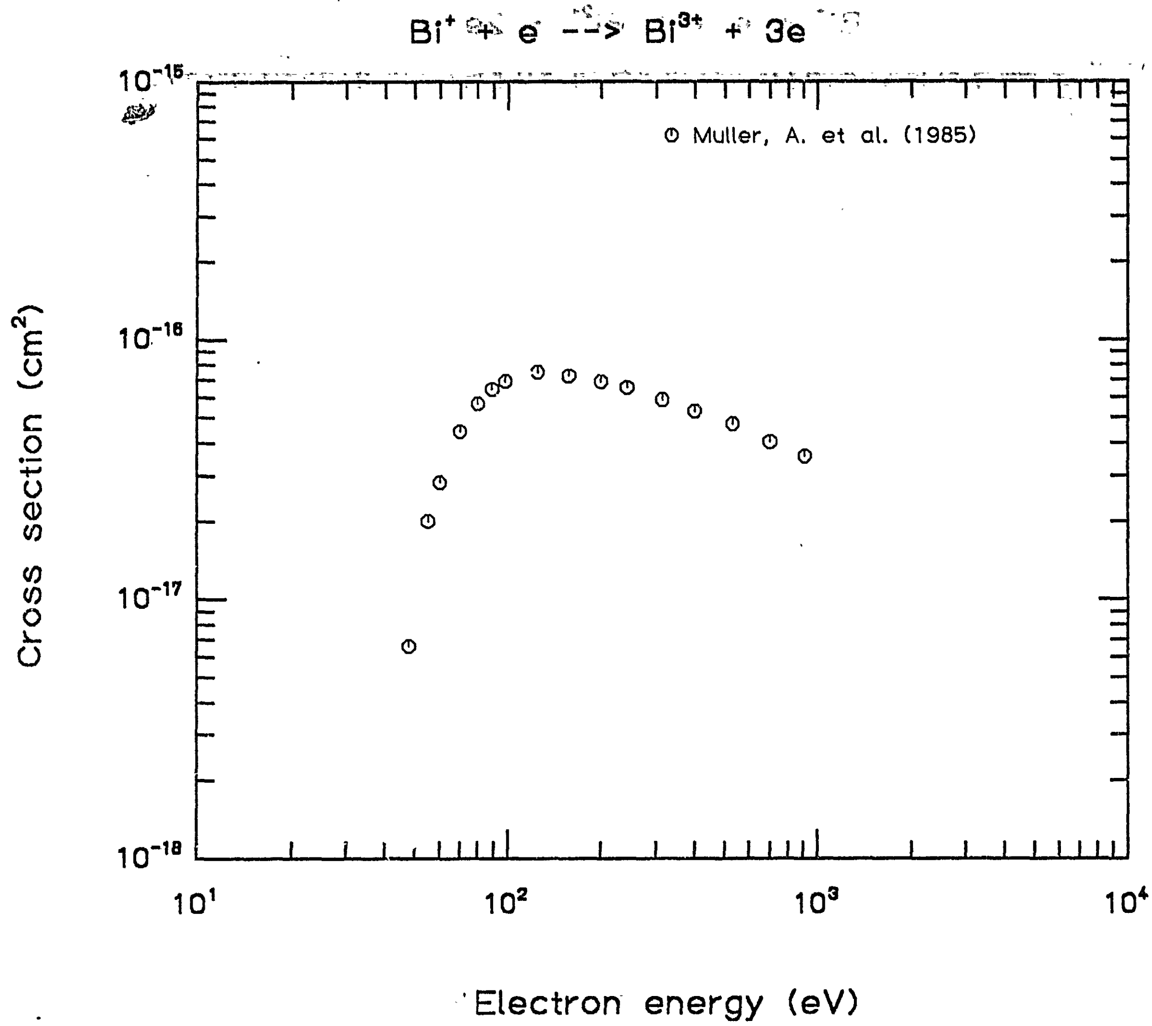


Fig. 283 Electron energy (eV)


Bi+ + e --> Bi3+ + 3e
Muller, A. et al. (1985)
Cross section (cm2)
10-15
10-16
10-17
10-18
101
102
103
104
Electron energy (eV)

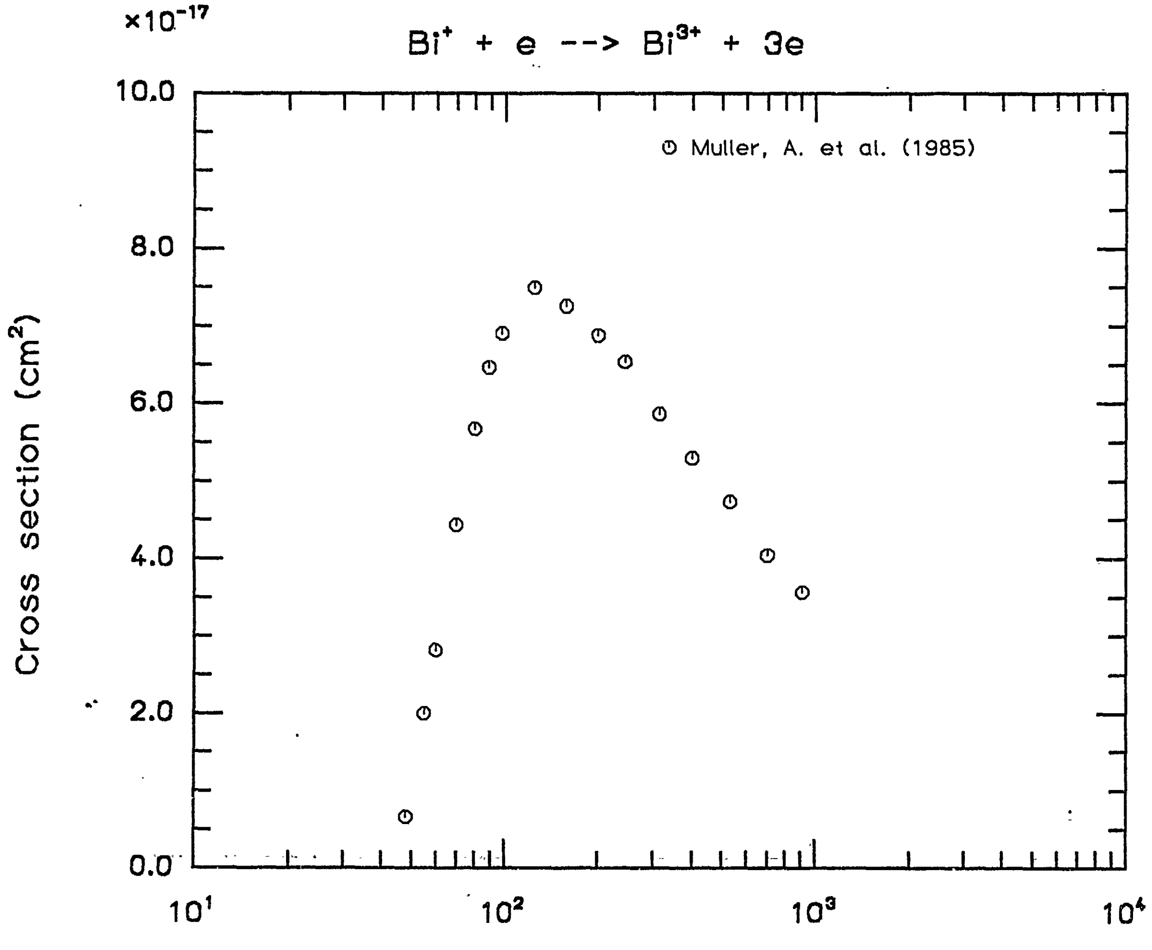
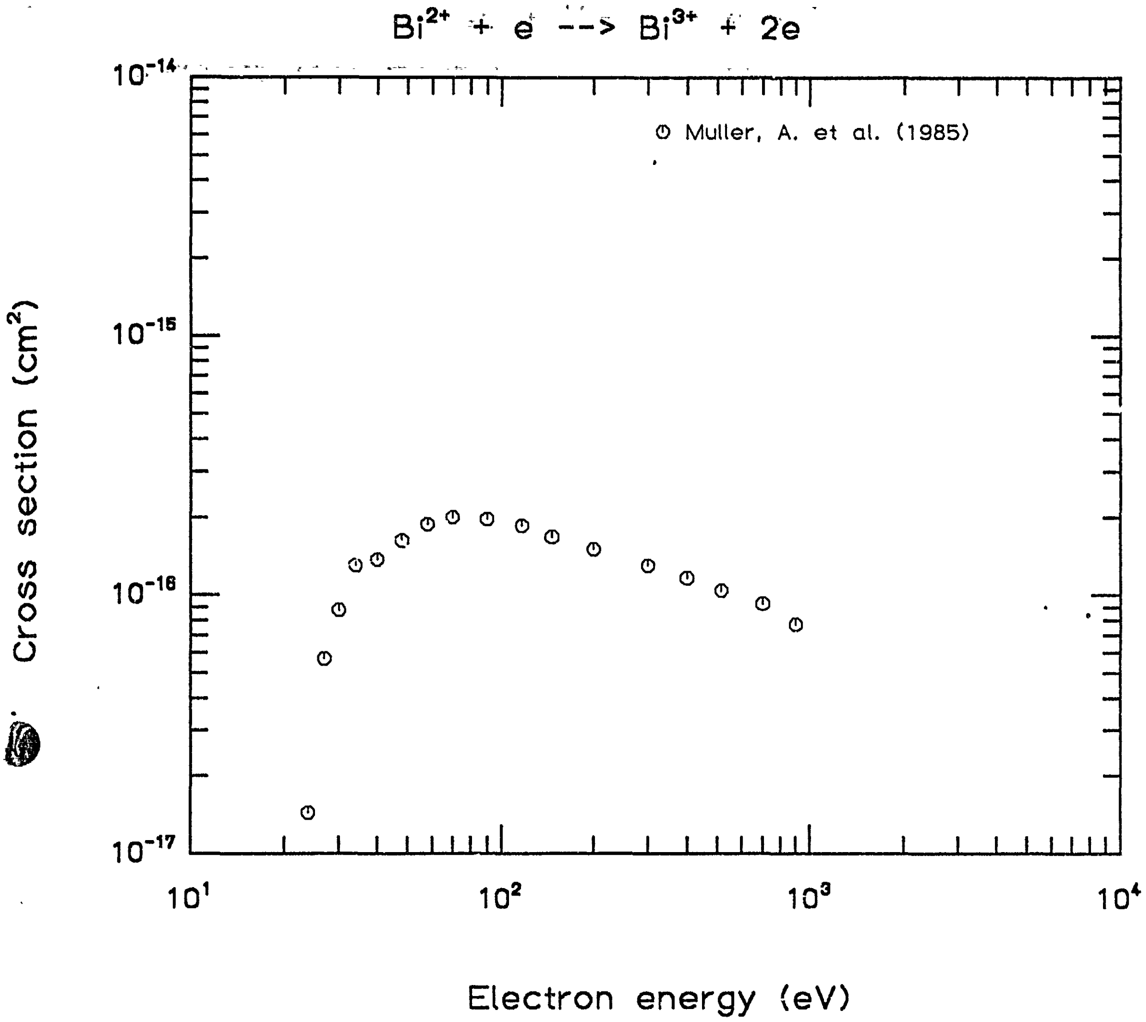

×10-17
Bi+ + e --> Bi3+ + 3e
Muller, A. et al. (1985)
Cross section (cm2)
10.0
8.0
6.0
4.0
2.0
0.0
101
102
103
104
Electron energy (eV)

Fig. 284



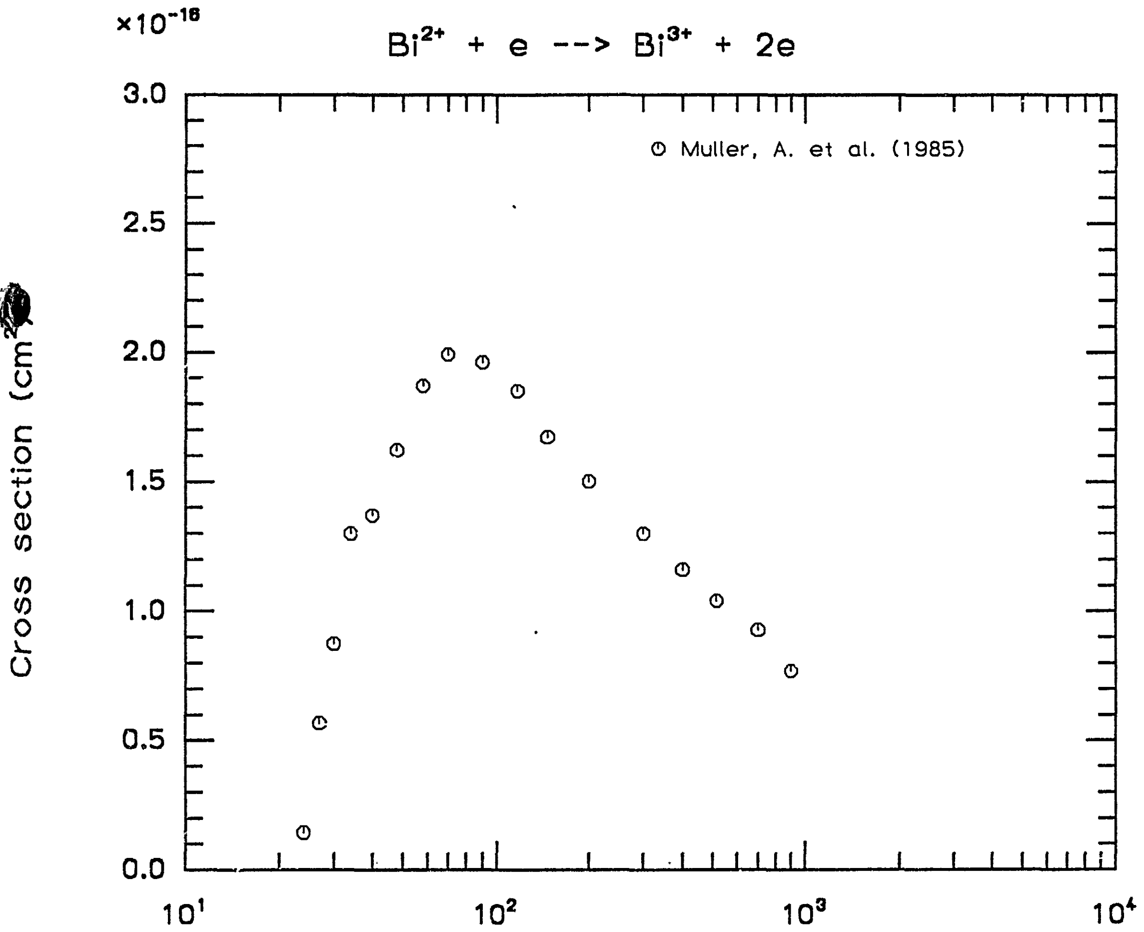
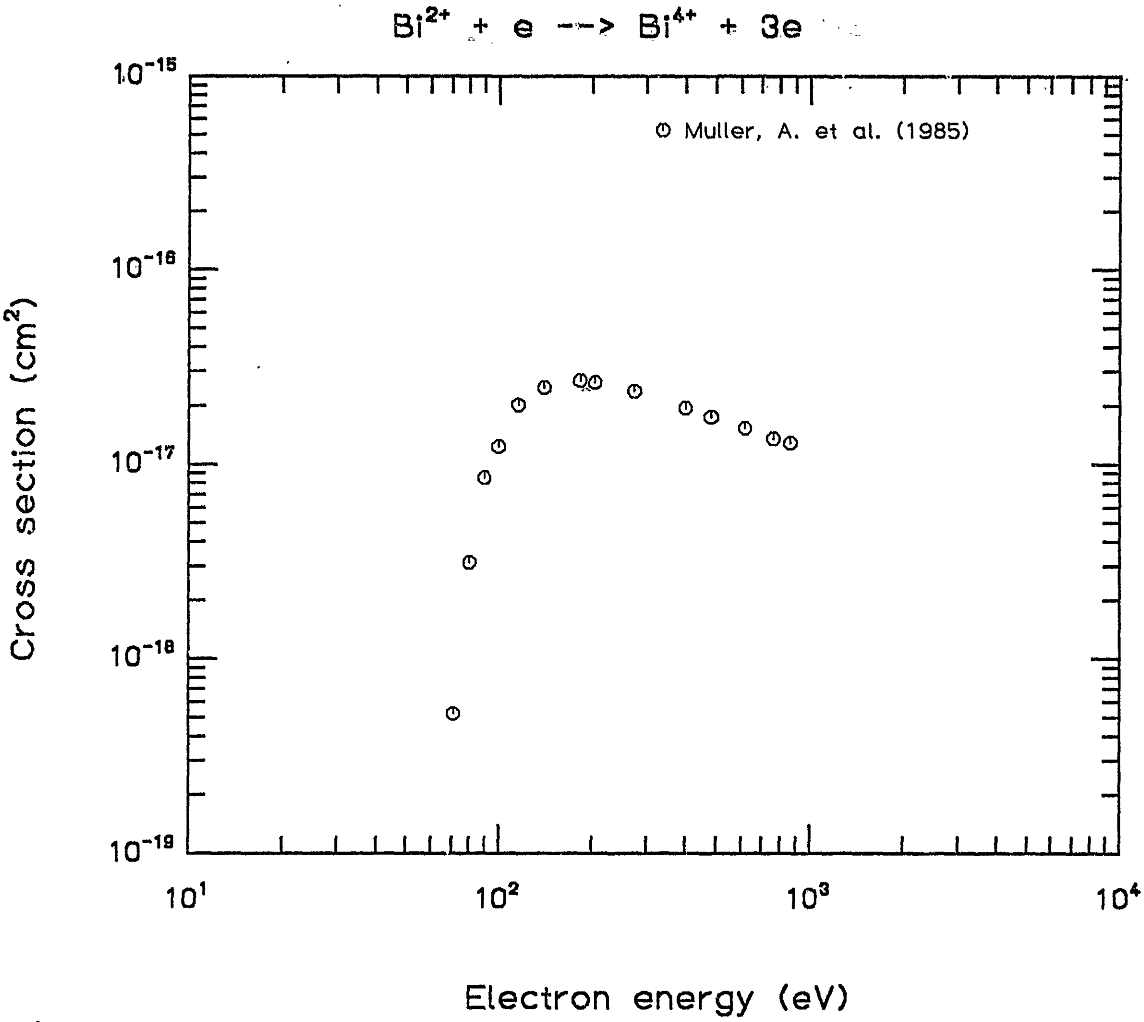


Fig. 285 Electron energy (eV)



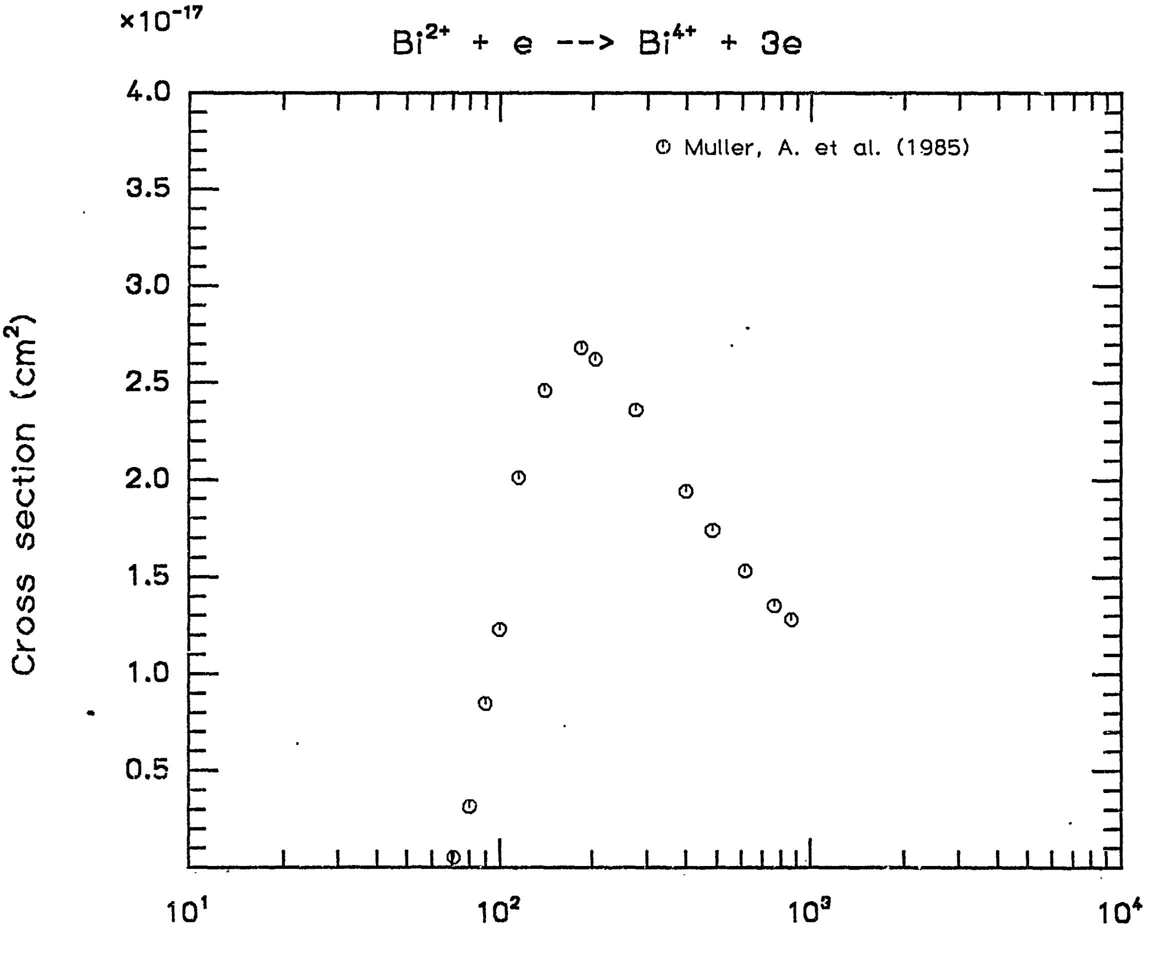
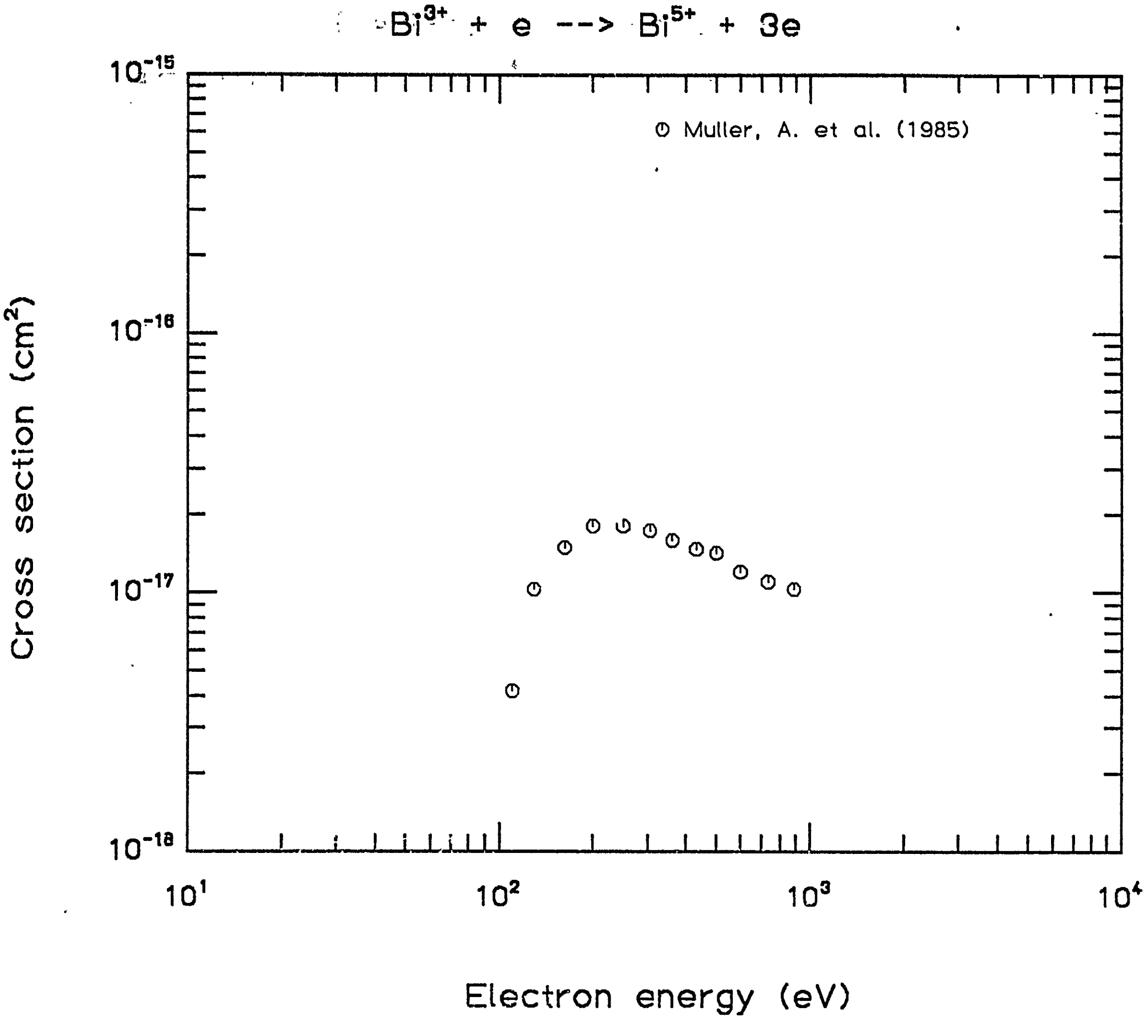


Fig. 286 Electron energy (eV)



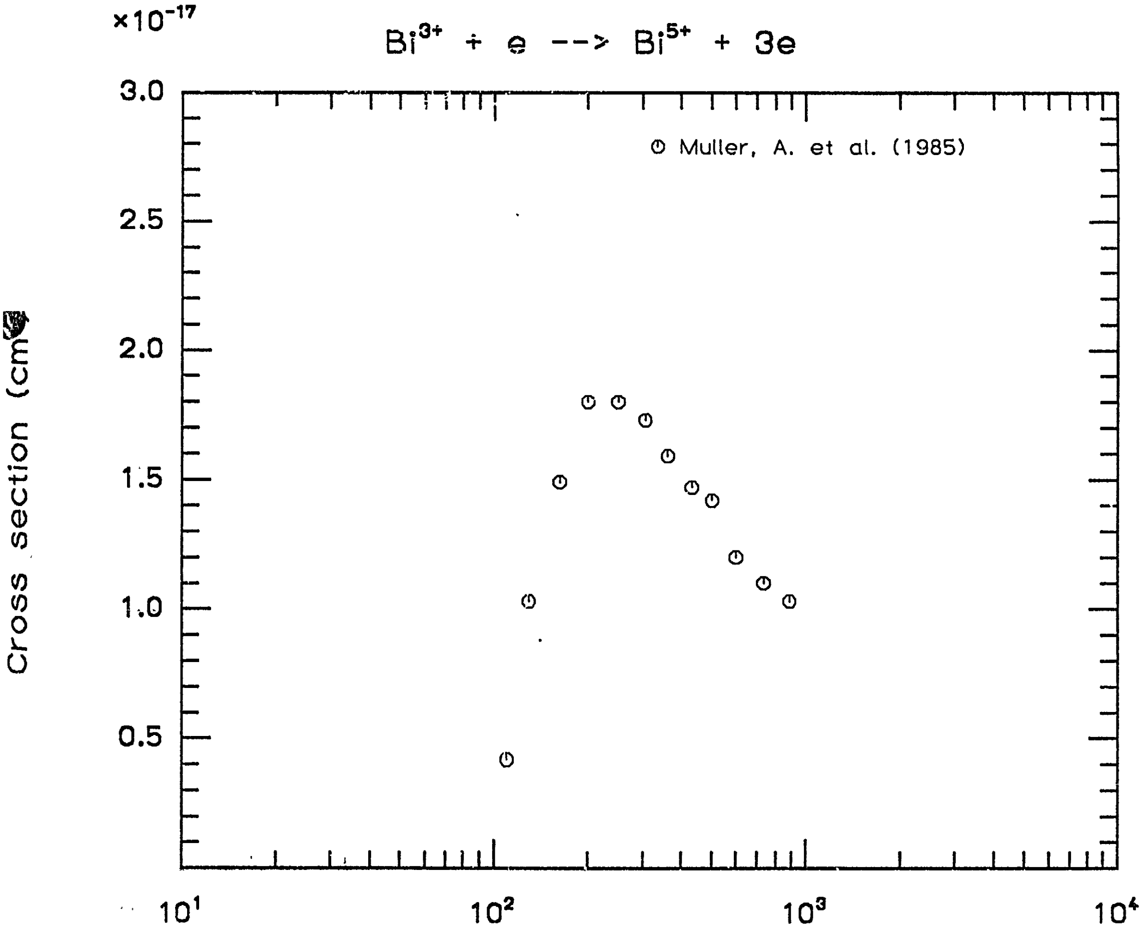
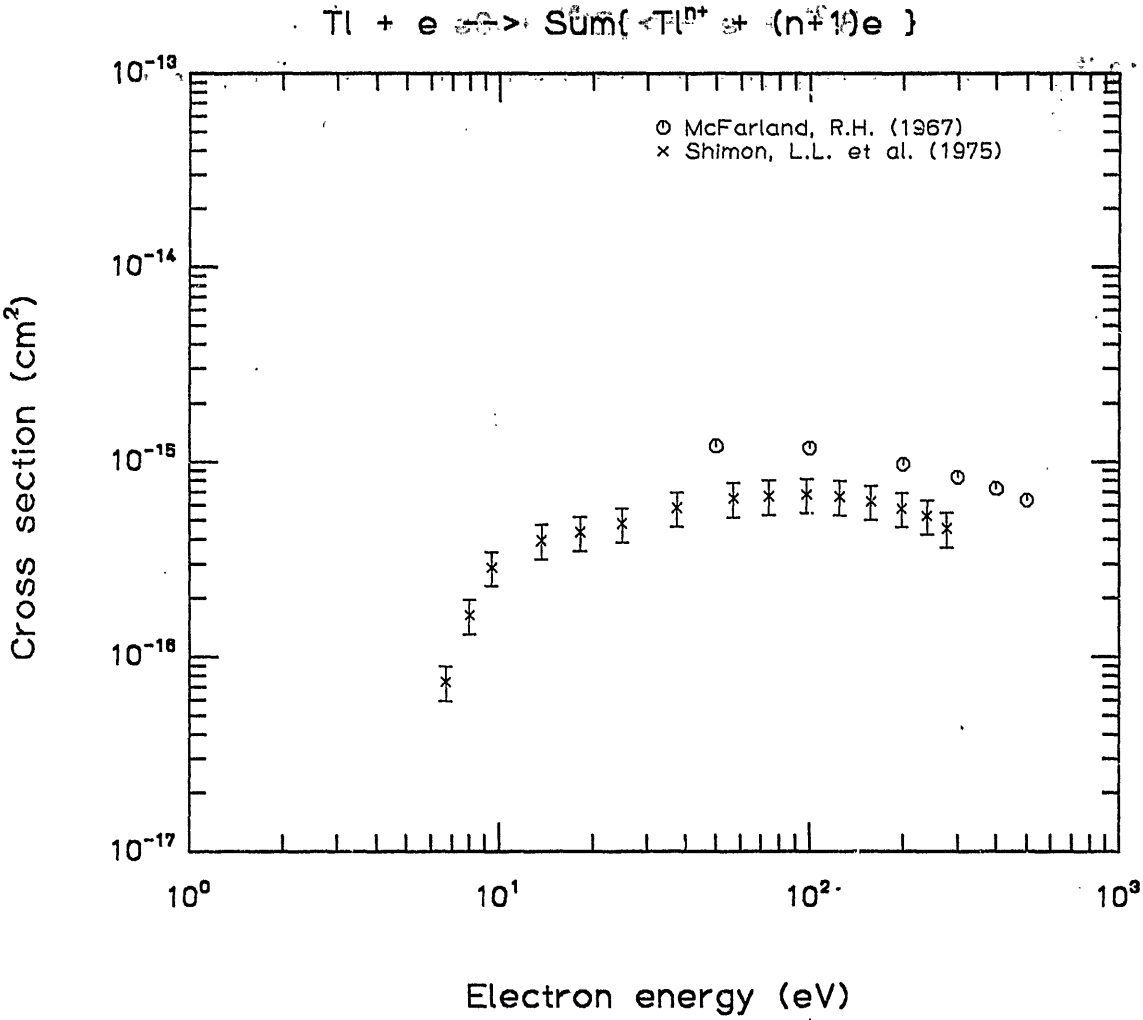


Fig. 287 Electron energy (eV)


Tl + e --> Sum{ Tl^n+ + (n+1)e }
McFarland, R.H. (1967)
Shimon, L.L. et al. (1975)
Cross section (cm²)
Electron energy (eV)
10^-13
10^-14
10^-15
10^-16
10^-17
10^0
10^1
10^2
10^3

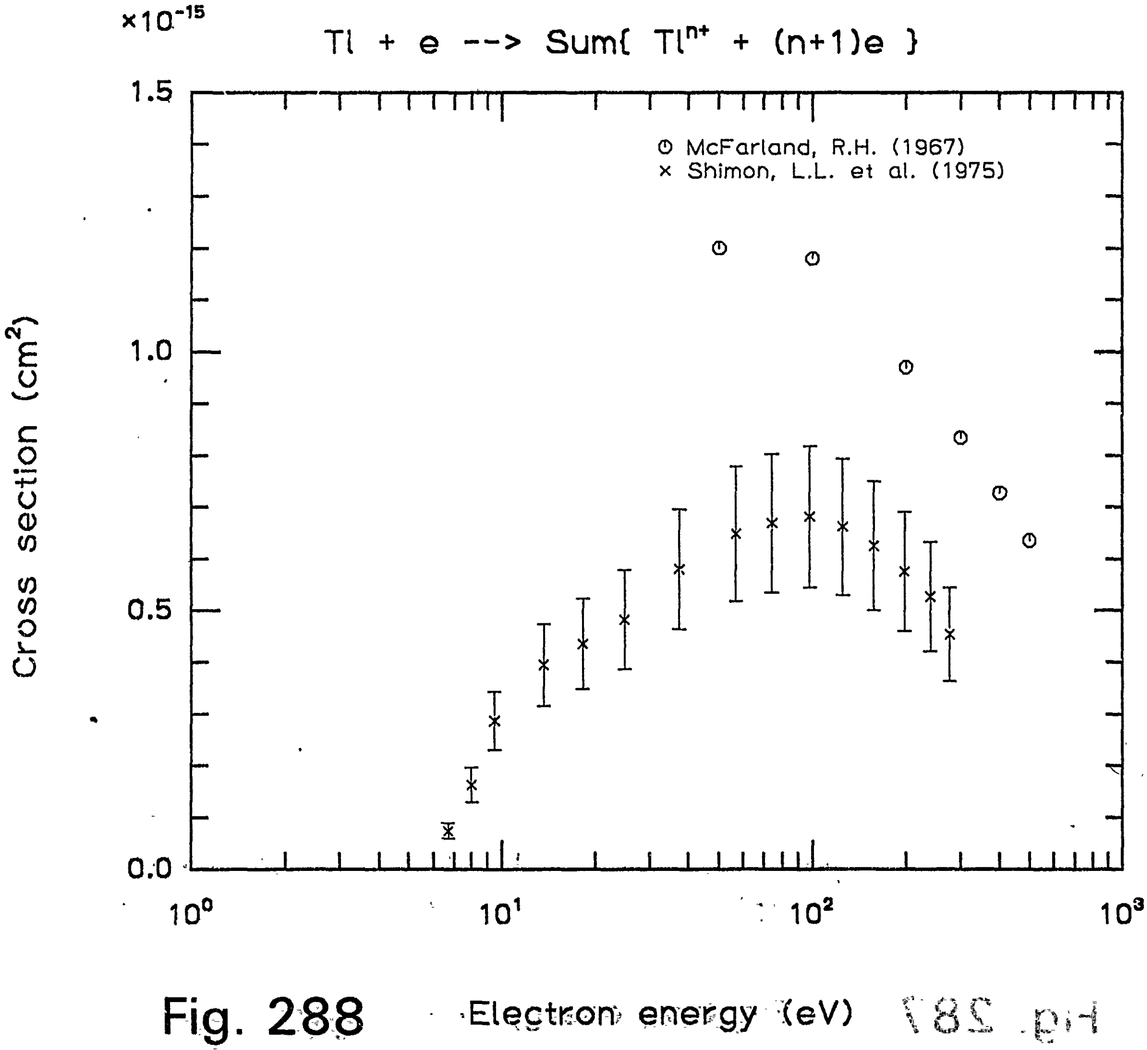
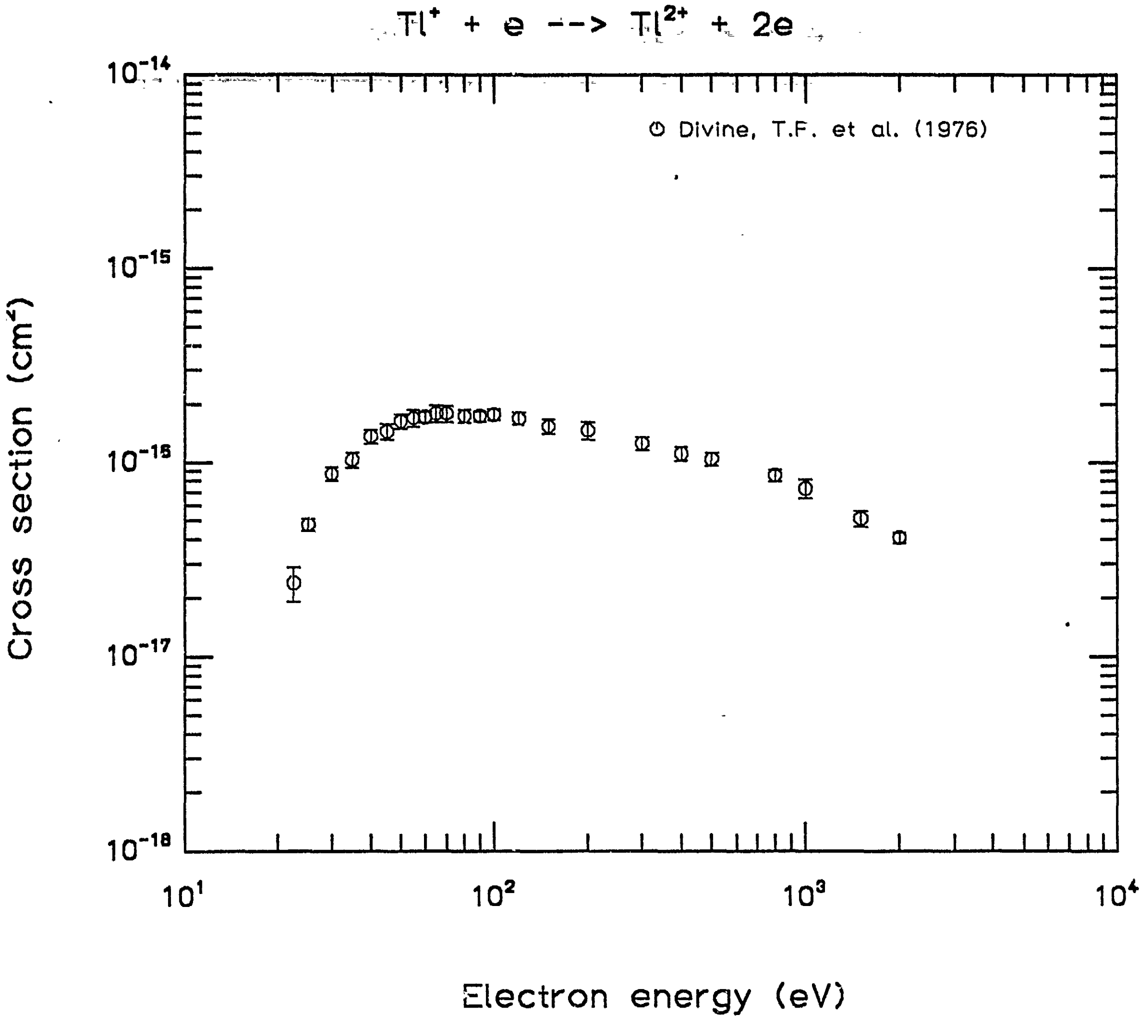

×10^-15
Tl + e --> Sum{ Tl^n+ + (n+1)e }
McFarland, R.H. (1967)
Shimon, L.L. et al. (1975)
Cross section (cm²)
1.5
1.0
0.5
0.0
10^0
10^1
10^2
10^3
Electron energy (eV)

Fig. 288



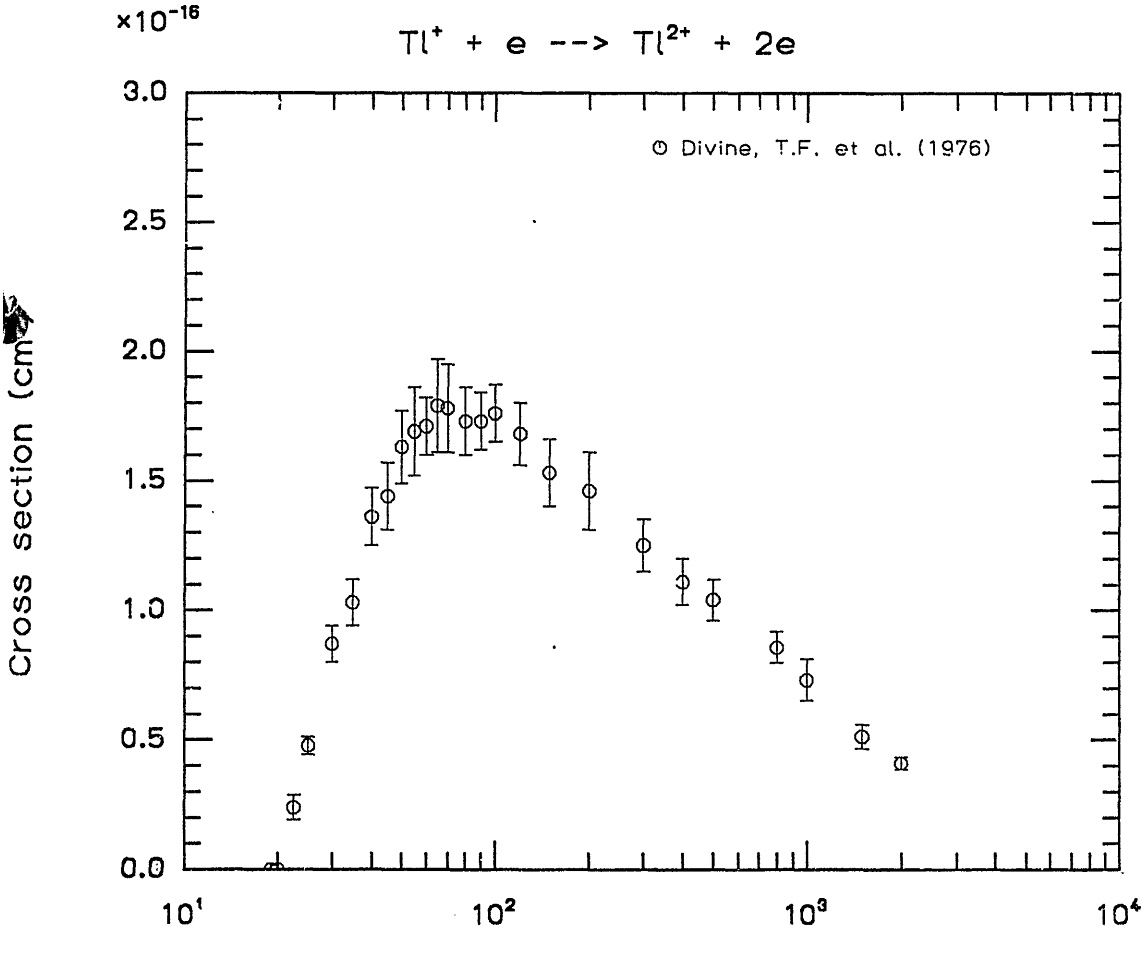
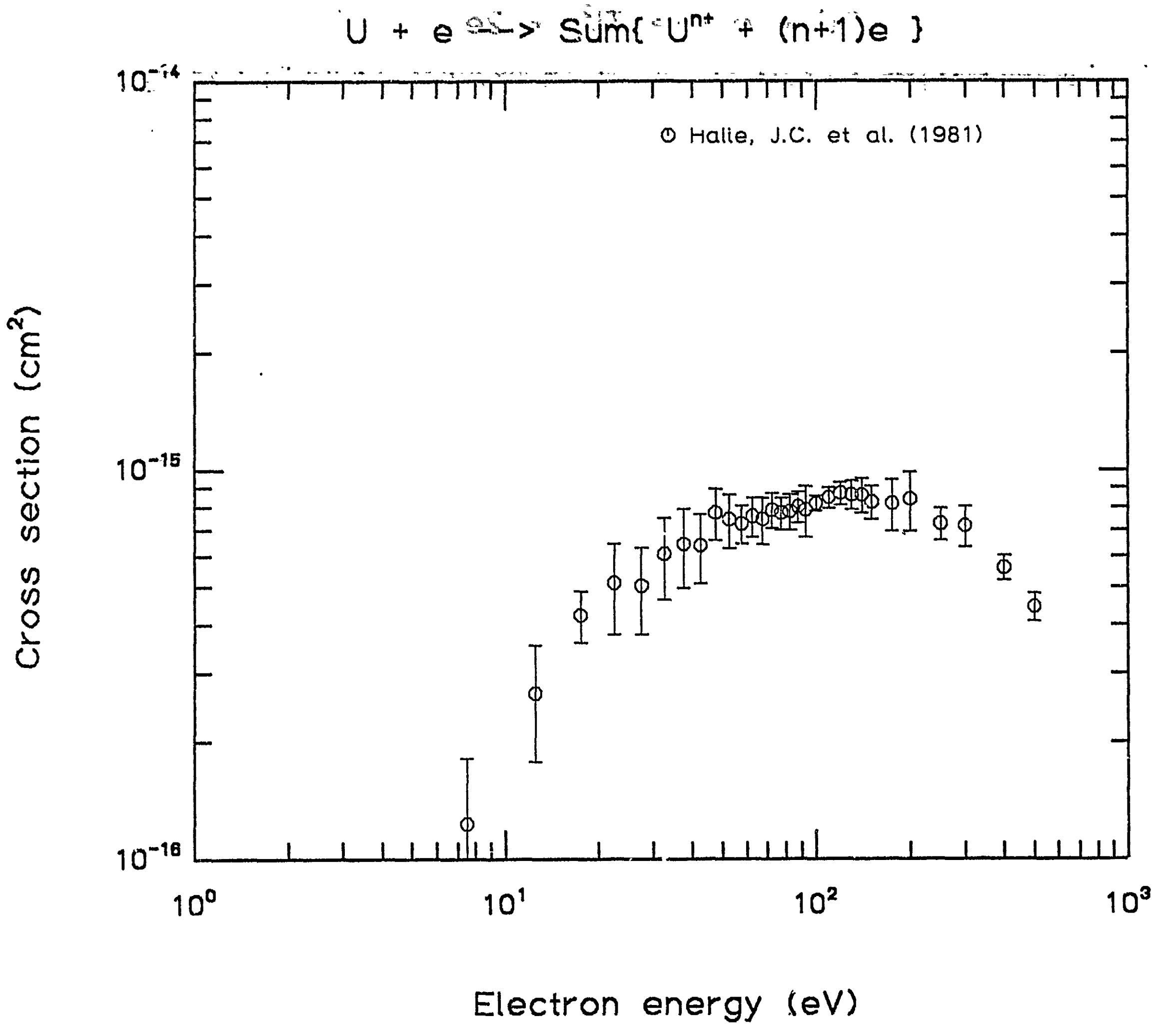


Fig. 289 Electron energy (eV)



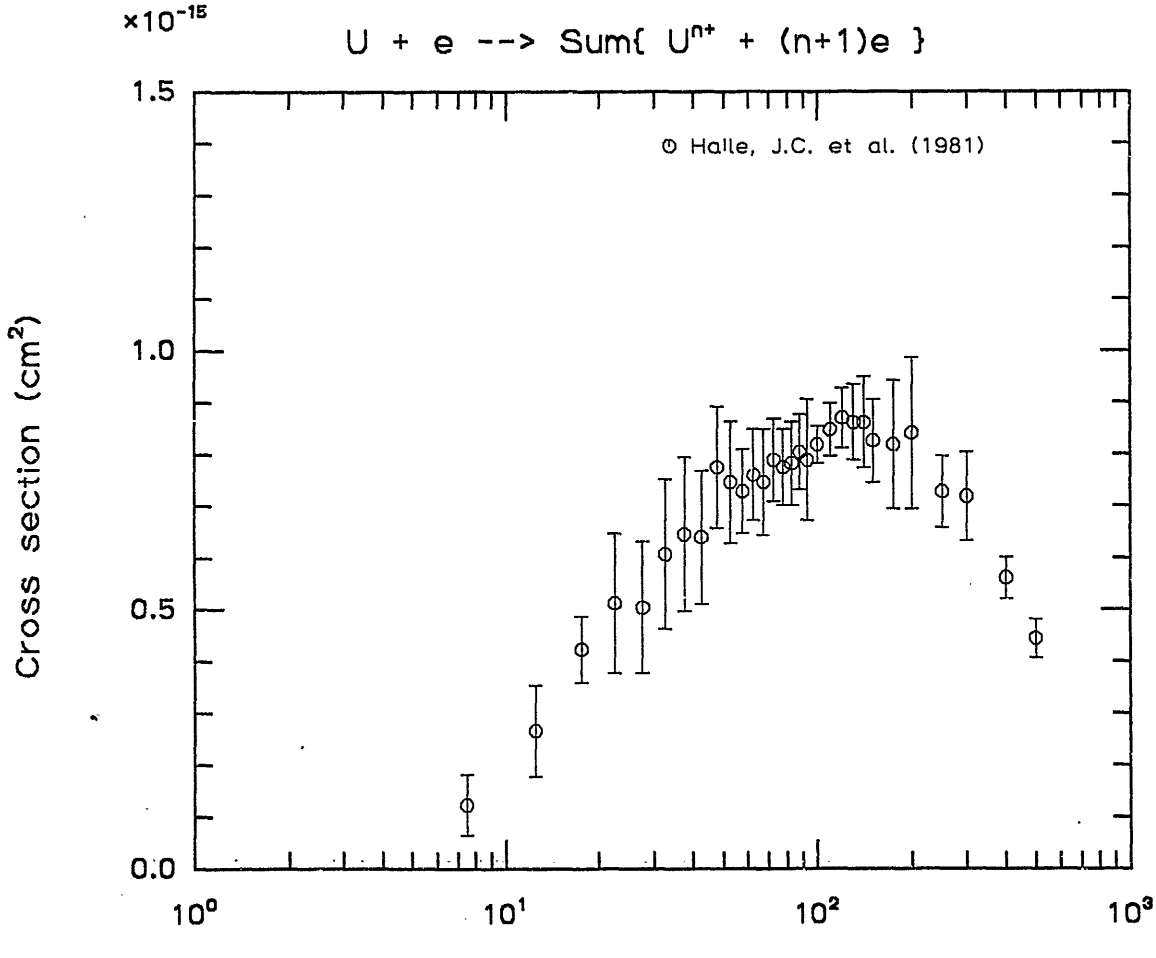
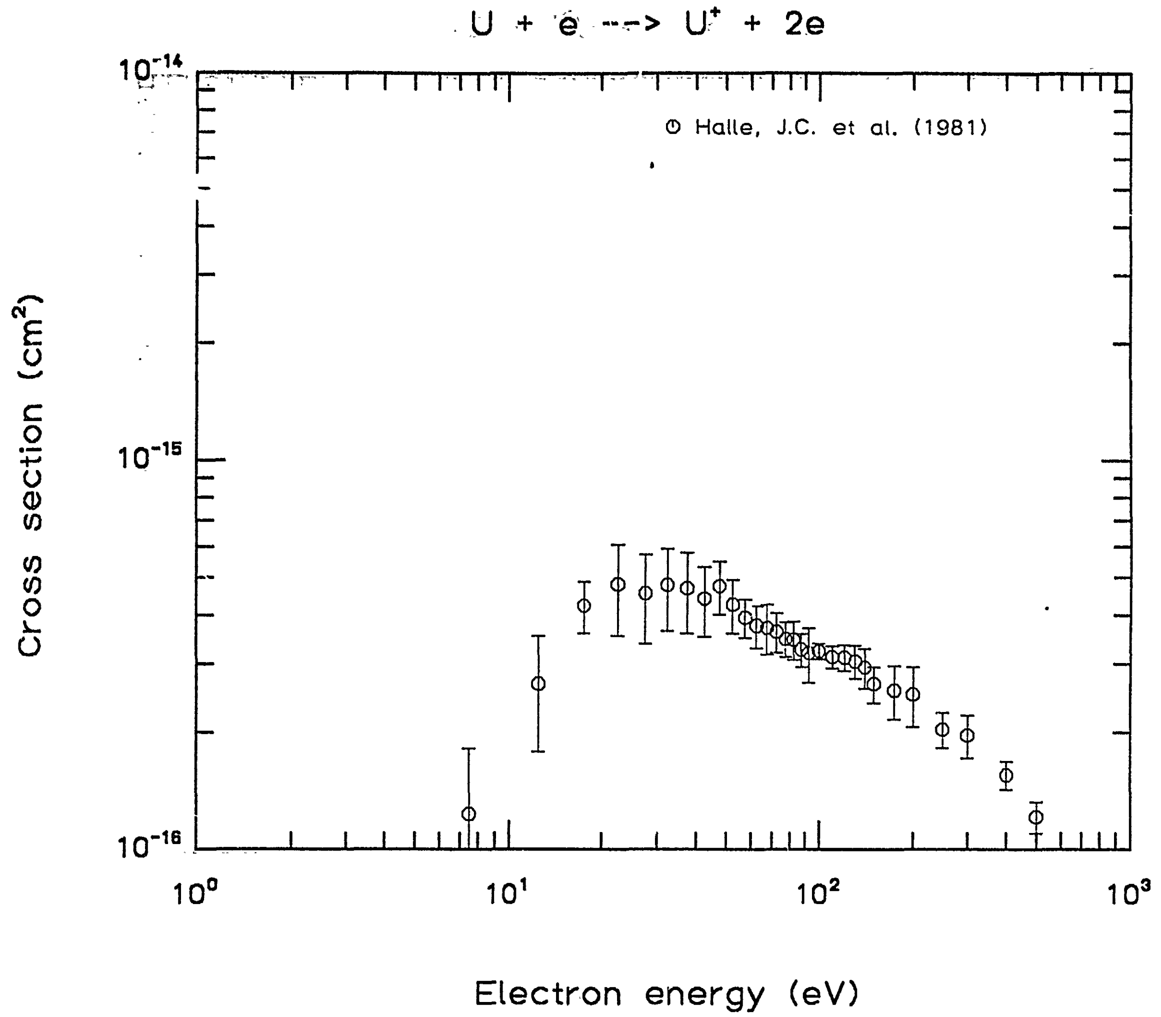


Fig. 290 Electron energy (eV)


U + e --> U⁺ + 2e
Halle, J.C. et al. (1981)
Cross section (cm²)
10⁻¹⁴
10⁻¹⁵
10⁻¹⁶
10⁰
10¹
10²
10³
Electron energy (eV)

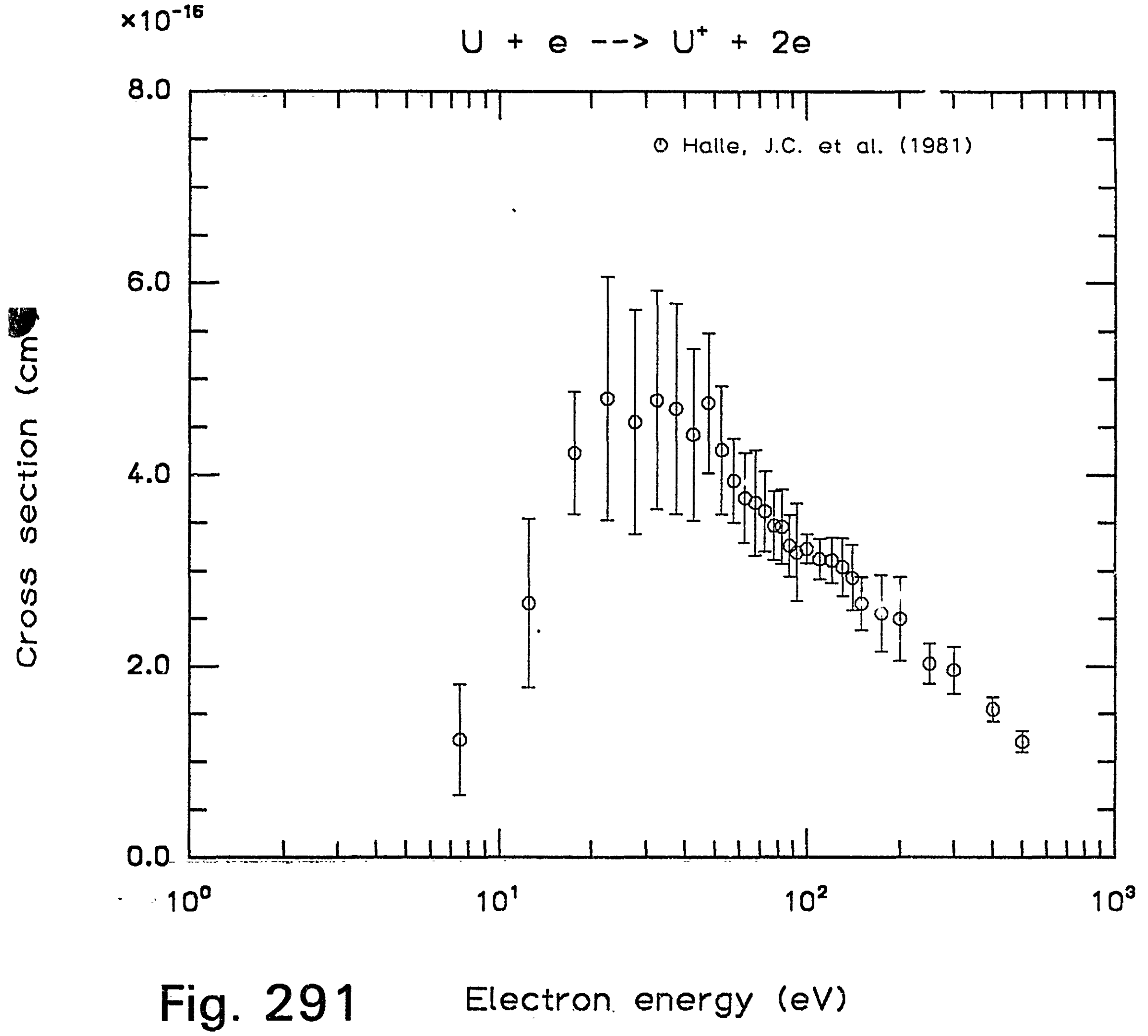
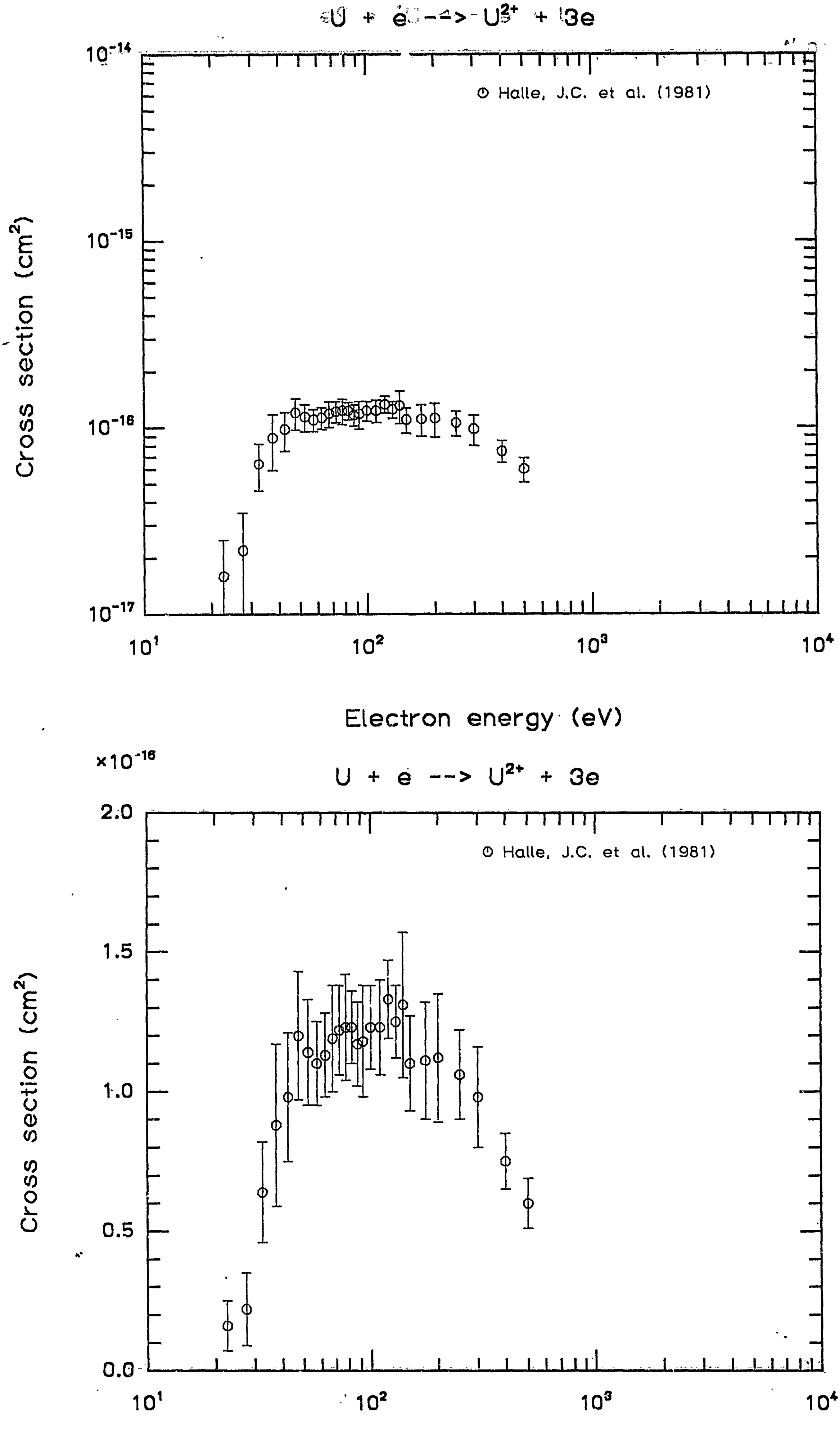
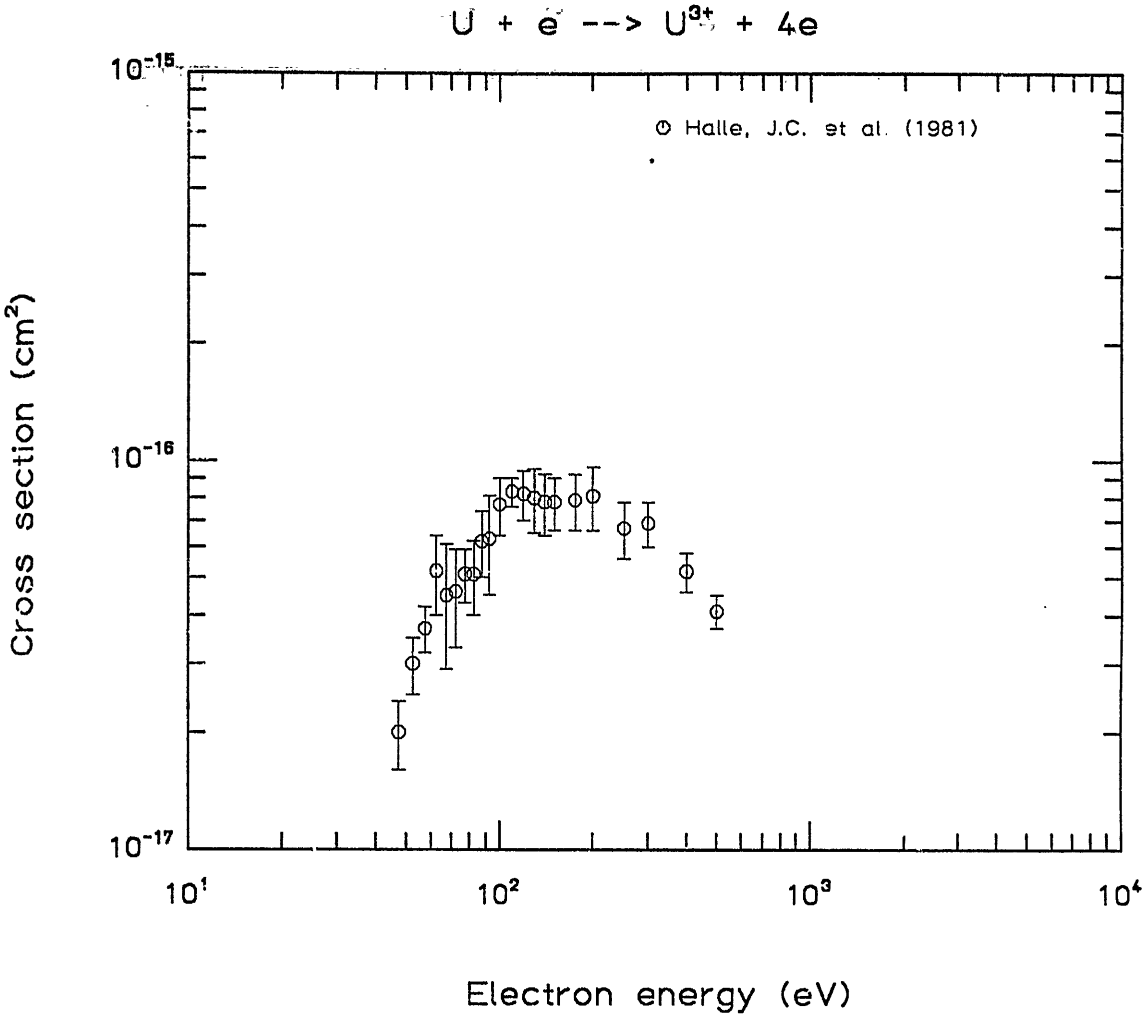

×10⁻¹⁶
U + e --> U⁺ + 2e
Halle, J.C. et al. (1981)
Cross section (cm²)
8.0
6.0
4.0
2.0
0.0
10⁰
10¹
10²
10³
Electron energy (eV)

Fig. 291

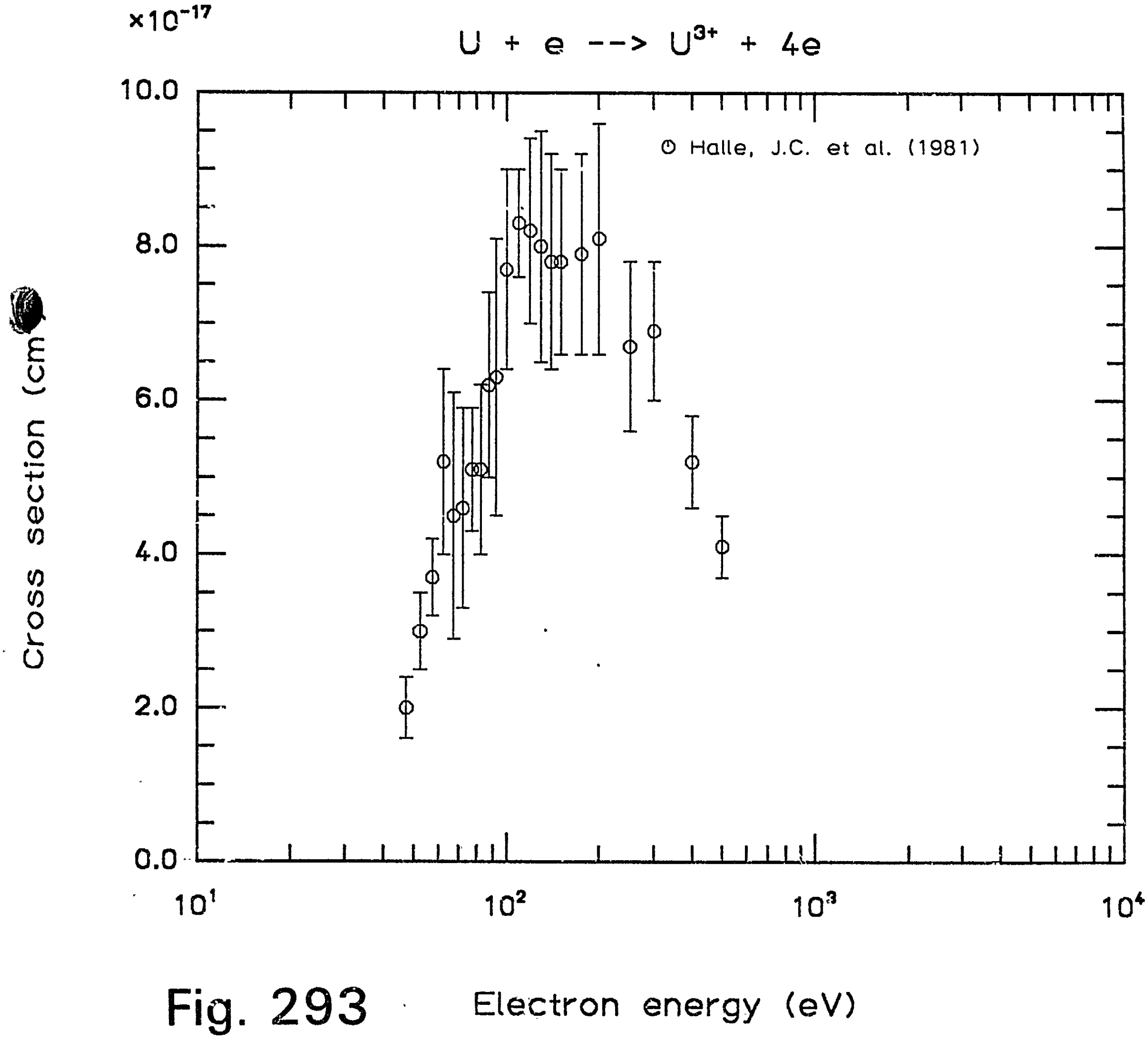


U + e --> U2+ + 3e
Halle, J.C. et al. (1981)
Cross section (cm2)
10-14
10-15
10-16
10-17
10¹
10²
10³
10⁴
Electron energy (eV)
×10-16
U + e --> U2+ + 3e
Halle, J.C. et al. (1981)
Cross section (cm2)
2.0
1.5
1.0
0.5
0.0
10¹
10²
10³
10⁴
Electron energy (eV)

Fig. 292

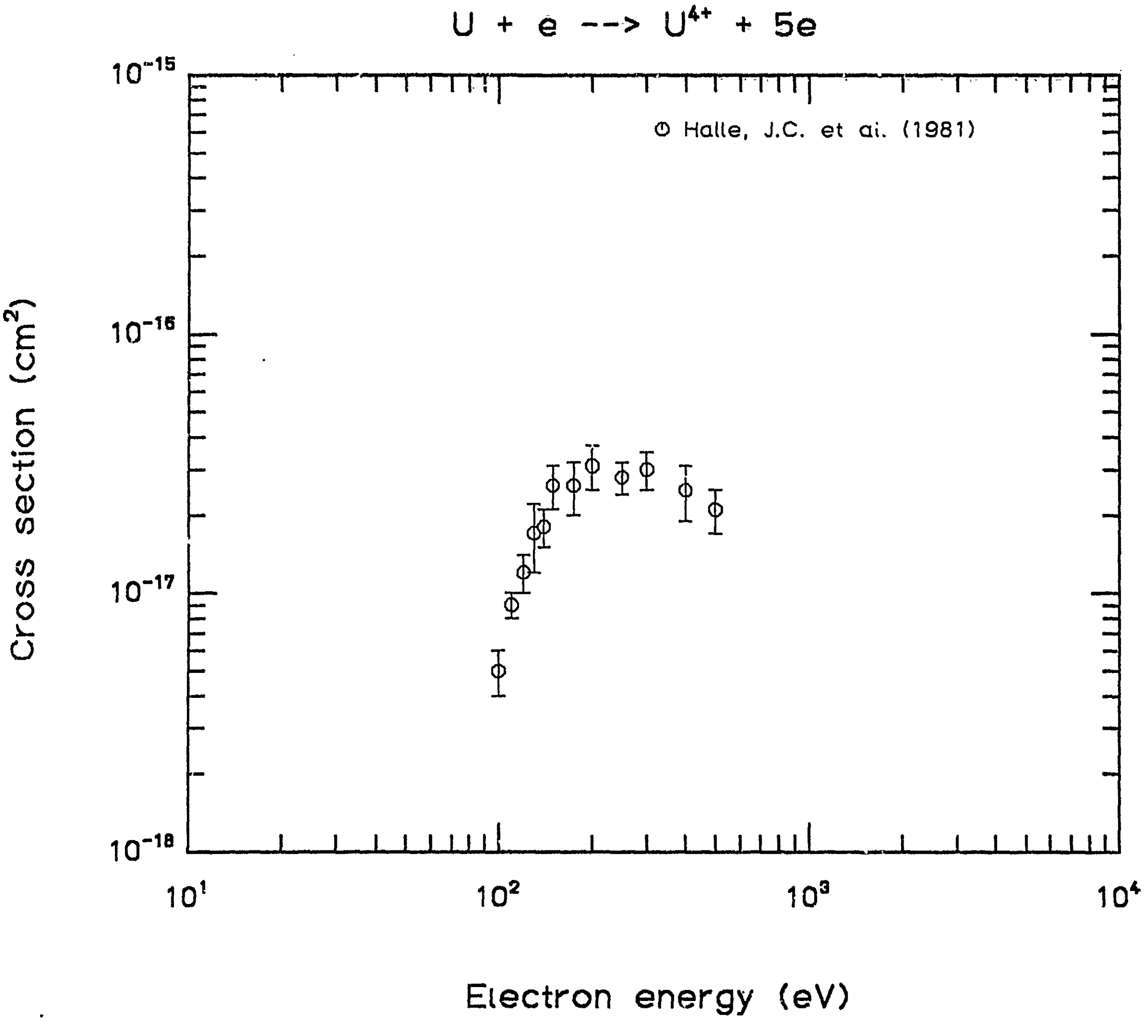


U + e --> U3+ + 4e
Halle, J.C. et al. (1981)
Cross section (cm2)
10-15
10-16
10-17
101
102
103
104
Electron energy (eV)



×10-17
U + e --> U3+ + 4e
Halle, J.C. et al. (1981)
Cross section (cm
10.0
8.0
6.0
4.0
2.0
0.0
101
102
103
104
Electron energy (eV)

Fig. 293



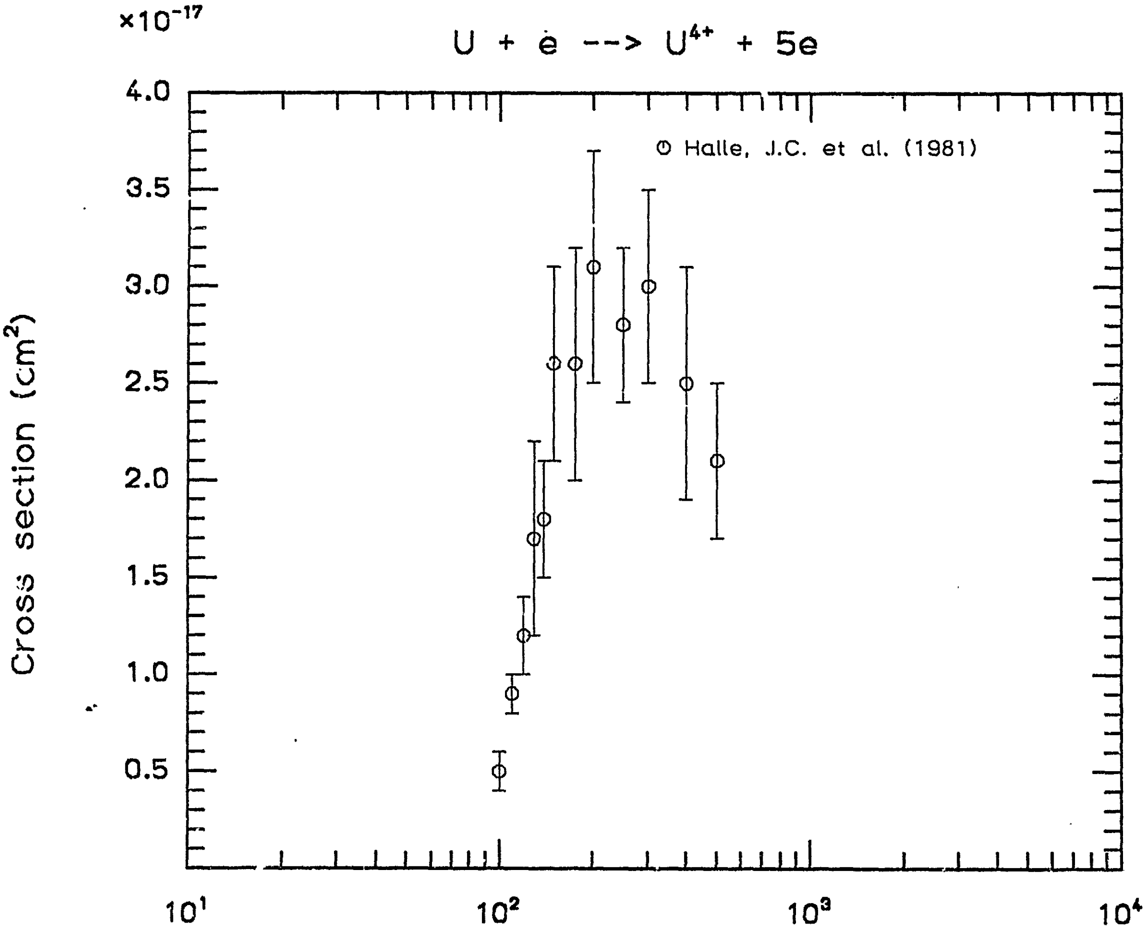


Fig. 294 Electron energy (eV)

References for Figures

Experiment

Achenbach, C., Muller, A., Salzborn, E., Becker, R.
J. Phys. B 17, 1405 (1984)
Single ionization of multiply charged xenon ions by electron impact

Adamczyk, B., Boerboom, A.J.H., Schram, B.L., Kistemaker, J.
J. Chem. Phys. 44, 4640 (1966)
Partial ionization cross sections of He, Ne, H_2 and CH_4 for electrons from 20 to 500 eV

Aitken, K.L., Harrison, M.F.A.
J. Phys. B 4, 1176 (1971)
Measurements of the cross sections for electron impact ionization of multi-electron ions. I. O^+ to O^{2+} and O^{2+} to O^{3+}

Aitken, K.L., Harrison, M.F.A., Runder, R.D.
J. Phys. B 4, 1189 (1971)
Measurement of the cross sections for electron impact ionization of multi-electron ions. II. N^{2+} to N^{3+} and C^+ to C^{2+}

Asundi, R.K., Craggs, J.D., Kurepa, M.V.
Proc. Phys. Soc. 82, 967 (1963)
Electron attachment and ionization in oxygen, carbon monoxide and carbon dioxide

Asundi, R.K., Krepa, M.V.
J. Electron. Control 15, 41 (1963)
Ionization cross sections in He, Ne, A, Kr and Xe by electron impact

Bellina, G.M., Pavlov, S.I., Rakhovskii, V.I., Sorokaletov, O.D.
J. Appl. Mechan. Tech. Phys. 2, 86 (1965)
Measurement of electron impact ionization functions for metal atoms

Bleakney, W.
Phys. Rev. 35, 139 (1930)
Probability and critical potentials for the formation of multiply charged ions in Hg vapor by electron impact

Bleakney, W.
Phys. Rev. 36, 1303 (1930)
Ionization potentials and probabilities for the formation of multiply charged ions in helium, neon and argon

Boyd, R.L., Green, G.W.
Proc. Phys. Soc. 71, 351 (1958)
Electron ionization cross sections using chopped beams

Brink, G.O.
Phys. Rev. 134, A345 (1964)
Absolute ionization cross sections of the alkali metals

Brook, E., Harrison, M.F.A., Smith, A.C.H.
J. Phys. B 11, 3115 (1978)
Measurements of the electron impact ionization cross sections of He, C, O and N atoms

Cowling, I.R., Fletcher, J.
J. Phys. B 6, 665 (1973)
Electron-molecule collision ionization in hydrogen and deuterium

Crandall, D.H., Phaneuf, R.A., Taylor, P.O.
Phys. Rev. A 18, 1911 (1978)
Electron-impact ionization of C^{3+} and N^{4+}

Crandall, D.H., Phaneuf, R.A., Hasselquist, B.E., Gregory, D.C.
J. Phys. B 12, L249 (1979)
Measured cross sections for ionization of C^{3+}, N^{4+} and O^{5+} ions with contribution due to excitation-autoionization

Crandall, D.H., Phaneuf, R.A., Gregory, D.C.
ORNL/TM 7020 (1979)
Electrom impact ionization of multicharged ions

Crandall, D.H., Phaneuf, R.A., Falk, R.A., Belic, D.S., Dunn, G.H.
Phys. Rev. A 25, 143 (1982)
Absolute cross-section measurements for electron-impact ionization of Na-like ions-Mg^{+}, Al^{2+}, and Si^{3+}

Crawford, C.K., Wang, K.I.
J. Chem. Phys. 47, 4667 (1967)
Electron-impact ionization cross sections for silver

Crowe, A., McConkey, J.W.
J. Phys. B 6, 2088 (1973)
Dissociative ionization by electron impact I. protons from H_2

Crowe, A., McConkey, J.W.
J. Phys. B 6, 2108 (1973)
Dissociative ionization by electron impact II. N^{+} and N^{++} from N_2

Daly, N.R., Powell, R.E.
Proc. Phys. Soc. 89, 273 (1966)
Electron collisions in nitrogen

Danjo, A., Matsumoto, A., Ohtani, S., Suzuki, H., Tawara, H., Wakiya, K., Yoshino, M.
J. Phys. Soc. Jpn. 53, 4091 (1984)
Electron impact single ionization of Ne^{2+}, Ar^{2+}, Kr^{2+} and Xe^{2+} ions

Defrance, P., Brouillard, F., Claeys, W., van Wassenhove, G.
J. Phys. B 14, 103 (1981)
Crossed beam measurement of absolute cross sections on alternative method and its application to the electron impact ionisation of He^{+}

Defrance, P., Claeys, W., Cornet, A., Poulaert, G.
J. Phys. B 14, 111 (1981)
Electron impact ionization of metastable atomic hydrogen

Dettman, J.M., Karstensen, F.
J. Phys. B 15, 287 (1982)
Absolute ionisation functions for electron impact with barium

Diserens, M.J., Harrison, M.F.A., Smith, A.C.H.
J. Phys. B 17, L621 (1984)
A measurement of the cross section for electron impact ionisation of Ne^{+}

Divine, T.F., Feeney, R.F., Sayle, II, W.E., Hooper, J.W.
Phys. Rev. A 13, 54 (1976)
Absolute experimental cross section for the ionization of Tl^{+} ions by electron impact

Dixon, A.J., von Engel, A., Harrison, M.F.A.
Proc. R. Soc. London A 343, 333 (1975)
A measurement of the electron impact ionization cross section of atomic hydrogen in the metastable 2S state

Dixon, A.J., Harrison, M.F.A., Smith, A.C.H.
J. Phys. B 9, 2617 (1976)
A measurement of the electron impact ionization cross sections of helium atoms in metastable states

Dolder, K.T., Harrison, M.F.A., Thonemann, P.C.
Proc. R. Soc. London A 264, 367 (1961)
A measurement of the ionization cross sections of ions by electron impact

Dolder, K.T., Harrison, M.F.A., Thonemann, P.C.
Proc. R. Soc. London A 274, 546 (1963)
A measurement of the ionization cross section of Ne^{+} to Ne^{2+} by electron impact

Donets, E.D., Ovsyannikov, V.P.
Sov. Phys.-JETP 53, 466 (1981)
Investigation of ionization of positive ions by electron impact

El-Sherbini, Th.M., Van der Wiel, M.J., de Heer, F.J.
Physica 48, 157 (1970)
Multiple ionization of Kr and Xe by 2-14 keV electrons

Falk, R.A., Dunn, G.H.
Phys. Rev. A 27, 75 (1983)
Electron-impact ionization of Be^{+}

Falk, R.A., Dunn, G.H., Gregory, D.C., Crandall, D.H.
Phys. Rev. A 27, 724 (1983)
Measurement of the contribution of excitation-autoionization to electron impact ionization of ions: Ti^{+3}, Zr^{+3}, Hf^{+3}, and Ta^{+3}

Falk, R.A., Stefani, G., Camilloni, R., Dunn, G.H., Phaneuf, R.A., Gregory, D.C., Crandall, D.H.
Phys. Rev. A 28, 91 (1983)
Measured electron-impact ionizaion of Be-like ions: B^+, C^{2+}, N^{3+}, and O^{4+}

Feeney, R.K., Hooper, J.W., Elford, M.T.
Phys. Rev. A 6, 1469 (1972)
Absolute experimental cross sections for the ionization of singly charged barium ions by electron impact

Feeney, R.K., Sayle, II, W.E., Divine, T.F.
Phys. Rev. A 18, 82 (1978)
Absolute experimental cross sections for the electron-impact ionization of Rb^+ ions

Fite, W.L., Brackmann, R.T.
Phys. Rev. 112, 1141 (1958)
Collisions of electron with hydrogen atoms. I. Ionization

Fite, W.L., Brackmann, R.T.
Phys. Rev. 113, 815 (1959)
Ionization of atomic oxygen on electron impact

Fletcher, J., Cowling, I.R.
J. Phys. B 6, L258 (1973)
Electron impact ionization of neon and argon

Gaudin, A., Hageman, R.
J. Chim. Phys. 64, 1209 (1967)
Determinations absolues des sections efficaces totales et partielles d'ionisation de l'helium, du neon, de l'argon et de lacetylene, pour des electrons de 100 a 200 eV

Gregory, D.C., Dittner, P.F., Crandall, D.H.
Phys. Rev. A 27, 724 (1983)
Absolute-cross-section measurements for electron-impact ionization of triply charged inert-gas ions: Ne^{3+}, Ar^{3+}, Kr^{3+}, and Xe^{3+}

Gregory, D.C., Crandall, D.H.
Phys. Rev. A 27, 2338 (1983)
Measurement of the cross section for electron-impact ionization of Xe^{6+} ions

Gregory, D.C., Crandall, D.H., Phaneuf, R.A., Howald, A.M., Dunn, G.H., Falk, R.A., Mueller, D.W., Morgan, T.J.
ORNL/TM 9501 (1985)
Electron impact ionization of multicharged ions at ORNL:1980-1984

Griffin, D.C., Bottcher, C., Pindzola, M.S., Younger, S.M., Gregory, D.C., Crandall, D.H.
Phys. Rev. A 29, 1729 (1984)
Electron-impact ionization in the xenon isonuclear sequence

Halas, St., Adamczyk, B.
Int. J. Mass Spectrometry and Ion Phys. 10, 157 (1972)
Cross sections for the production of N^+_2, N^+ and N^{2+}_2 from nitrogen by electrons in the energy range 16-600 eV

Halle, J.C., Lo, H.H., Fite, W.
Phys. Rev. A 23, 1708 (1981)
Ionization of uranium atoms by electron impact

Hamdan, M., Birkinshaw, K., Hasted, J.B.
J. Phys. B 11, 331 (1978)
Ionisation of positive ions by electons in the hollow-beam trap.

Harrison, M.F.A., Dolder, K.T., Thonemann, P.C.
Proc. Phys. Soc. 82, 368 (1963)
A measurement of the cross section for the ionization of N^+ to N^{2+} by electron impact

Hasted, J.B., Awad, G.L.
J. Phys. B 5, 1719 (1972)
Electron impact ionization of ions trapped in a hollow electron beam.

Heil, H., Scott, B.
Phys. Rev. 145, 279 (1966)
Cesium ionization cross section from threshold to 50 eV

Hertling, D.R., Feeney, R.K., Hughes, D.W., Sayle II, W.E.
J. Appl. Phys. 53, 5427 (1982)
Absolute experimental cross sections for the electron impact single, double, triple, and quadruple ionization of Cs^+ ions

Hooper, J.W., Lineberger, W.C., Bacon, F.M.
Phys. Rev. 141, 165 (1966)
Absolute cross sections for single ionization of alkali ions by electron impact.
II. Na^+ and K^+ results and comparison with theory

Hughes, D.W., Feeney, R.K.
Phys. Rev. A 23, 2241 (1981)
Absolute experimental cross sections for the electron-impact multiple ionization of singly charged rubidium ions

Jalin, R., Hageman, R., Botter, R.
J. Chem. Phys. 59, 952 (1973)
Absolute electron impact ionization cross sections of Li in the energy range from 100 to 2000 eV

Jones, T.J.
Phys. Rev. 29, 822 (1929)
Probability of ionization of mercury vapor by electron impact

Karstensen, F., Schneider, M.
Z. Phys. A 273, 321 (1975)
Ionization function of magnesium for electron impact

Karstensen, F., Schneider, M.
J. Phys. B 11, 167 (1978)
Absolute cross sections for single and double ionization of Mg atoms by electron impact

Korchevoi, Yu.P., Przonski, A.M.
Sov. Phys.-JETP 24, 1089 (1967)
Effective electron excitation and ionization cross sections for cesium, rubidium and potassium atoms in the pre-threshold region

Krebarle, P., Godbole, E.W.
J. Chem. Phys. 36, 302 (1962)
Ionization and fragmentation of some molecules by high energy electrons

Lin, S.S., Stafford, F.E.
J. Chem. Phys. 47, 4664 (1967)
Electron-impact ionization cross sections. IV. group IVb atoms

Lineberger, W.C., Hooper, J.W., McDaniel, E.W.
Phys. Rev. 141, 151 (1966)
Absolute cross sections for single ionization of alkali ions by electron impact. I. Description of apparatus and Li^+ results

Liska, J.W.
Phys. Rev. 46, 169 (1934)
Efficiencies of ionization of helium and mercury by electron impact at high voltage

Long, D.R., Geballe, R.
Phys. Rev. A 1, 260 (1970)
Electron-impact ionization of He(2s ^3S)

Lyubimov, A.P., Pavlov, S.I., Rakhovskii, V.I., Zaitseva, N.G.
Bull. Acad. USSR. Phys. Ser. 17, 1033 (1963)
Procedure for measuring the ionization cross sections and ionization coefficients of metal atoms

Muller, A., Salzborn, E., Frodl, R., Becker, R., Klein, H., Winter, H.
J. Phys. B 13, 1877 (1980)
Absolute ionization cross sections for electron incident on O^+ , Ne^+ , Xe^+ , and Ar^{i+} (i=1,...,5) ions

Muller, A., Frodl, R.
Phys. Rev. Lett. 44, 29 (1980)
L-shell contributions to multiple ionization of Ar^{i+} ions (i=1,2,3) by electron impact

Mark, T.D.
J. Chem. Phys. 63, 3731 (1975)
Cross section for single and double ionization of N_2 and O_2 molecules by electron impact from threshold up to 170 eV

Martin, S.O., Peart, B., Dolder, K.T.
J. Phys. B 1, 537 (1968)
Measurements of cross sections for the ionization of Mg^+ to Mg^{2+} by electron impact

McFarland, R.H., Kinney, J.D.
Phys. Rev. 137, A1058 (1965)
Absolute cross sections of lithium and other alkali metal atoms for ionization by electrons

McFarland, R.H.
Phys. Rev. 159, 20 (1967)
Electron-impact ionization measurements of surface-ionizable atoms

McGowan, J.W., Clarke, E.M.
Phys. Rev. 167, 43 (1968)
Ionization of H(1s) near threshold

McGowan, J.W., Fineman, R.A., Clarke, E.M., Hanson, H.P.
Phys. Rev. 167, 52 (1968)
Direct and auto-ionization of H_2 near threshold

Montague, R.G., Harrison, M.F.A.
J. Phys. B 16, 3045 (1983)
A Measurement of the Cross Section for Electron Impact Ionization of Al^+

Montague, R.G., Diserens, M.J., Harrison, M.F.A.
J. Phys. B 17, 2085 (1984)
A measurement of the cross section for electron impact ionisation of Fe^+

Montague, R.G., Harrison, M.F.A.
J. Phys. B 17, 2707 (1984)
A measurement of the cross section for electron impact ionisation of singly charged tungsten ions

Montague, R.G., Harrison, M.F.A., Smith, A.C.H.
J. Phys. B 17, 3295 (1984)
A measurement of the cross section for ionisation of helium by electron impact using a fast crossed beam technique

Muller, A., Achenbach, C., Salzborn, E., Becker, R.
J. Phys. B 17, 1427 (1984)
Multiple ionization of multiply charged xenon ions by electron impact

Muller, A., Tinschert, K., Achenbach, C., Becker, R., Salzborn, E.
J. Phys. B (1984)
Electron-impact double ionisation of Ar^{1+} and Ar^{4+} ions

Muller, A., Tinschert, K., Achenbach, C., Salzborn, E., Becker, R., Pindzola, M.S.
Phys. Rev. Letters 54, 414 (1985)
Collision-strength shift in electron impact single and double ionization of Sb and Bi ions

Muller, A.
Private Communication (1985)

Nagy, P., Skutlartz, A., Schmidt, V.
J. Phys. B 13, 1249 (1980)
Absolute ionization cross sections for electron impact in rare gases

Nygaard, K.J.
J. Chem. Phys. 49, 1995 (1968)
Electron-impact ionization cross sections in cesium

Okuno, Y., Okuno, K., Kaneko, Y., Kanomata, I.
J. Phys. Soc. Jpn. 29, 164 (1970)
Absolute mesurement of total ionization cross section of Mg by electron impact

Okuno, Y.
J. Phys. Soc. Jpn. 31, 1189 (1971)
Ionization cross sections of Ca, Sr and Ba by electron impact

Pavlov, S.I., Rakhovskii, V.I., Fedorova, G.M.
Sov. Phys.-JETP 25, 12 (1967)
Measurement of cross sections for ionization by electron impact at low vapor pressures

Pavlov, S.I., Stotskii, G.I.
Sov. Phys.-JETP 31, 61 (1970)
Single and multiple ionization of lead atoms by electrons

Peart, B., Dolder, K.T.
J. Phys. B 1, 240 (1968)
Measurements of cross sections for the ionization of Na^+ to Na^{2+} and K^+ to K^{2+} by electron impact

Peart, B., Dolder, K.T.
J. Phys. B 1, 872 (1968)
Measurements of cross sections for the ionization of Li^+ and Ba^+ ions by electron impact

Peart, B., Dolder, K.T.
J. Phys. B 2, 1169 (1969)
The ionization of Li^+ to Li^{3+} by electron impact

Peart, B., Martin, S.O., Dolder, K.T.
J. Phys. B 2, 1176 (1969)
Measurements of electron impact ionization cross section of Mg^{2+} ions and a note on the classical scaling law

Peart, B., Walton, D.S., Dolder, K.T.
J. Phys. B 2, 1347 (1969)
The ranges of validity of the Born and Bethe approximations for the single ionization of He^+ and Li^+ ions by electron impact

Peart, B., Dolder, K.T.
J. Phys. B 8, 56 (1975)
Measurements of cross sections for inner- and outer- shell ionization of Rb^+, Cs^+, Ca^+ and Sr^+ ions by electron impact

Peart, B., Stevenson, J.G., Dolder, K.T.
J. Phys. B 6, 146 (1973)
Measurements of cross sections for the ionization of Ba^+ by energy resolved electrons

Pindzola, M.S., Griffin, D.C., Bottcher, C., Crandall, D.H., Phaneuf, R.A., Gregory, D.C.
Phys. Rev. A 29, 1749 (1984)
Electron-impact double ionization of rare-gas ions

Pottie, R.F.
J. Chem. Phys. 44, 916 (1966)
Cross sections for ionization by electrons. I. absolute ionization cross sections of Zn, Cd and Te_2. II. comparison of theoretical with experimental values for atoms and molecules

Rakhovskii, V.I., Stepanov, A.M.
High Temp. 7, 1001 (1969)
Absolute values of the apparent cross sections for calcium ionization by electrons

Rapp, D., Englander-Golden, P.
J. Chem. Phys. 43, 1464 (1965)
Total cross sections for ionization and attachment in gases by electron impact. I. positive ionization

Rogers, W.T., Stefani, G., Camilloni, R., Dunn, G.H., Msezane, A.Z., Henry, R.J.W.
Phys. Rev. A 25, 737 (1982)
Electron-impact ionization of Zn^+ and Ga^+

Rothe, E.W., Marino, L.L., Neynaber, R.H., Trujillo, S.M.
Phys. Rev. 125, 582 (1962)
Electron impact ionization of atomic hydrogen and atomic oxygen

Schneider, M.
J. Phys. D. 7, L83 (1974)
Measurement of absolute ionization cross sections for electron impact

Schram, B.L., de Heer, F.J., Van der Wiel M.J., Kistemaker, J.
Physica 31, 94 (1965)
Ionization cross sections for electrons (0.6-20 keV) in noble and diatomic gases

Schram, B.L., Boerboom, A.J.H., Kistemaker, J.
Physica 32, 185 (1966)
Partial ionization cross sections of noble gases for electrons with energy 0.5-16 keV. I helium and neor

Schram, B.L.
Physica 32, 197 (1966)
Partial ionization cross sections of noble gases for electrons with energy 0.5-18 keV. II argon, krypton and xenon

Schram, B.L., Moustafa, H.R., Schutten, J., de Heer, F.J.
Physica 32, 734 (1966)
Ionization cross sections for electrons (100-600 eV) in noble and diatomic gases

Schroeer, J.M., Gunduz, D.H., Livingston, S.
J. Chem. Phys. 58, 5035 (1973)
Electron impact ionization cross sections of Cu and Au between 40 and 250 eV, and the velocity of evaporated atoms

Shchemelinin, S.G., Andreev, E.P.
Sov. Phys.-Tech. Phys. 20, 941 (1976)
Absolute cross sections for single and multiple electron-impact ionization of He, Ne and Ar

Shimon, L.L., Nepiipov, E.I., Zapesochnyi, I.P.
Sov. Phys.-Tech. Phys. 20, 434 (1975)
Effective total electron-impact ionization cross sections for aluminum, gallium, indium and thallium

Smith, A.C.H., Caplinger, E., Neynaber, R.H., Rothe, E.W., Trujillo, S.M.
Phys. Rev. 127, 1647 (1962)
Electron impact ionization of atomic nitrogen

Smith, P.T.
Phys. Rev. 36, 1293 (1930)
The ionization of helium, neon, and argon by electron impact

Smith, P.T.
Phys. Rev. 37, 808 (1931)
The ionization of mercury vapor by electron impact

Srinivasan, V., Rees, J.A.
J. Appl. Phys. 18, 59 (1967)
A note on the total ionization cross section for electrons in the inert gases and carbon monoxide

Stephan, K., Helm, H., Mark, T.D.
J. Chem. Phys. 73, 3763 (1980)
Mass spectrometric determination of partial electron impact ionization cross sections of He, Ne, Ar and Kr from threshold up to 180 eV

Tate, J.T., Smith, P.T.
Phys. Rev. 39, 270 (1932)
The efficiencies of ionization and ionization potentials of various gases under electron impact

Tate, J.T., Smith, P.T.
Phys. Rev. 46, 773 (1934)
Ionization potentials and probabilities for the formation of multiply charged ions in the alkali vapors and in krypton and xenon

Tozer, B.A., Craggs, J.D.
J. Electron. Control 8, 103 (1960)
Cross sections for ionization of the inert gases by electron impact

Vainshtein, L.A., Ochkur, V.I., Rakhovskii, V.I., Stepanov, A.M.
Sov. Phys.-JETP 34, 271 (1972)
Absolute values of electron impact ionization cross sections for magnesium, calcium, strontium and barium

Van der Wiel, M.J., El-Sherbini, Th.M., Vriens, L.
Physica 42, 411 (1969)
Multiple ionization of He, Ne and Ar by 2-16 keV electrons

Wareing, J.B., Dolder, K.T.
Proc. Phys. Soc. 91, 887 (1967)
A measurement of the cross section for ionization of Li^{+} to Li^{2+} by electron impact

Woodruff, P.R., Hublet, M.-C., Harrison, M.F.A.
J. Phys. B 11, L305 (1978)
A measurement of the cross section for electron impact ionization of Ar^{+}

Woodruff, P.R., Hublet, M.-C., Harrison, M.F.A., Brook, E.
J. Phys. B 11, L679 (1978)
A measurement of the cross section for electron impact ionization of C^{2+}

Zapesochnyi, I.P., Aleksakhin, I.S.
Sov. Phys.-JETP 28, 41 (1969)
Ionization of alkali metal atoms by slow electrons

Ziegler, D.L., Newman, J.H., Smith, K.A., Stebbings, R.F.
Planet. & Space Sci. 30, 451 (1982)
Double ionization of atomic oxygen by electron impact

Ziegler, D.L., Newman, J.H., Goeller, L.N., Smith, K.A., Stebbings, R.F.
Planet. & Space Sci. 30, 1269 (1982)
Single and multiple ionization of sulfur atoms by electron impact

References for Figures

Theory

Banks, D., Boesten, L.G.J.
J. Phys. B 11, 2209 (1978)
Ionisation of He^{+} ions by electron impact

Bely, O., Schwartz, S.B., Val, J.L.
J. Phys. B 4, 1482 (1971)
Autoionization structure in the ionization of Ba^{+} by electron impact.

Blaha, M., Davis, J.
NRL Memo. Rept. 4245 (1980)
Electron ionization cross sections in the distorted-wave approximation

Burgess, A., Summers, H.P., Cochrane, D.M., McWhirter, R.W.P.
Mon. Not. R. Astron. Soc. 179, 275 (1977)
Cross-sections for ionization of positive ions by electron impact

Burke, P.G., Kingston, A.E., Thompson, A.
J. Phys. B 16, L385 (1983)
Electorn impact ionisation of Ca^{+}

Burke, P.G., Fon, W.C., Kingston, A.E.
J. Phys. B 17, L733 (1984)
Electron impact ionisation of Ti^{3+}

Burnett, T., Rountree, S.P.
Phys Rev. A 20, 1468 (1979)
Differential and total cross sections for electron-impact ionization of atomic oxygen

Griffin, D.C., Bottcher, C., Pindzola, M.S.
Phys. Rev. A 25, 154 (1982)
Contributions of excitation autoionization to the electron-impact ionization of Mg^{+}, Al^{2+}, and Si^{3+} in the distorted-wave approximation with exchange

Griffin, D.C., Pindzola, M.S., Bottcher, C.
J. Phys. B 17, 3183 (1984)
Calculations of the contributions of excitation-autoionisation to the electron impact ionisation of Ca^{+} and Ba^{+} in the distorted-wave approximation

Hahn, Y.
Phys. Rev. A 18, 1028 (1978)
Distorted-wave theory of electron-ion collisions.II. Auger ionization and excitation fluorescence

Jakubowicz, H., Moores, D.L.
J. Phys. B 14, 3733 (1981)
Electron impact ionisation of Li-like and Be-like ions

Kumar, A., Roy, B.N.
Phys. Lett. A 66, 362 (1978)
Electron impact ionization of positive ions

Kumar, A., Roy, B.N.
J. Phys. B 12, 3979 (1979)
Electron impact ionisation of alkali metal ions

Kunc, J.A.
J. Phys. B 13, 587 (1980)
Electron ionisation cross sections of excited atoms and ions

Mathur, K.C., Tripathi, A.N., Joshi, S.K.
Phys. Rev. 184, 242 (1969)
Electron-impact ionization cross section of ions.

Mathur, K.C., Tripathi, A.N., Joshi, S.K.
Astrophys. J. 165, 425 (1971)
Cross-sections and reaction rates for electron impact ionization of lithiumlike and sodiumlike positive ions.

McGuire, E.J.
Phys. Rev. A 26, 125 (1982)
Born-approximation electron ionization cross sections for Al^{n+} and some ions of the Na isoelectronic sequence

Moores, D.L.
J. Phys. B 5, 286 (1972)
Electron impact ionization of positive ions with configuration $1s^2 2s^2 2p^q$.

Moores, D.L.
J. Phys. B 11, L403 (1978)
Electron impact ionization of Li-like and Be-like carbon and nitrogen ions

Moores, D.L.
J. Phys. B 12, 4171 (1979)
The autoionisation contribution to the electron impact ionisation cross sections of C^+ and N^{2+} at low energies

Pindzola, M.S., Griffin, D.C., Bottcher, C.
Phys. Rev. A 25, 211 (1982)
Electron-impact excitation autoionization of Ga II

Pindzola, M.S., Griffin, D.C., Bottcher, C.
J. Phys. B 16, L355 (1983)
Electron impact double-ionisation of Xe II

Rudge, M.R.H., Schwartz, S.B.
Proc. Phys. Soc. 88, 579 (1966)
The ionization of complex ions by electron impact : I.- Ionization cross section for Fe XV and Fe XVI.

Salop, A.
Phys. Rev. A 14, 2905 (1976)
Electron impact ionization of multicharged ions.

Sampson, D.H., Golden, L.B.
J. Phys. B 12, L785 (1979)
Ionisation cross sections for Li-like ions including excitation-autoionisation contributions

Sampson, D.H.
J. Phys. B 15, 2087 (1982)
Ionisation of Na-like ions including excitation-autoionisation

Sato, Ŝ., Kobayashi, K., Takebe, H.
Publ. Astron. Soc. Jpn. 19, 290 (1967)
Collisional ionization cross-sections for Fe ions and the temperature of the solar corona.

Thomas, B.K., Garcia, J.D.
Phys. Rev. 179, 94 (1969)
Ionization of positive ions.

Tsuji, A., Kotegawa, H., Narumi, H.
J. Phys. Soc. Jpn. 48, 2062 (1980)
Eikonal approach to break-up processes of hydrogenic ions

Younger, S.M.
Phys. Rev. A 22, 111 (1980)
Electron-impact ionization cross sections for highly ionized hydrogen- and lithium-like atoms.

Younger, S.M.
Phys. Rev. A 22, 1425 (1980)
Electron-impact-ionization cross sections for highly ionized heliumlike atoms

Younger, S.M.
Phys. Rev. A 23, 1138 (1981)
Distorted-wave electron-impact-ionization cross sections for highly ionized neonlike atoms

Younger, S.M.
Phys. Rev. A 24, 1272 (1981)
Cross sections and rates for direct electron-impact ionization of sodiumlike ions

Younger, S.M.
Phys. Rev. A 24, 1278 (1981)
Electron-impact-ionization cross sections and rates for highly ionized berylliumlike ions

Younger, S.M.
J. Quant. Spectrosc. & Radiat. Transfer 27, 541 (1982)
Electron impact ionization rate coefficients and cross sections for highly ionized iron

Younger, S.M.
Private Communication (1982)
Analytic fits to distorted wave Born-exchange cross sections for argon ions.

Younger, S.M.
Private Communication (1982)

Younger, S.M.
Phys. Rev. A 25, 3396 (1982)
Electron impact ionization cross sections for highly ionized chlorine-like ions

Younger, S.M.
Phys. Rev. A 26, 3177 (1982)
Distorted-electron impact ionization cross sections for the argon isoelectronic sequence

Younger, S.M.
J. of Res. of the National Bureau of Standards 87, 49 (1982)
Electron impact ionization of lithium

Younger, S.M.
Private Communication (1982)
Distorted wave Born-exchange cross sections for electron impact ionization

Younger, S.M.
J. Quant. Spectrosc. & Radiat. Transfer 29, 61 (1982)
Electron ionization rate coefficients for highly ionized iron and scandium

LIST OF IPPJ-AM REPORTS

IPPJ-AM-1* "Cross Sections for Charge Transfer of Hydrogen Beams in Gases and Vapors in the Energy Range 10 eV–10 keV"
H. Tawara (1977) [Published in Atomic Data and Nuclear Data Tables 22, 491 (1978)]

IPPJ-AM-2* "Ionization and Excitation of Ions by Electron Impact –Review of Empirical Formulae–"
T. Kato (1977)

IPPJ-AM-3 "Grotrian Diagrams of Highly Ionized Iron FeVIII-FeXXVI"
K. Mori, M. Otsuka and T. Kato (1977) [Published in Atomic Data and Nuclear Data Tables 23, 196 (1979)]

IPPJ-AM-4 "Atomic Processes in Hot Plasmas and X-Ray Emission"
T. Kato (1978)

IPPJ-AM-5* "Charge Transfer between a Proton and a Heavy Metal Atom"
S.Hiraide, Y. Kigoshi and M. Matsuzawa (1978)

IPPJ-AM-6* "Free-Free Transition in a Plasma –Review of Cross Sections and Spectra–"
T. Kato and H. Narumi (1978)

IPPJ-AM-7* "Bibliography on Electron Collisions with Atomic Positive Ions: 1940 Through 1977"
K. Takayanagi and T. Iwai (1978)

IPPJ-AM-8 "Semi-Empirical Cross Sections and Rate Coefficients for Excitation and Ionization by Electron Collision and Photoionization of Helium"
T. Fujimoto (1978)

IPPJ-AM-9 "Charge Changing Cross Sections for Heavy-Particle Collisions in the Energy Range from 0.1 eV to 10 MeV I. Incidence of He, Li, Be, B and Their Ions"
Kazuhiko Okuno (1978)

IPPJ-AM-10 "Charge Changing Cross Sections for Heavy-Particle Collisions in the Energy Range from 0.1 eV to 10 MeV II. Incidence of C, N, O and Their Ions"
Kazuhiko Okuno (1978)

IPPJ-AM-11 "Charge Changing Cross Sections for Heavy-Particle Collisions in the Energy Range from 0.1 eV to 10 Mev III. Incidence of F, Ne, Na and Their Ions"
Kazuhiko Okuno (1978)

IPPJ-AM-12* "Electron Impact Excitation of Positive Ions Calculated in the Coulomb-Born Approximation –A Data List and Comparative Survey–"
S. Nakazaki and T. Hashino (1979)

IPPJ-AM-13 "Atomic Processes in Fusion Plasmas – Proceedings of the Nagoya Seminar on Atomic Processes in Fusion Plasmas Sept. 5-7, 1979"
Ed. by Y. Itikawa and T. Kato (1979)

IPPJ-AM-14 "Energy Dependence of Sputtering Yields of Monatomic Solids"
N. Matsunami, Y. Yamamura, Y. Itikawa, N. Itoh, Y. Kazumata, S. Miyagawa, K. Morita and R. Shimizu (1980)

IPPJ-AM-15 "Cross Sections for Charge Transfer Collisions Involving Hydrogen Atoms"
Y. Kaneko, T. Arikawa, Y. Itikawa, T. Iwai, T. Kato, M. Matsuzawa, Y. Nakai, K. Okuno, H. Ryufuku, H. Tawara and T. Watanabe (1980)

IPPJ-AM-16 "Two-Centre Coulomb Phaseshifts and Radial Functions"
H. Nakamura and H. Takagi (1980)

IPPJ-AM-17 "Empirical Formulas for Ionization Cross Section of Atomic Ions for Electron Collisions –Critical Review with Compilation of Experimental Data–"
Y. Itikawa and T. Kato (1981)

IPPJ-AM-18 "Data on the Backscattering Coefficients of Light Ions from Solids"
T. Tabata, R. Ito, Y. Itikawa, N. Itoh and K. Morita (1981)

IPPJ-AM-19 "Recommended Values of Transport Cross Sections for Elastic Collision and Total Collision Cross Section for Electrons in Atomic and Molecular Gases"
M. Hayashi (1981)

IPPJ-AM-20 "Electron Capture and Loss Cross Sections for Collisions between Heavy Ions and Hydrogen Molecules"
Y. Kaneko, Y. Itikawa, T. Iwai, T. Kato, Y. Nakai, K. Okuno and H. Tawara (1981)

IPPJ-AM-21 "Surface Data for Fusion Devices – Proceedings of the U.S–Japan Workshop on Surface Data Review Dec. 14-18, 1981"
Ed. by N. Itoh and E.W. Thomas (1982)

IPPJ-AM-22 "Desorption and Related Phenomena Relevant to Fusion Devices"
Ed. by A. Koma (1982)

IPPJ-AM-23 "Dielectronic Recombination of Hydrogenic Ions"
T. Fujimoto, T. Kato and Y. Nakamura (1982)

IPPJ-AM-24 "Bibliography on Electron Collisions with Atomic Positive Ions: 1978 Through 1982 (Supplement to IPPJ-AM-7)"
Y. Itikawa (1982)

IPPJ-AM-25 "Bibliography on Ionization and Charge Transfer Processes in Ion-Ion Collision"
H. Tawara (1983)

IPPJ-AM-26 "Angular Dependence of Sputtering Yields of Monatomic Solids"
Y. Yamamura, Y. Itikawa and N. Itoh (1983)

IPPJ-AM-27 "Recommended Data on Excitation of Carbon and Oxygen Ions by Electron Collisions"
Y. Itikawa, S. Hara, T. Kato, S. Nakazaki, M.S. Pindzola and D.H. Crandall (1983)

IPPJ-AM-28 "Electron Capture and Loss Cross Sections for Collisions Between Heavy Ions and Hydrogen Molecules (Up-dated version of IPPJ-AM-20)
H. Tawara, T. Kato and Y. Nakai (1983)

IPPJ-AM-29 "Bibliography on Atomic Processes in Hot Dense Plasmas"
T. Kato, J. Hama, T. Kagawa, S. Karashima, N. Miyanaga, H. Tawara, N. Yamaguchi, K. Yamamoto and K. Yonei (1983)

IPPJ-AM-30 "Cross Sections for Charge Transfers of Highly Ionized Ions in Hydrogen Atoms (Up-dated version of IPPJ-AM-15)"
H. Tawara, T. Kato and Y. Nakai (1983)

IPPJ-AM-31 "Atomic Processes in Hot Dense Plasmas"
T. Kagawa, T. Kato, T. Watanabe and S. Karashima (1983)

IPPJ-AM-32 "Energy Dependence of the Yields of Ion-Induced Sputtering of Monatomic Solids"
N. Matsunami, Y. Yamamura, Y. Itikawa, N. Itoh, Y. Kazumata, S. Miyagawa, K. Morita, R. Shimizu and H. Tawara (1983)

IPPJ-AM-33 "Proceedings on Symposium on Atomic Collision Data for Diagnostics and Modelling of Fusion Plasmas, Aug. 29 – 30, 1983"
Ed. by H. Tawara (1983)

IPPJ-AM-34 "Dependence of the Backscattering Coefficients of Light Ions upon Angle of Incidence"
T. Tabata, R. Ito , Y. Itikawa, N. Itoh, K. Morita and H. Tawara (1984)

IPPJ-AM-35 "Proceedings of Workshop on Synergistic Effects in Surface Phenomena Related to Plasma-Wall Interactions, May 21 – 23, 1984"
Ed. by N. Itoh, K. Kamada and H. Tawara (1984)

IPPJ-AM-36 "Equilibrium Charge State Distributions of Ions ($Z_1 \geqq 4$) after Passage through Foils – Compilation of Data after 1972"
K. Shima, T. Mikumo and H. Tawara (1985)

IPPJ-AM-37 "Ionization Cross Sections of Atoms and Ions by Electron Impact"
H. Tawara, T. Kato and M. Ohnishi (1985)

Available upon request to Research Information Center, Institute of Plasma Physics, Nagoya University, Nagoya 464, Japan, except for the reports noted with*.