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ヘリウム原子・イオンと原子分子の衝突に関するデータ集・I

(He, He^+ およびHe^{++} とH, H_2 および He の電荷移動断面積)

1980年5月

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日本原子力研究所
Japan Atomic Energy Research Institute

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ヘリウム原子・イオンと原子分子の衝突に関するデータ集・I
(He, He^+ および He^{++} とH, H_2 およびHeの電荷移動断面積)

日本原子力研究所東海研究所物理部
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(1980年4月11日受理)

この報告書は，He，He^+ および He^{++} とH，H_2 およびHe の電荷移動断面積の実験データを収集したものである。このデータ集は，上述の過程の1979年末までに数値表として発表された文献を調べた結果のものであり，断面積の値を入射粒子のエネルギーの函数としてグラフおよび数値表として文献リストとともにまとめた。

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Data on Collisions of Helium Atoms and Ions with Atoms and Molecules I. (Cross Sections for Charge Transfer of He, He^+, and He^{++} with H, H_2, and He)

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(Received April 11, 1980)

This report presents a compilation of the experimental data on cross sections for charge transfer of He, He^+, and He^{++} with H, H_2, and He.

A survey has been made systematically of the literature up to the end of 1979. The cross sections are given as a function of projectile energy in graphs and tables ; a list of references is also attached.

Keywords: Charge Transfer, Helium Atom, Helium Ion, α-particle, Atomic Hydrogen, Ion-Atom Collision, Atom-Atom Collision, Ion-Ion Collision, Data, Cross section

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Contents

1. はじめに

He 原子およびイオンと原子分子の衝突による電荷移動過程は，最近，衝突過程の基礎的な解明という見地からはもとより，プラズマ物理，宇宙空間の物理，放射線物理や加速器物理などの分野で重要な役割を演じていることが認識され，注目を浴びている。

この中でも，とくに重要なのは，将来のＤＴ核融合炉では

$$D^+ + T^+ \rightarrow 4He^{++}(3.5\,MeV) + n(14.1\,MeV) \quad (1)$$

によって3.5MeVのHe^{++} が発生する。そしてプラズマ構成粒子との衝突による減速過程の中で，もし中性粒子Aが存在すると

$$He^{++} + A \rightarrow He^+ + A^+ \quad (2)$$

$$He^+ + A \rightarrow He + A^+ \quad (3)$$

の電荷移動反応によって中性のHe 原子が生成し，プラズマの磁場閉込めから離脱して，壁へエネルギーをもち去る。この壁にあたる中性He の生成量を推定するには，He 原子・イオンの3.5MeV 以下の全エネルギー領域にわたり，上の(2)(3)の過程を含めた考えられるすべての可能な過程の断面積が必要になってくる。

He 原子・イオンと原子分子の電荷移動断面積については2,3のデータ集[1)~3)]にも収集されているが，われわれは，上述のような見地から標的Aとしては H，H_2，He をえらび，われわれ自身が測定した最近のデータを含めて，Table 1 に示すような電荷移動過程の収集を行った。この中で最後の過程は，最近話題になっているイオン交叉法によって得られたイオン－イオン衝突の実験結果で注目のデータであるのでとくにとりあげた。

収集したデータは，１９７９年末までの実験データのうちで数値データが表として記載されているものをえらんだ。しかし，これらの過程の中で，文献にグラフのみしか与えられていなく，どうしても必要なものについては，直接著者に依頼して数値データの提供を得た。

さらに１９７５年までのデータについてはBarnett et al. のデータ集[1)]の評価した数値を主として利用し，そこに引用しているものは多少の例外を除いて文献名のみ記した。

データとしては，各文献に記載されている数値をそのままグラフ化および数値表化した。

2. 説　　明

2.1 過程の説明

一般に電子捕獲，損失などの電荷移動断面積の過程は標的原子分子が中性である場合には

$$He^{i+} + A \rightarrow He^{f+} + A^{k+} + (f + k - i)e \quad (4)$$

であらわされる。こゝでｉ，ｆは入射粒子の衝突前後の電荷数，ｋは標的原子分子の衝突後の電荷数である。この過程の断面積をσ_{if0k} とすると，

$$\sigma_{if} = \sum_{k} \sigma_{ifok} \qquad (5)$$

が入射粒子の電荷移動断面積を表わす。そして，i＞fの場合を電子捕獲断面積，i＜fの場合を電子損失断面積と称する。

したがって，ここでまとめた電荷移動断面積については，入射粒子のみに注目して，その電荷の変化をみていてとくに標的原子分子の衝突にともなう状態の変化についてはふれていない。したがって，ここでは過程の表示としては，例えば，

$$\left.\begin{aligned} He^{+} + H_2 &\rightarrow He \quad \sigma_{10} \\ He^{++} + H_2 &\rightarrow He \quad \sigma_{20} \end{aligned}\right\} \qquad (6)$$

のように記述する。

2.2 グラフおよび表の説明

グラフは，核データセンターのSPLINTプログラムを利用して作図した。このグラフはデータの全貌を見るために，エネルギー範囲を1eVから10^7eVにとっている。しかし，SPLINTでは，このX，Y軸の長さ，スケールをlog. linearなどを含めて自由にかえうるので，利用者からの依頼があれば，任意の形で作図することが出来る。

もちろん，これらの数値データはすべて計算機のなかにファィルされているので，必要な場合はいつもとり出せる。

数値表については，各文献に記載されているものをそのまゝ示すとともに，利用者の便を考えて，エネルギーおよび断面積を次のような表示であらわしている。

E（EV）：electron volt単位

E（AU）：atomic unit単位

$$1\ a.u. = e^2/a_0 = 2\ Ry = 27.212\ eV$$

E（RY）：Rydberg単位：

$$1\ Ry = 13.606\ eV$$

E（KEV）：keV単位

V（10(8)＊CM／SEC）

＝V（10^8 cm／sec）：速度単位

SIGMA（CM(2)）＝σ（cm^2）：断面積

SIGMA（AU）＝σ（a.u）：原子単位での断面積

$$1\ a.u = a_0^2 = 0.280028 \times 10^{-16}\ cm^2$$

SIGMA（PAI＊AO(2)）＝σ（πa_0^2）：πa_0^2単位の断面積

$$\pi a_0^2 = 0.879735 \times 10^{-16}\ cm^2$$

なおこれらの数値は文献2によった。

また，グラフおよび表に記載されている過程の表示は次の通りである。たとえば(6)式の場合には

HE＋－H2（10）

HE++−H2(20)

になっている。

さらに，He^{++} の実験データはほとんど全部 $^4He^{++}$ を用いず $^3He^{++}$ を用いているので，エネルギーの値は $^4He^{++}$ に換算した。$^3He^{++}$ を用いる理由は $^4He^{++}$ であると，中に不純物として含まれている H_2^+ と，磁場で曲げた場合に分けられないためである。

なお，以下のグラフおよび数値表の番号は，Table Ⅰの過程の番号と対応させてあり，したがってNo data の過程は欠番になっている。

3. コ メ ン ト

このデータ集は，あくまで，今後の数値データの評価や，経験式を作成するための一次資料および一連の過程のデータの現状を把握するために収集したものである。したがって，こゝでは，個々のデータについての考察を加えることは避けるが，全般を見渡し，実際に収集を行って気のついたことを二，三述べておく。

ⅰ) ターゲットがHすなわち水素原子のデータは，全般的にみて，非常に少なく最近になってやっと出はじめた。これは，きちんとしたターゲット用水素原子の生成およびその量の測定の困難さによるものと思われる。とくにTable Ⅰの過程(12)(15)はまだデータが存在しないので，一刻も早く他の過程で水素原子での測定を行ったグループなどによる測定が望まれる。

ⅱ) 全般的に低エネルギー（数10keV）以下のデータが不足している。この領域の加速器をもっているところと研究者の興味がマッチングすれば幸である。

ⅲ) 新しい測定値（1975年以降位）と古い測定値の（1960年前半位）の違いの見られるものがある。例えば過程(10)の $He^+ + H_2$ の σ_{12} は，Fig. 10でもわかるようにBarnettのデータ集[1]に出ている値と，Shahやわれわれの測定した値が相当に違っている。前者の値は，1962年代に測定されたもので，この当時では，実験技術たとえば真空技術，試料気体圧力の測定方法および入射粒子の調整方法などに問題があり，最近の新しい実験技術を駆使して洗いなおす必要があるのではなかろうかと思われる。

おわりに，このデータ集のグラフ化に際し，SPLINTプログラムの利用をすゝめて頂いた核データセンター成田孟氏に謝意を表する。また著者たちの求めに応じて数値データを提供されたORNLのDr. Phaneuf および名大プラズマ研究所の野田信明博士の御協力に謝意を表する。

4. 本 文 の 文 献

1) C.F.Barnett, J.A.Ray, E.Ricci, M.I.Wilker, E.W.McDaniel, E.W.Thomas H.B.Gilbody; Atomic Data for Controlled Fusion

Research : ORNL-5206 (Vol 1) (1977).

2) K. Takayanagi, H. Suzuki and S. Ohtani ed; Cross Sections for Atomic Processes Vol 2. (1976). Institute of Plasma Physics, Nagoya University.

3) K. Okuno ; 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, IPPJ-AM-9, (1978) Institute of Plasma Physics, Nagoya University.

Table I. Compiled Processes

Type of Cross Sections	Processes	Remarks
σ_{10}	(1) $He^{+} + H \rightarrow He$ (2) $He^{+} + H_2 \rightarrow He$ (3) $He^{+} + He \rightarrow He$	
σ_{21}	(4) $He^{++} + H \rightarrow He^{+}$ (5) $He^{++} + H_2 \rightarrow He^{+}$ (6) $He^{++} + He \rightarrow He^{+}$	
σ_{20}	(7) $He^{++} + H_2 \rightarrow He$ (8) $He^{++} + He \rightarrow He$	
σ_{12}	(9) $He^{+} + H \rightarrow He^{++}$ (10) $He^{+} + H_2 \rightarrow He^{++}$ (11) $He^{+} + He \rightarrow He^{++}$	
σ_{01}	(12) $He + H \rightarrow He^{+}$ (13) $He + H_2 \rightarrow He^{+}$ (14) $He + He \rightarrow He^{+}$	No data
σ_{02}	(15) $He + H \rightarrow He^{++}$ (16) $He + H_2 \rightarrow He^{++}$ (17) $He^{+} + He \rightarrow He^{++}$	No data
σ_{12}	(18) $He^{+} + H^{+} \rightarrow He^{++}$	

5. Figures and Tables

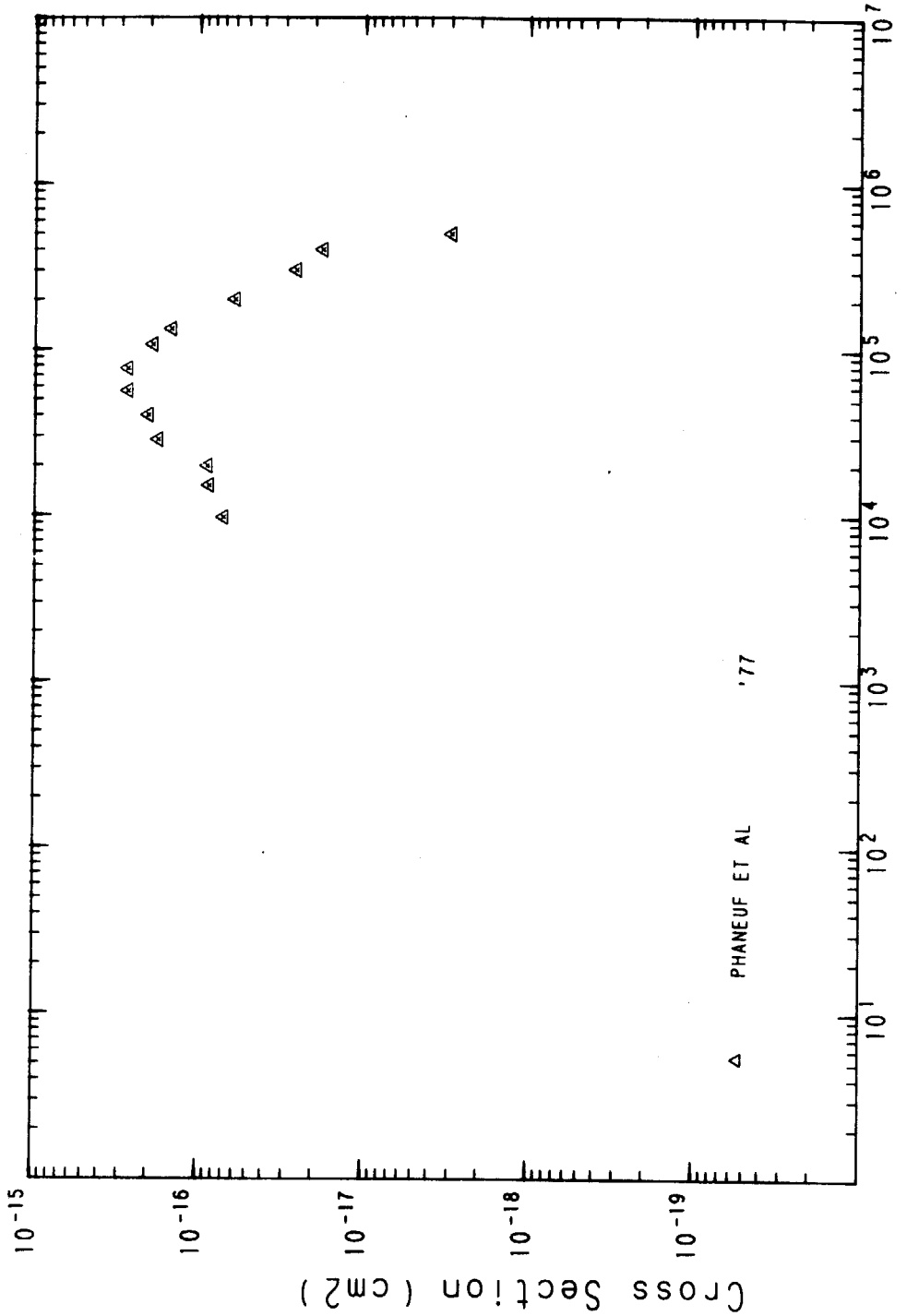

FIG. 1

TABLE 1

PROCESS : HE+-H(10)
PHANEUF ET AL. PHYS.REV. A16 1867(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
9.700E+03	3.565E+02	7.129E+02	9.700E+00	6.840E-01	7.100E-17	2.535E+00	8.071E-01
1.510E+04	5.549E+02	1.110E+03	1.510E+01	8.535E-01	8.700E-17	3.107E+00	9.889E-01
1.980E+04	7.276E+02	1.455E+03	1.980E+01	9.773E-01	8.900E-17	3.178E+00	1.012E+00
2.850E+04	1.047E+03	2.095E+03	2.850E+01	1.173E+00	1.770E-16	6.321E+00	2.012E+00
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	2.030E-16	7.249E+00	2.308E+00
5.600E+04	2.058E+03	4.116E+03	5.600E+01	1.644E+00	2.710E-16	9.678E+00	3.080E+00
7.670E+04	2.819E+03	5.637E+03	7.670E+01	1.924E+00	2.720E-16	9.713E+00	3.092E+00
1.070E+05	3.932E+03	7.864E+03	1.070E+02	2.272E+00	1.920E-16	6.856E+00	2.182E+00
1.330E+05	4.888E+03	9.775E+03	1.330E+02	2.533E+00	1.480E-16	5.285E+00	1.682E+00
2.010E+05	7.386E+03	1.477E+04	2.010E+02	3.114E+00	6.100E-17	2.178E+00	6.934E-01
3.030E+05	1.113E+04	2.227E+04	3.030E+02	3.823E+00	2.600E-17	9.285E-01	2.955E-01
4.030E+05	1.481E+04	2.962E+04	4.030E+02	4.409E+00	1.800E-17	6.428E-01	2.046E-01
5.030E+05	1.848E+04	3.697E+04	5.030E+02	4.926E+00	3.000E-18	1.071E-01	3.410E-02

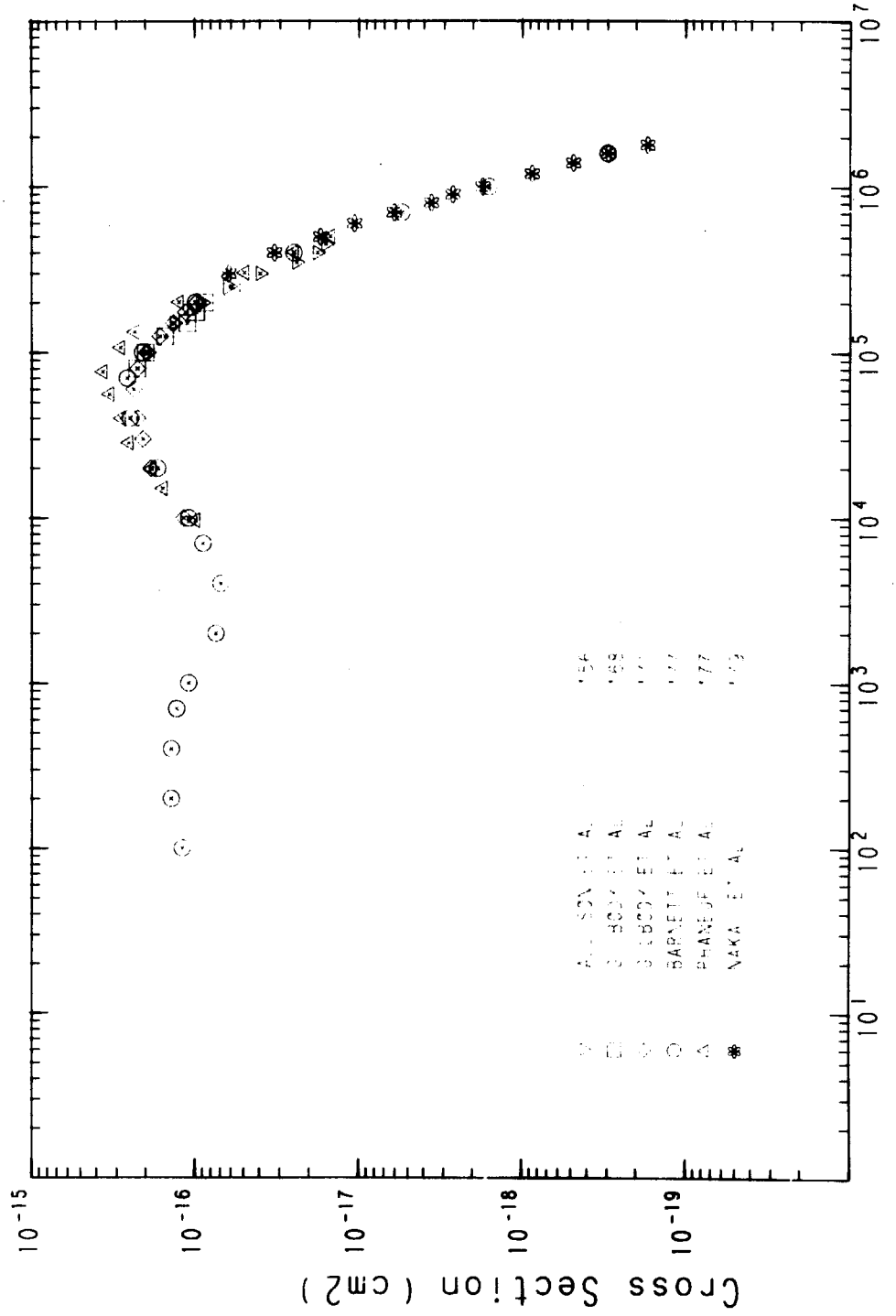

FIG. 2 HE+-H2(10) ENERGY 100.00(eV) - 1.80(MeV)

TABLE 2

PROCESS : HE+-H2(10)
ALLISON ET AL, PHYS.REV.102 1041(1956)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	1.940E-16	6.928E+00	2.205E+00
1.500E+05	5.512E+03	1.102E+04	1.500E+02	2.690E+00	1.340E-16	4.785E+00	1.523E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	9.000E-17	3.214E+00	1.023E+00
2.500E+05	9.187E+03	1.837E+04	2.500E+02	3.473E+00	6.200E-17	2.214E+00	7.048E-01
3.000E+05	1.102E+04	2.205E+04	3.000E+02	3.804E+00	4.000E-17	1.428E+00	4.547E-01
3.500E+05	1.286E+04	2.572E+04	3.500E+02	4.109E+00	2.400E-17	8.571E-01	2.728E-01
4.000E+05	1.470E+04	2.940E+04	4.000E+02	4.393E+00	1.800E-17	6.428E-01	2.046E-01
4.500E+05	1.654E+04	3.307E+04	4.500E+02	4.659E+00	1.600E-17	5.714E-01	1.819E-01

PROCESS : HE+-H2(10)
GILBODY ET AL, J. PHYS. B1 863 (1968)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
8.000E+04	2.940E+03	5.880E+03	8.000E+01	1.964E+00	2.260E-16	8.071E+00	2.569E+00
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	2.010E-16	7.178E+00	2.285E+00
1.250E+05	4.594E+03	9.187E+03	1.250E+02	2.456E+00	1.530E-16	5.464E+00	1.739E+00
1.500E+05	5.512E+03	1.102E+04	1.500E+02	2.690E+00	1.120E-16	4.000E+00	1.273E+00
1.750E+05	6.431E+03	1.286E+04	1.750E+02	2.905E+00	9.900E-17	3.535E+00	1.125E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	8.800E-17	3.143E+00	1.000E+00
2.500E+05	9.187E+03	1.837E+04	2.500E+02	3.473E+00	6.000E-17	2.143E+00	6.820E-01

TABLE 2 - CONTINUED

PROCESS : HE+-H2(10)
GILBODY ET AL. J. PHYS. B 4 800 (1971)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
1.000E+04	3.675E+02	7.350E+02	1.000E+01	6.945E-01	1.180E-16	4.214E+00	1.341E+00
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	1.870E-16	6.678E+00	2.126E+00
3.000E+04	1.102E+03	2.205E+03	3.000E+01	1.203E+00	2.090E-16	7.464E+00	2.376E+00
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	2.250E-16	8.035E+00	2.558E+00
6.000E+04	2.205E+03	4.410E+03	6.000E+01	1.701E+00	2.370E-16	8.463E+00	2.694E+00
8.000E+04	2.940E+03	5.880E+03	8.000E+01	1.964E+00	2.250E-16	8.035E+00	2.558E+00
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	1.980E-16	7.071E+00	2.251E+00
1.250E+05	4.594E+03	9.187E+03	1.250E+02	2.456E+00	1.640E-16	5.857E+00	1.864E+00
1.500E+05	5.512E+03	1.102E+04	1.500E+02	2.690E+00	1.360E-16	4.857E+00	1.546E+00
1.750E+05	6.431E+03	1.286E+04	1.750E+02	2.905E+00	1.150E-16	4.107E+00	1.307E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	9.900E-17	3.535E+00	1.125E+00

PROCESS : HE+-H2(10)
BARNETT ET AL. ORNL-5206(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
1.000E+02	3.675E+00	7.350E+00	1.000E-01	6.945E-02	1.200E-16	4.285E+00	1.364E+00
2.000E+02	7.350E+00	1.470E+01	2.000E-01	9.822E-02	1.400E-16	5.000E+00	1.591E+00
4.000E+02	1.470E+01	2.940E+01	4.000E-01	1.389E-01	1.400E-16	5.000E+00	1.591E+00
7.000E+02	2.572E+01	5.145E+01	7.000E-01	1.836E-01	1.300E-16	4.642E+00	1.478E+00
1.000E+03	3.675E+01	7.350E+01	1.000E+00	2.196E-01	1.100E-16	3.928E+00	1.250E+00
2.000E+03	7.350E+01	1.470E+02	2.000E+00	3.106E-01	7.500E-17	2.678E+00	8.525E-01
4.000E+03	1.470E+02	2.940E+02	4.000E+00	4.393E-01	7.000E-17	2.500E+00	7.957E-01
7.000E+03	2.572E+02	5.145E+02	7.000E+00	5.811E-01	9.000E-17	3.214E+00	1.023E+00
1.000E+04	3.675E+02	7.350E+02	1.000E+01	6.945E-01	1.100E-16	3.928E+00	1.250E+00
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	1.700E-16	6.071E+00	1.932E+00
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	2.500E-16	8.928E+00	2.842E+00
7.000E+04	2.572E+03	5.145E+03	7.000E+01	1.838E+00	2.600E-16	9.285E+00	2.955E+00
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	2.100E-16	7.499E+00	2.387E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	1.000E-16	3.571E+00	1.137E+00
4.000E+05	1.470E+04	2.940E+04	4.000E+02	4.393E+00	2.500E-17	8.928E-01	2.842E-01
7.000E+05	2.572E+04	5.145E+04	7.000E+02	5.811E+00	5.500E-18	1.964E-01	6.252E-02
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	1.600E-18	5.714E-02	1.819E-02
1.600E+06	5.880E+04	1.176E+05	1.600E+03	8.785E+00	3.000E-19	1.071E-02	3.410E-03

TABLE 2 - CONTINUED

PROCESS : HE+-H2(10)
PHANEUF ET AL. PHYS.REV. A16 1867(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
9.700E+03	3.565E+02	7.129E+02	9.700E+00	6.840E-01	1.000E-16	3.571E+00	1.137E+00
1.510E+04	5.549E+02	1.110E+03	1.510E+01	8.535E-01	1.580E-16	5.642E+00	1.796E+00
1.980E+04	7.276E+02	1.455E+03	1.980E+01	9.773E-01	1.850E-16	6.606E+00	2.103E+00
2.850E+04	1.047E+03	2.095E+03	2.850E+01	1.173E+00	2.550E-16	9.106E+00	2.899E+00
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	2.840E-16	1.014E+01	3.228E+00
5.600E+04	2.058E+03	4.116E+03	5.600E+01	1.644E+00	3.340E-16	1.193E+01	3.797E+00
7.670E+04	2.819E+03	5.637E+03	7.670E+01	1.924E+00	3.660E-16	1.307E+01	4.160E+00
1.070E+05	3.932E+03	7.864E+03	1.070E+02	2.272E+00	2.860E-16	1.021E+01	3.251E+00
1.330E+05	4.888E+03	9.775E+03	1.330E+02	2.533E+00	2.340E-16	8.356E+00	2.660E+00
2.010E+05	7.386E+03	1.477E+04	2.010E+02	3.114E+00	1.260E-16	4.500E+00	1.432E+00
3.030E+05	1.113E+04	2.227E+04	3.030E+02	3.823E+00	5.000E-17	1.786E+00	5.684E-01
4.030E+05	1.481E+04	2.962E+04	4.030E+02	4.409E+00	2.500E-17	8.928E-01	2.842E-01
5.030E+05	1.848E+04	3.697E+04	5.030E+02	4.926E+00	1.500E-17	5.357E-01	1.705E-01

PROCESS : HE+-H2(10)
NAKAI ET AL. JAERI (UNPUBLISHED) (1979)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
3.000E+05	1.102E+04	2.205E+04	3.000E+02	3.804E+00	6.240E-17	2.228E+00	7.093E-01
4.000E+05	1.470E+04	2.940E+04	4.000E+02	4.393E+00	3.280E-17	1.171E+00	3.728E-01
5.000E+05	1.837E+04	3.675E+04	5.000E+02	4.911E+00	1.720E-17	6.142E-01	1.955E-01
6.000E+05	2.205E+04	4.410E+04	6.000E+02	5.380E+00	1.070E-17	3.821E-01	1.216E-01
7.000E+05	2.572E+04	5.145E+04	7.000E+02	5.811E+00	6.140E-18	2.193E-01	6.979E-02
8.000E+05	2.940E+04	5.880E+04	8.000E+02	6.212E+00	3.620E-18	1.293E-01	4.115E-02
9.000E+05	3.307E+04	6.615E+04	9.000E+02	6.589E+00	2.670E-18	9.535E-02	3.035E-02
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	1.750E-18	6.249E-02	1.989E-02
1.200E+06	4.410E+04	8.820E+04	1.200E+03	7.608E+00	8.720E-19	3.114E-02	9.912E-03
1.400E+06	5.145E+04	1.029E+05	1.400E+03	8.218E+00	4.880E-19	1.743E-02	5.547E-03
1.600E+06	5.880E+04	1.176E+05	1.600E+03	8.785E+00	2.980E-19	1.064E-02	3.387E-03
1.800E+06	6.615E+04	1.323E+05	1.800E+03	9.318E+00	1.700E-19	6.071E-03	1.932E-03

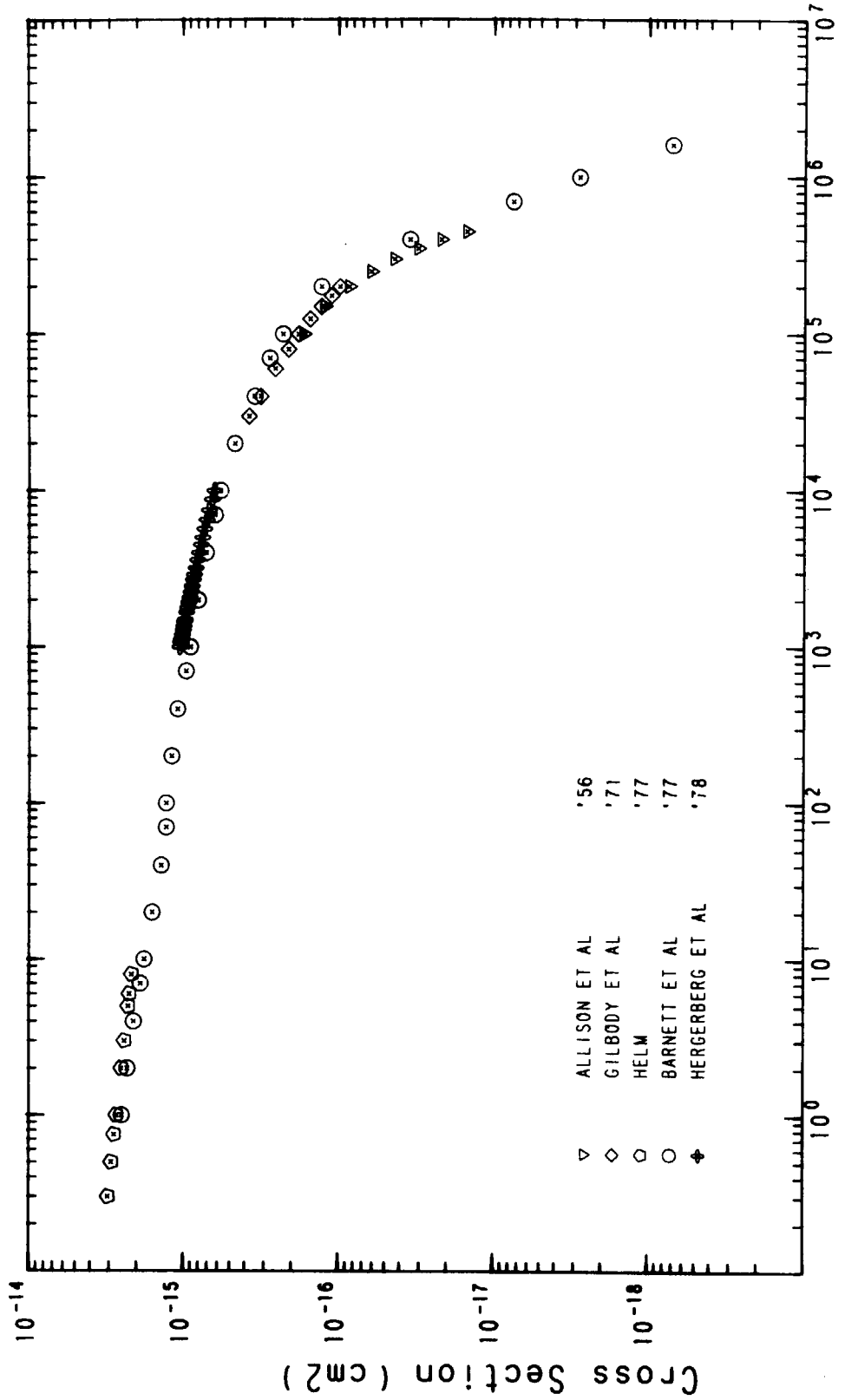

FIG. 3 HE+-HE(10) ENERGY 0.30(eV) - 1.60(MeV)

TABLE 3

PROCESS : HE+-HE(10)
ALLISON ET AL, PHYS.REV.102 1041(1956)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
1,000E+02	3,675E+00	7,350E+00	1,000E-01	6,945E-02	1,690E-16	6,035E+00	1,921E+00
1,500E+02	5,512E+00	1,102E+01	1,500E-01	8,506E-02	1,240E-16	4,428E+00	1,410E+00
2,000E+02	7,350E+00	1,470E+01	2,000E-01	9,822E-02	8,600E-17	3,071E+00	9,776E-01
2,500E+02	9,187E+00	1,837E+01	2,500E-01	1,098E-01	6,200E-17	2,214E+00	7,048E-01
3,000E+02	1,102E+01	2,205E+01	3,000E-01	1,203E-01	4,400E-17	1,571E+00	5,002E-01
3,500E+02	1,286E+01	2,572E+01	3,500E-01	1,299E-01	3,100E-17	1,107E+00	3,524E-01
4,000E+02	1,470E+01	2,940E+01	4,000E-01	1,389E-01	2,200E-17	7,856E-01	2,501E-01
4,500E+02	1,654E+01	3,307E+01	4,500E-01	1,473E-01	1,500E-17	5,357E-01	1,705E-01

PROCESS : HE+-HE(10)
GILBODY ET AL, J.PHYS.B,4 800(1971)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
3,000E+04	1,102E+03	2,205E+03	3,000E+01	1,203E+00	3,800E-16	1,357E+01	4,319E+00
4,000E+04	1,470E+03	2,940E+03	4,000E+01	1,389E+00	3,200E-16	1,143E+01	3,637E+00
6,000E+04	2,205E+03	4,410E+03	6,000E+01	1,701E+00	2,580E-16	9,213E+00	2,933E+00
8,000E+04	2,940E+03	5,880E+03	8,000E+01	1,964E+00	2,120E-16	7,571E+00	2,410E+00
1,000E+05	3,675E+03	7,350E+03	1,000E+02	2,196E+00	1,830E-16	6,535E+00	2,080E+00
1,250E+05	4,594E+03	9,187E+03	1,250E+02	2,456E+00	1,540E-16	5,499E+00	1,751E+00
1,500E+05	5,512E+03	1,102E+04	1,500E+02	2,690E+00	1,300E-16	4,642E+00	1,478E+00
1,750E+05	6,431E+03	1,286E+04	1,750E+02	2,905E+00	1,120E-16	4,000E+00	1,273E+00
2,000E+05	7,350E+03	1,470E+04	2,000E+02	3,106E+00	9,900E-17	3,535E+00	1,125E+00

TABLE 3 - CONTINUED

PROCESS : HE+-HE(10)
BARNETT ET AL, ORNL 5206 (1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
1.000E+00	3.675E-02	7.350E-02	1.000E-03	6.945E-03	2.500E-15	8.928E+01	2.842E+01
2.000E+00	7.350E-02	1.470E-01	2.000E-03	9.822E-03	2.300E-15	8.213E+01	2.614E+01
4.000E+00	1.470E-01	2.940E-01	4.000E-03	1.389E-02	2.100E-15	7.499E+01	2.387E+01
7.000E+00	2.572E-01	5.145E-01	7.000E-03	1.838E-02	1.900E-15	6.785E+01	2.160E+01
1.000E+01	3.675E-01	7.350E-01	1.000E-02	2.196E-02	1.800E-15	6.428E+01	2.046E+01
2.000E+01	7.350E-01	1.470E+00	2.000E-02	3.106E-02	1.600E-15	5.714E+01	1.819E+01
4.000E+01	1.470E+00	2.940E+00	4.000E-02	4.393E-02	1.400E-15	5.000E+01	1.591E+01
7.000E+01	2.572E+00	5.145E+00	7.000E-02	5.811E-02	1.300E-15	4.642E+01	1.478E+01
1.000E+02	3.675E+00	7.350E+00	1.000E-01	6.945E-02	1.300E-15	4.642E+01	1.478E+01
2.000E+02	7.350E+00	1.470E+01	2.000E-01	9.822E-02	1.200E-15	4.285E+01	1.364E+01
4.000E+02	1.470E+01	2.940E+01	4.000E-01	1.389E-01	1.100E-15	3.928E+01	1.250E+01
7.000E+02	2.572E+01	5.145E+01	7.000E-01	1.838E-01	9.700E-16	3.464E+01	1.103E+01
1.000E+03	3.675E+01	7.350E+01	1.000E+00	2.196E-01	9.100E-16	3.250E+01	1.034E+01
2.000E+03	7.350E+01	1.470E+02	2.000E+00	3.106E-01	8.100E-16	2.893E+01	9.207E+00
4.000E+03	1.470E+02	2.940E+02	4.000E+00	4.393E-01	7.200E-16	2.571E+01	8.184E+00
7.000E+03	2.572E+02	5.145E+02	7.000E+00	5.811E-01	6.300E-16	2.250E+01	7.161E+00
1.000E+04	3.675E+02	7.350E+02	1.000E+01	6.945E-01	5.800E-16	2.071E+01	6.593E+00
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	4.700E-16	1.678E+01	5.343E+00
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	3.500E-16	1.250E+01	3.978E+00
7.000E+04	2.572E+03	5.145E+03	7.000E+01	1.838E+00	2.800E-16	9.999E+00	3.183E+00
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	2.300E-16	8.213E+00	2.614E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	1.300E-16	4.642E+00	1.478E+00
4.000E+05	1.470E+04	2.940E+04	4.000E+02	4.393E+00	3.500E-17	1.250E+00	3.978E-01
7.000E+05	2.572E+04	5.145E+04	7.000E+02	5.811E+00	7.500E-18	2.678E-01	8.525E-02
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	2.800E-18	9.999E-02	3.183E-02
1.600E+06	5.880E+04	1.176E+05	1.600E+03	8.785E+00	7.000E-19	2.500E-02	7.957E-03

PROCESS : HE+-HE(10)
HELM, J.PHYS.B,10 3683(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
3.000E-01	1.102E-02	2.205E-02	3.000E-04	3.804E-03	3.080E-15	1.100E+02	3.501E+01
5.000E-01	1.837E-02	3.675E-02	5.000E-04	4.911E-03	2.920E-15	1.043E+02	3.319E+01
7.500E-01	2.756E-02	5.512E-02	7.500E-04	6.015E-03	2.800E-15	9.999E+01	3.183E+01
1.000E+00	3.675E-02	7.350E-02	1.000E-03	6.945E-03	2.710E-15	9.678E+01	3.080E+01
2.000E+00	7.350E-02	1.470E-01	2.000E-03	9.822E-03	2.520E-15	8.999E+01	2.865E+01
3.000E+00	1.102E-01	2.205E-01	3.000E-03	1.203E-02	2.410E-15	8.606E+01	2.739E+01
5.000E+00	1.837E-01	3.675E-01	5.000E-03	1.553E-02	2.280E-15	8.142E+01	2.592E+01
6.000E+00	2.205E-01	4.410E-01	6.000E-03	1.701E-02	2.240E-15	7.999E+01	2.546E+01
8.000E+00	2.940E-01	5.880E-01	8.000E-03	1.964E-02	2.170E-15	7.749E+01	2.467E+01

TABLE 3 - CONTINUED

PROCESS : HE+-HE(10)
HERGERBERG ET AL, J.PHYS.B.11 133(1978)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
1,000E+03	3,675E+01	7,350E+01	1,000E+00	2,196E-01	1,066E-15	3,807E+01	1,212E+01
1,070E+03	3,932E+01	7,864E+01	1,070E+00	2,272E-01	1,051E-15	3,753E+01	1,195E+01
1,100E+03	4,042E+01	8,085E+01	1,100E+00	2,304E-01	1,046E-15	3,735E+01	1,189E+01
1,130E+03	4,153E+01	8,305E+01	1,130E+00	2,335E-01	1,041E-15	3,717E+01	1,183E+01
1,200E+03	4,410E+01	8,820E+01	1,200E+00	2,406E-01	1,028E-15	3,671E+01	1,169E+01
1,280E+03	4,704E+01	9,408E+01	1,280E+00	2,485E-01	1,015E-15	3,625E+01	1,154E+01
1,360E+03	4,998E+01	9,996E+01	1,360E+00	2,561E-01	1,005E-15	3,589E+01	1,142E+01
1,460E+03	5,365E+01	1,073E+02	1,460E+00	2,654E-01	9,940E-16	3,550E+01	1,130E+01
1,500E+03	5,512E+01	1,102E+02	1,500E+00	2,690E-01	9,850E-16	3,518E+01	1,120E+01
1,670E+03	6,137E+01	1,227E+02	1,670E+00	2,838E-01	9,650E-16	3,446E+01	1,097E+01
1,790E+03	6,578E+01	1,316E+02	1,790E+00	2,939E-01	9,530E-16	3,403E+01	1,083E+01
1,930E+03	7,092E+01	1,418E+02	1,930E+00	3,051E-01	9,350E-16	3,339E+01	1,063E+01
2,080E+03	7,644E+01	1,529E+02	2,080E+00	3,168E-01	9,200E-16	3,285E+01	1,046E+01
2,260E+03	8,305E+01	1,661E+02	2,260E+00	3,302E-01	9,020E-16	3,221E+01	1,025E+01
2,450E+03	9,003E+01	1,801E+02	2,450E+00	3,438E-01	8,910E-16	3,182E+01	1,013E+01
2,700E+03	9,922E+01	1,984E+02	2,700E+00	3,609E-01	8,740E-16	3,121E+01	9,935E+00
2,900E+03	1,066E+02	2,131E+02	2,900E+00	3,740E-01	8,590E-16	3,068E+01	9,764E+00
3,200E+03	1,176E+02	2,352E+02	3,200E+00	3,929E-01	8,390E-16	2,996E+01	9,537E+00
3,600E+03	1,323E+02	2,646E+02	3,600E+00	4,167E-01	8,190E-16	2,925E+01	9,310E+00
4,000E+03	1,470E+02	2,940E+02	4,000E+00	4,393E-01	7,980E-16	2,850E+01	9,071E+00
4,500E+03	1,654E+02	3,307E+02	4,500E+00	4,659E-01	7,770E-16	2,775E+01	8,832E+00
5,000E+03	1,837E+02	3,675E+02	5,000E+00	4,911E-01	7,590E-16	2,710E+01	8,628E+00
5,700E+03	2,095E+02	4,189E+02	5,700E+00	5,244E-01	7,370E-16	2,632E+01	8,378E+00
6,500E+03	2,389E+02	4,777E+02	6,500E+00	5,600E-01	7,130E-16	2,546E+01	8,105E+00
7,500E+03	2,756E+02	5,512E+02	7,500E+00	6,015E-01	6,890E-16	2,460E+01	7,832E+00
8,800E+03	3,234E+02	6,468E+02	8,800E+00	6,515E-01	6,580E-16	2,350E+01	7,480E+00
1,000E+04	3,675E+02	7,350E+02	1,000E+01	6,945E-01	6,350E-16	2,268E+01	7,218E+00

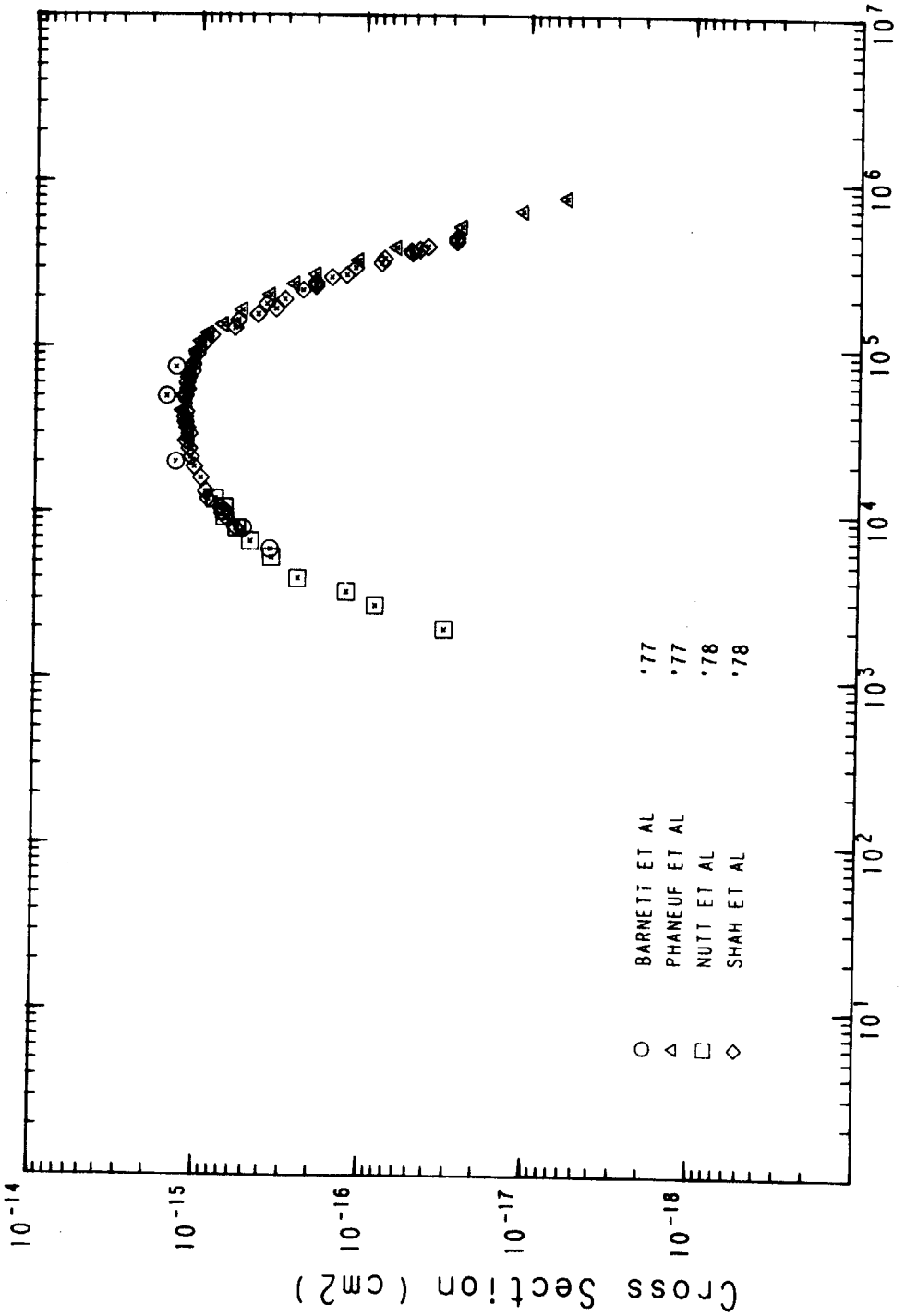

FIG. 4 HE++-H (21) ENERGY 2.00(keV) - 802.70(keV)

TABLE 4

PROCESS : HE++-H (21)
BARNETT ET AL. ORNL 5206 (1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
6.000E+03	2.205E+02	4.410E+02	6.000E+00	5.380E-01	3.700E-16	1.321E+01	4.206E+00
8.000E+03	2.940E+02	5.880E+02	8.000E+00	6.212E-01	5.400E-16	1.928E+01	6.138E+00
1.000E+04	3.675E+02	7.350E+02	1.000E+01	6.945E-01	7.200E-16	2.571E+01	8.184E+00
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	1.400E-15	5.000E+01	1.591E+01
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	1.600E-15	5.714E+01	1.819E+01
7.500E+04	2.756E+03	5.512E+03	7.500E+01	1.902E+00	1.400E-15	5.000E+01	1.591E+01

PROCESS : HE++-H (21)
PHANEUF ET AL. PHYS.REV.A 16 1867(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2.693E+04	9.896E+02	1.979E+03	2.693E+01	1.140E+00	1.170E-15	4.178E+01	1.330E+01
3.400E+04	1.249E+03	2.499E+03	3.400E+01	1.281E+00	1.180E-15	4.214E+01	1.341E+01
4.053E+04	1.489E+03	2.979E+03	4.053E+01	1.398E+00	1.290E-15	4.607E+01	1.466E+01
4.627E+04	1.700E+03	3.401E+03	4.627E+01	1.494E+00	1.200E-15	4.285E+01	1.364E+01
5.013E+04	1.842E+03	3.684E+03	5.013E+01	1.555E+00	1.240E-15	4.428E+01	1.410E+01
5.813E+04	2.136E+03	4.272E+03	5.813E+01	1.675E+00	1.180E-15	4.214E+01	1.341E+01
6.667E+04	2.450E+03	4.900E+03	6.667E+01	1.793E+00	1.150E-15	4.107E+01	1.307E+01
7.973E+04	2.930E+03	5.860E+03	7.973E+01	1.961E+00	1.070E-15	3.821E+01	1.216E+01
9.333E+04	3.430E+03	6.859E+03	9.333E+01	2.122E+00	1.060E-15	3.785E+01	1.205E+01
1.071E+05	3.936E+03	7.872E+03	1.071E+02	2.273E+00	1.000E-15	3.571E+01	1.137E+01
1.200E+05	4.410E+03	8.820E+03	1.200E+02	2.406E+00	9.000E-16	3.214E+01	1.023E+01
1.360E+05	4.998E+03	9.996E+03	1.360E+02	2.561E+00	7.300E-16	2.607E+01	8.298E+00
1.667E+05	6.126E+03	1.225E+04	1.667E+02	2.836E+00	5.600E-16	2.000E+01	6.366E+00
2.053E+05	7.544E+03	1.509E+04	2.053E+02	3.147E+00	3.800E-16	1.357E+01	4.319E+00
2.400E+05	8.820E+03	1.764E+04	2.400E+02	3.403E+00	2.700E-16	9.642E+00	3.069E+00
2.733E+05	1.004E+04	2.009E+04	2.733E+02	3.631E+00	2.000E-16	7.142E+00	2.273E+00
3.333E+05	1.225E+04	2.450E+04	3.333E+02	4.010E+00	1.100E-16	3.928E+00	1.250E+00
4.000E+05	1.470E+04	2.940E+04	4.000E+02	4.393E+00	6.500E-17	2.321E+00	7.389E-01
5.333E+05	1.960E+04	3.920E+04	5.333E+02	5.072E+00	2.600E-17	9.285E-01	2.955E-01
6.640E+05	2.440E+04	4.880E+04	6.640E+02	5.660E+00	1.100E-17	3.928E-01	1.250E-01
8.027E+05	2.950E+04	5.900E+04	8.027E+02	6.223E+00	6.000E-18	2.143E-01	6.820E-02

TABLE 4 - CONTINUED

PROCESS : HE++-H (21)
NUTT ET AL, J.PHYS.B,11 1457(1978)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2.000E+03	7.350E+01	1.470E+02	2.000E+00	3.106E-01	3.200E-17	1.143E+00	3.637E-01
2.760E+03	1.014E+02	2.029E+02	2.760E+00	3.649E-01	8.400E-17	3.000E+00	9.548E-01
3.330E+03	1.224E+02	2.447E+02	3.330E+00	4.008E-01	1.260E-16	4.500E+00	1.432E+00
4.000E+03	1.470E+02	2.940E+02	4.000E+00	4.393E-01	2.500E-16	8.928E+00	2.842E+00
5.330E+03	1.959E+02	3.917E+02	5.330E+00	5.071E-01	3.620E-16	1.293E+01	4.115E+00
6.670E+03	2.451E+02	4.902E+02	6.670E+00	5.672E-01	4.880E-16	1.743E+01	5.547E+00
8.000E+03	2.940E+02	5.880E+02	8.000E+00	6.212E-01	5.880E-16	2.100E+01	6.684E+00
9.330E+03	3.429E+02	6.857E+02	9.330E+00	6.709E-01	6.980E-16	2.493E+01	7.934E+00
1.070E+04	3.932E+02	7.864E+02	1.070E+01	7.184E-01	7.020E-16	2.507E+01	7.980E+00
1.200E+04	4.410E+02	8.820E+02	1.200E+01	7.608E-01	8.050E-16	2.875E+01	9.150E+00

TABLE 4 - CONTINUED

PROCESS : HE++-H (21)
SHAH GILBODY, J.PHYS,B.11 121(1978)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
8.000E+03	2.940E+02	5.880E+02	8.000E+00	6.212E-01	6.000E-16	2.143E+01	6.820E+00
9.300E+03	3.418E+02	6.835E+02	9.300E+00	6.698E-01	6.900E-16	2.464E+01	7.843E+00
1.070E+04	3.932E+02	7.864E+02	1.070E+01	7.184E-01	7.400E-16	2.643E+01	8.412E+00
1.200E+04	4.410E+02	8.820E+02	1.200E+01	7.608E-01	8.900E-16	3.178E+01	1.012E+01
1.330E+04	4.888E+02	9.775E+02	1.330E+01	8.010E-01	9.150E-16	3.268E+01	1.040E+01
1.600E+04	5.880E+02	1.176E+03	1.600E+01	8.785E-01	9.850E-16	3.518E+01	1.120E+01
1.870E+04	6.872E+02	1.374E+03	1.870E+01	9.498E-01	1.080E-15	3.857E+01	1.228E+01
2.130E+04	7.827E+02	1.565E+03	2.130E+01	1.014E+00	1.130E-15	4.035E+01	1.284E+01
2.400E+04	8.820E+02	1.764E+03	2.400E+01	1.076E+00	1.160E-15	4.142E+01	1.319E+01
2.670E+04	9.812E+02	1.962E+03	2.670E+01	1.135E+00	1.220E-15	4.357E+01	1.387E+01
2.930E+04	1.077E+03	2.153E+03	2.930E+01	1.189E+00	1.160E-15	4.142E+01	1.319E+01
3.200E+04	1.176E+03	2.352E+03	3.200E+01	1.242E+00	1.200E-15	4.285E+01	1.364E+01
3.470E+04	1.275E+03	2.550E+03	3.470E+01	1.294E+00	1.230E-15	4.392E+01	1.398E+01
3.730E+04	1.371E+03	2.741E+03	3.730E+01	1.341E+00	1.240E-15	4.428E+01	1.410E+01
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	1.220E-15	4.357E+01	1.387E+01
4.990E+04	1.834E+03	3.667E+03	4.990E+01	1.551E+00	1.250E-15	4.464E+01	1.421E+01
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	1.230E-15	4.392E+01	1.398E+01
5.490E+04	2.017E+03	4.035E+03	5.490E+01	1.627E+00	1.190E-15	4.250E+01	1.353E+01
6.000E+04	2.205E+03	4.410E+03	6.000E+01	1.701E+00	1.210E-15	4.321E+01	1.375E+01
6.470E+04	2.378E+03	4.755E+03	6.470E+01	1.767E+00	1.180E-15	4.214E+01	1.341E+01
7.000E+04	2.572E+03	5.145E+03	7.000E+01	1.838E+00	1.120E-15	4.000E+01	1.273E+01
7.750E+04	2.848E+03	5.696E+03	7.750E+01	1.934E+00	1.110E-15	3.964E+01	1.262E+01
9.000E+04	3.307E+03	6.615E+03	9.000E+01	2.084E+00	1.050E-15	3.750E+01	1.194E+01
1.033E+05	3.796E+03	7.592E+03	1.033E+02	2.232E+00	9.600E-16	3.428E+01	1.091E+01
1.167E+05	4.289E+03	8.577E+03	1.167E+02	2.373E+00	8.600E-16	3.071E+01	9.776E+00
1.300E+05	4.777E+03	9.555E+03	1.300E+02	2.504E+00	6.200E-16	2.214E+01	7.048E+00
1.447E+05	5.318E+03	1.064E+04	1.447E+02	2.642E+00	5.900E-16	2.107E+01	6.707E+00
1.573E+05	5.781E+03	1.156E+04	1.573E+02	2.755E+00	4.500E-16	1.607E+01	5.115E+00
1.693E+05	6.222E+03	1.244E+04	1.693E+02	2.858E+00	3.500E-16	1.250E+01	3.978E+00
1.813E+05	6.663E+03	1.333E+04	1.813E+02	2.957E+00	4.000E-16	1.428E+01	4.547E+00
1.933E+05	7.103E+03	1.421E+04	1.933E+02	3.054E+00	3.100E-16	1.107E+01	3.524E+00
2.200E+05	8.085E+03	1.617E+04	2.200E+02	3.258E+00	2.400E-16	8.571E+00	2.728E+00
2.320E+05	8.526E+03	1.705E+04	2.320E+02	3.345E+00	2.000E-16	7.142E+00	2.273E+00
2.440E+05	8.967E+03	1.793E+04	2.440E+02	3.431E+00	2.000E-16	7.142E+00	2.273E+00
2.627E+05	9.654E+03	1.931E+04	2.627E+02	3.560E+00	1.600E-16	5.714E+00	1.819E+00
2.720E+05	9.996E+03	1.999E+04	2.720E+02	3.622E+00	1.300E-16	4.642E+00	1.478E+00
3.000E+05	1.102E+04	2.205E+04	3.000E+02	3.804E+00	1.150E-16	4.107E+00	1.307E+00
3.213E+05	1.181E+04	2.361E+04	3.213E+02	3.937E+00	8.000E-17	2.857E+00	9.094E-01
3.420E+05	1.257E+04	2.514E+04	3.420E+02	4.062E+00	7.700E-17	2.750E+00	8.753E-01
3.700E+05	1.360E+04	2.719E+04	3.700E+02	4.225E+00	5.200E-17	1.857E+00	5.911E-01
3.807E+05	1.399E+04	2.798E+04	3.807E+02	4.285E+00	5.300E-17	1.893E+00	6.025E-01
3.893E+05	1.431E+04	2.861E+04	3.893E+02	4.334E+00	4.700E-17	1.678E+00	5.343E-01
4.050E+05	1.488E+04	2.977E+04	4.050E+02	4.420E+00	4.200E-17	1.500E+00	4.774E-01
4.360E+05	1.602E+04	3.204E+04	4.360E+02	4.586E+00	2.800E-17	9.999E-01	3.183E-01
4.573E+05	1.681E+04	3.361E+04	4.573E+02	4.697E+00	2.800E-17	9.999E-01	3.183E-01

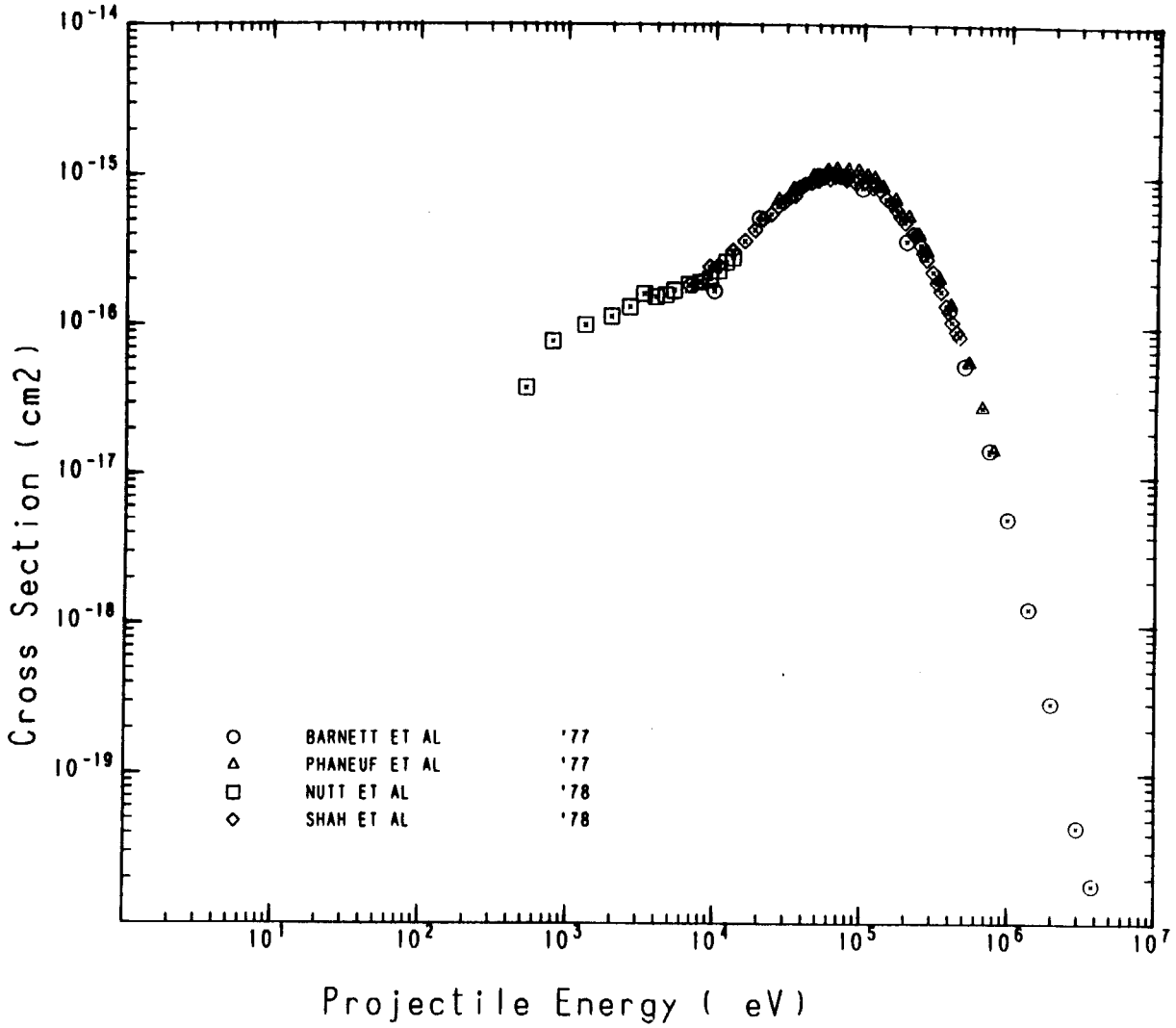

FIG. 5 HE++-H2 (21) ENERGY 530.00(eV) - 3.80(MeV)

TABLE 5

PROCESS : HE++-H2 (21)
BARNETT ET AL. ORNL 5206(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
1.000E+04	3.675E+02	7.350E+02	1.000E+01	6.945E-01	1.700E-16	6.071E+00	1.932E+00
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	5.200E-16	1.857E+01	5.911E+00
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	1.000E-15	3.571E+01	1.137E+01
7.500E+04	2.756E+03	5.512E+03	7.500E+01	1.902E+00	1.000E-15	3.571E+01	1.137E+01
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	8.300E-16	2.964E+01	9.435E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	3.700E-16	1.321E+01	4.206E+00
5.000E+05	1.837E+04	3.675E+04	5.000E+02	4.911E+00	5.500E-17	1.964E+00	6.252E-01
7.500E+05	2.756E+04	5.512E+04	7.500E+02	6.015E+00	1.500E-17	5.357E-01	1.705E-01
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	5.200E-18	1.857E-01	5.911E-02
1.400E+06	5.145E+04	1.029E+05	1.400E+03	8.218E+00	1.300E-18	4.642E-02	1.478E-02
2.000E+06	7.350E+04	1.470E+05	2.000E+03	9.822E+00	3.000E-19	1.071E-02	3.410E-03
3.000E+06	1.102E+05	2.205E+05	3.000E+03	1.203E+01	4.400E-20	1.571E-03	5.002E-04
3.800E+06	1.396E+05	2.793E+05	3.800E+03	1.354E+01	1.800E-20	6.428E-04	2.046E-04

PROCESS : HE++-H2 (21)
PHANEUF ET AL. PHYS.REV,A16 1867(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2.693E+04	9.896E+02	1.979E+03	2.693E+01	1.140E+00	6.900E-16	2.464E+01	7.843E+00
3.400E+04	1.249E+03	2.499E+03	3.400E+01	1.281E+00	8.200E-16	2.928E+01	9.321E+00
4.053E+04	1.489E+03	2.979E+03	4.053E+01	1.398E+00	8.700E-16	3.107E+01	9.889E+00
4.627E+04	1.700E+03	3.401E+03	4.627E+01	1.494E+00	1.000E-15	3.571E+01	1.137E+01
5.013E+04	1.842E+03	3.684E+03	5.013E+01	1.555E+00	1.010E-15	3.607E+01	1.148E+01
5.813E+04	2.136E+03	4.272E+03	5.813E+01	1.675E+00	1.090E-15	3.892E+01	1.239E+01
6.667E+04	2.450E+03	4.900E+03	6.667E+01	1.793E+00	1.110E-15	3.964E+01	1.262E+01
7.973E+04	2.930E+03	5.860E+03	7.973E+01	1.961E+00	1.100E-15	3.928E+01	1.250E+01
9.333E+04	3.430E+03	6.859E+03	9.333E+01	2.122E+00	1.090E-15	3.892E+01	1.239E+01
1.071E+05	3.936E+03	7.872E+03	1.071E+02	2.273E+00	1.010E-15	3.607E+01	1.148E+01
1.200E+05	4.410E+03	8.820E+03	1.200E+02	2.406E+00	9.700E-16	3.464E+01	1.103E+01
1.360E+05	4.998E+03	9.996E+03	1.360E+02	2.561E+00	8.500E-16	3.035E+01	9.662E+00
1.667E+05	6.126E+03	1.225E+04	1.667E+02	2.836E+00	7.000E-16	2.500E+01	7.957E+00
2.053E+05	7.544E+03	1.509E+04	2.053E+02	3.147E+00	5.400E-16	1.928E+01	6.138E+00
2.400E+05	8.820E+03	1.764E+04	2.400E+02	3.403E+00	4.100E-16	1.464E+01	4.661E+00
2.733E+05	1.004E+04	2.009E+04	2.733E+02	3.631E+00	3.200E-16	1.143E+01	3.637E+00
3.333E+05	1.225E+04	2.450E+04	3.333E+02	4.010E+00	2.100E-16	7.499E+00	2.387E+00
4.000E+05	1.470E+04	2.940E+04	4.000E+02	4.393E+00	1.400E-16	5.000E+00	1.591E+00
5.333E+05	1.960E+04	3.920E+04	5.333E+02	5.072E+00	5.800E-17	2.071E+00	6.593E-01
6.640E+05	2.440E+04	4.880E+04	6.640E+02	5.660E+00	2.900E-17	1.036E+00	3.296E-01
8.027E+05	2.950E+04	5.900E+04	8.027E+02	6.223E+00	1.500E-17	5.357E-01	1.705E-01

TABLE 5 - CONTINUED

PROCESS : HE++-H2 (21)
NUTT ET AL, J.PHYS.B 11 1457(1978)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
5.300E-01	1.948E-02	3.895E-02	5.300E-04	5.056E-03	3.800E-17	1.357E+00	4.319E-01
8.000E-01	2.940E-02	5.880E-02	8.000E-04	6.212E-03	7.800E-17	2.785E+00	8.866E-01
1.330E+00	4.888E-02	9.775E-02	1.330E-03	8.010E-03	1.000E-16	3.571E+00	1.137E+00
2.000E+00	7.350E-02	1.470E-01	2.000E-03	9.822E-03	1.140E-16	4.071E+00	1.296E+00
2.670E+00	9.812E-02	1.962E-01	2.670E-03	1.135E-02	1.320E-16	4.714E+00	1.500E+00
3.330E+00	1.224E-01	2.447E-01	3.330E-03	1.267E-02	1.620E-16	5.785E+00	1.841E+00
4.000E+00	1.470E-01	2.940E-01	4.000E-03	1.389E-02	1.550E-16	5.535E+00	1.762E+00
4.670E+00	1.716E-01	3.432E-01	4.670E-03	1.501E-02	1.590E-16	5.678E+00	1.807E+00
5.330E+00	1.959E-01	3.917E-01	5.330E-03	1.603E-02	1.710E-16	6.107E+00	1.944E+00
6.670E+00	2.451E-01	4.902E-01	6.670E-03	1.794E-02	1.870E-16	6.678E+00	2.126E+00
8.000E+00	2.940E-01	5.880E-01	8.000E-03	1.964E-02	1.940E-16	6.928E+00	2.205E+00
9.330E+00	3.429E-01	6.857E-01	9.330E-03	2.121E-02	2.040E-16	7.285E+00	2.319E+00
1.067E+01	3.921E-01	7.842E-01	1.067E-02	2.269E-02	2.310E-16	8.249E+00	2.626E+00
1.200E+01	4.410E-01	8.820E-01	1.200E-02	2.406E-02	2.640E-16	9.428E+00	3.001E+00
1.333E+01	4.899E-01	9.797E-01	1.333E-02	2.536E-02	2.840E-16	1.014E+01	3.228E+00

TABLE 5 - CONTINUED

PROCESS : HE++-H2 (21)
SHAH ET AL. J.PHYS.B 11 121(1978)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
6.700E+03	2.462E+02	4.924E+02	6.700E+00	5.685E-01	1.860E-16	6.642E+00	2.114E+00
8.000E+03	2.940E+02	5.880E+02	8.000E+00	6.212E-01	1.970E-16	7.035E+00	2.239E+00
9.300E+03	3.418E+02	6.835E+02	9.300E+00	6.698E-01	2.460E-16	8.785E+00	2.796E+00
1.070E+04	3.932E+02	7.864E+02	1.070E+01	7.184E-01	2.510E-16	8.963E+00	2.853E+00
1.330E+04	4.888E+02	9.775E+02	1.330E+01	8.010E-01	3.150E-16	1.125E+01	3.581E+00
1.600E+04	5.880E+02	1.176E+03	1.600E+01	8.785E-01	3.670E-16	1.311E+01	4.172E+00
1.870E+04	6.872E+02	1.374E+03	1.870E+01	9.498E-01	4.370E-16	1.561E+01	4.967E+00
2.130E+04	7.827E+02	1.565E+03	2.130E+01	1.014E+00	5.160E-16	1.843E+01	5.865E+00
2.400E+04	8.820E+02	1.764E+03	2.400E+01	1.076E+00	5.550E-16	1.982E+01	6.309E+00
2.670E+04	9.812E+02	1.962E+03	2.670E+01	1.135E+00	6.260E-16	2.235E+01	7.116E+00
2.930E+04	1.077E+03	2.153E+03	2.930E+01	1.189E+00	6.670E-16	2.382E+01	7.582E+00
3.200E+04	1.176E+03	2.352E+03	3.200E+01	1.242E+00	7.220E-16	2.578E+01	8.207E+00
3.470E+04	1.275E+03	2.550E+03	3.470E+01	1.294E+00	7.380E-16	2.635E+01	8.389E+00
3.730E+04	1.371E+03	2.741E+03	3.730E+01	1.341E+00	8.340E-16	2.978E+01	9.480E+00
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	8.690E-16	3.103E+01	9.878E+00
4.490E+04	1.650E+03	3.300E+03	4.490E+01	1.472E+00	9.010E-16	3.218E+01	1.024E+01
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	9.370E-16	3.346E+01	1.065E+01
5.490E+04	2.017E+03	4.035E+03	5.490E+01	1.627E+00	9.780E-16	3.493E+01	1.112E+01
6.000E+04	2.205E+03	4.410E+03	6.000E+01	1.701E+00	9.640E-16	3.443E+01	1.096E+01
6.490E+04	2.385E+03	4.770E+03	6.490E+01	1.769E+00	9.990E-16	3.568E+01	1.136E+01
7.000E+04	2.572E+03	5.145E+03	7.000E+01	1.838E+00	9.900E-16	3.535E+01	1.125E+01
7.750E+04	2.848E+03	5.696E+03	7.750E+01	1.934E+00	9.510E-16	3.396E+01	1.081E+01
9.000E+04	3.307E+03	6.615E+03	9.000E+01	2.084E+00	9.010E-16	3.218E+01	1.024E+01
1.033E+05	3.796E+03	7.592E+03	1.033E+02	2.232E+00	9.260E-16	3.307E+01	1.053E+01
1.167E+05	4.289E+03	8.577E+03	1.167E+02	2.373E+00	8.440E-16	3.014E+01	9.594E+00
1.300E+05	4.777E+03	9.555E+03	1.300E+02	2.504E+00	8.160E-16	2.914E+01	9.276E+00
1.447E+05	5.318E+03	1.064E+04	1.447E+02	2.642E+00	7.080E-16	2.528E+01	8.048E+00
1.573E+05	5.781E+03	1.156E+04	1.573E+02	2.755E+00	6.660E-16	2.378E+01	7.570E+00
1.693E+05	6.222E+03	1.244E+04	1.693E+02	2.858E+00	6.000E-16	2.143E+01	6.820E+00
1.813E+05	6.663E+03	1.333E+04	1.813E+02	2.957E+00	5.370E-16	1.918E+01	6.104E+00
1.933E+05	7.103E+03	1.421E+04	1.933E+02	3.054E+00	4.960E-16	1.771E+01	5.638E+00
2.200E+05	8.085E+03	1.617E+04	2.200E+02	3.258E+00	4.180E-16	1.493E+01	4.751E+00
2.320E+05	8.526E+03	1.705E+04	2.320E+02	3.345E+00	4.090E-16	1.461E+01	4.649E+00
2.480E+05	9.114E+03	1.823E+04	2.480E+02	3.459E+00	3.500E-16	1.250E+01	3.978E+00
2.600E+05	9.555E+03	1.911E+04	2.600E+02	3.542E+00	3.100E-16	1.107E+01	3.524E+00
2.720E+05	9.996E+03	1.999E+04	2.720E+02	3.622E+00	2.840E-16	1.014E+01	3.228E+00
3.007E+05	1.105E+04	2.210E+04	3.007E+02	3.809E+00	2.330E-16	8.321E+00	2.649E+00
3.213E+05	1.181E+04	2.361E+04	3.213E+02	3.937E+00	1.980E-16	7.071E+00	2.251E+00
3.420E+05	1.257E+04	2.514E+04	3.420E+02	4.062E+00	1.730E-16	6.178E+00	1.967E+00
3.700E+05	1.360E+04	2.719E+04	3.700E+02	4.225E+00	1.380E-16	4.928E+00	1.569E+00
3.893E+05	1.431E+04	2.861E+04	3.893E+02	4.334E+00	1.260E-16	4.500E+00	1.432E+00
4.053E+05	1.489E+04	2.979E+04	4.053E+02	4.422E+00	1.080E-16	3.857E+00	1.228E+00
4.360E+05	1.602E+04	3.204E+04	4.360E+02	4.586E+00	9.300E-17	3.321E+00	1.057E+00
4.573E+05	1.681E+04	3.361E+04	4.573E+02	4.697E+00	8.600E-17	3.071E+00	9.776E-01

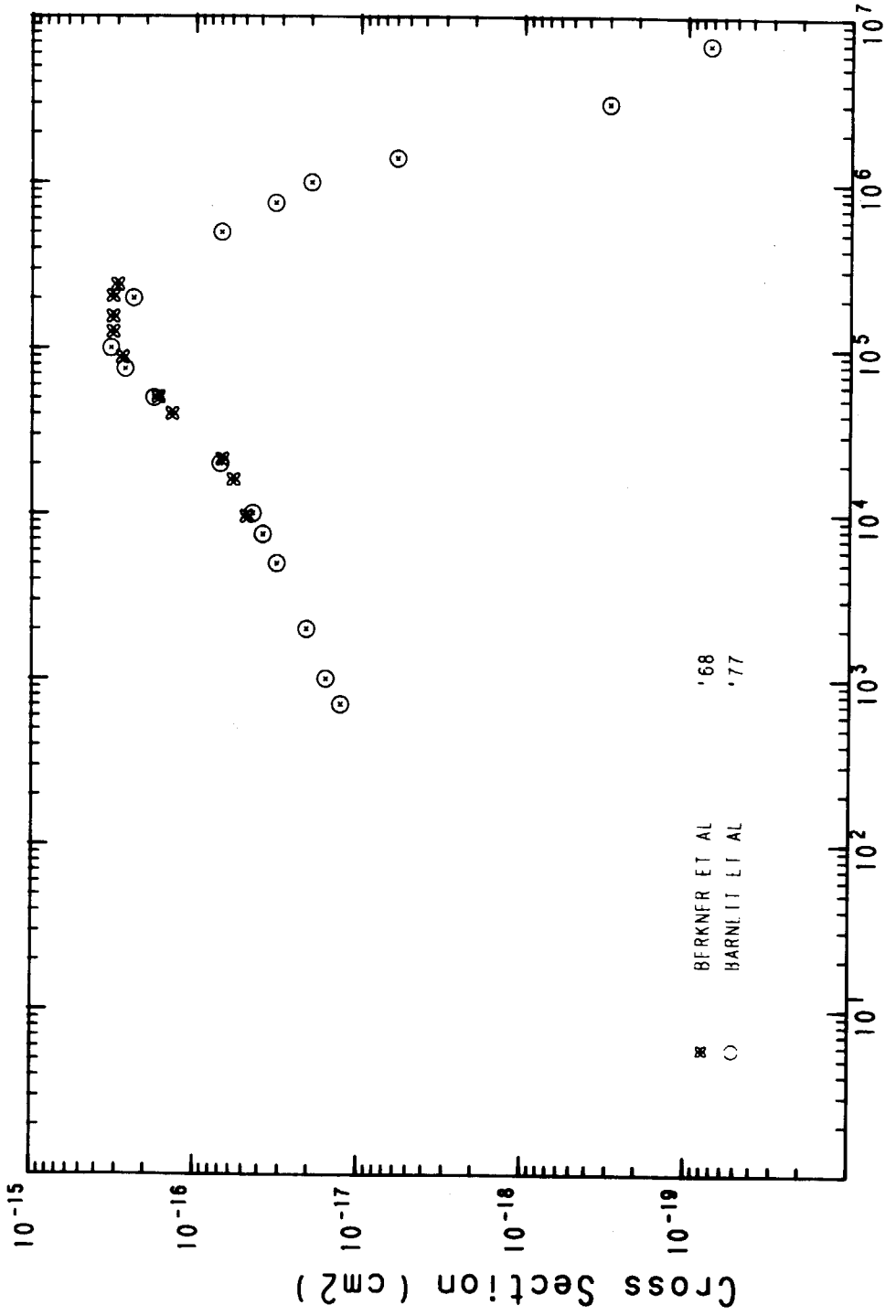

FIG. 6 HE++-HE(21) ENERGY 700.00(eV) - 6.80(MeV)

TABLE 6

PROCESS : HE++-HE(21)
BERKNER ET AL. PHYS.REV.166 44(1968)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
9.600E+03	3.528E+02	7.056E+02	9.600E+00	6.805E-01	4.900E-17	1.750E+00	5.570E-01
1.600E+04	5.880E+02	1.176E+03	1.600E+01	8.785E-01	5.900E-17	2.107E+00	6.707E-01
2.130E+04	7.827E+02	1.565E+03	2.130E+01	1.014E+00	6.900E-17	2.464E+00	7.843E-01
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	1.400E-16	5.000E+00	1.591E+00
5.070E+04	1.863E+03	3.726E+03	5.070E+01	1.564E+00	1.700E-16	6.071E+00	1.932E+00
8.800E+04	3.234E+03	6.468E+03	8.800E+01	2.060E+00	2.800E-16	9.999E+00	3.183E+00
1.253E+05	4.605E+03	9.209E+03	1.253E+02	2.459E+00	3.200E-16	1.143E+01	3.637E+00
1.547E+05	5.685E+03	1.137E+04	1.547E+02	2.732E+00	3.200E-16	1.143E+01	3.637E+00
2.053E+05	7.544E+03	1.509E+04	2.053E+02	3.147E+00	3.200E-16	1.143E+01	3.637E+00
2.413E+05	8.867E+03	1.773E+04	2.413E+02	3.412E+00	3.000E-16	1.071E+01	3.410E+00

PROCESS : HE++-HE(21)
BARNETT ET AL. ORNL 5206(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
7.000E+02	2.572E+01	5.145E+01	7.000E-01	1.838E-01	1.300E-17	4.642E-01	1.478E-01
1.000E+03	3.675E+01	7.350E+01	1.000E+00	2.196E-01	1.600E-17	5.714E-01	1.819E-01
2.000E+03	7.350E+01	1.470E+02	2.000E+00	3.106E-01	2.100E-17	7.499E-01	2.387E-01
5.000E+03	1.837E+02	3.675E+02	5.000E+00	4.911E-01	3.200E-17	1.143E+00	3.637E-01
7.500E+03	2.756E+02	5.512E+02	7.500E+00	6.015E-01	3.900E-17	1.393E+00	4.433E-01
1.000E+04	3.675E+02	7.350E+02	1.000E+01	6.945E-01	4.500E-17	1.607E+00	5.115E-01
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	7.100E-17	2.535E+00	8.071E-01
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	1.800E-16	6.428E+00	2.046E+00
7.500E+04	2.756E+03	5.512E+03	7.500E+01	1.902E+00	2.700E-16	9.642E+00	3.069E+00
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	3.300E-16	1.178E+01	3.751E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	2.400E-16	8.571E+00	2.728E+00
5.000E+05	1.837E+04	3.675E+04	5.000E+02	4.911E+00	7.000E-17	2.500E+00	7.957E-01
7.500E+05	2.756E+04	5.512E+04	7.500E+02	6.015E+00	3.300E-17	1.178E+00	3.751E-01
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	2.000E-17	7.142E-01	2.273E-01
1.400E+06	5.145E+04	1.029E+05	1.400E+03	8.218E+00	6.000E-18	2.143E-01	6.820E-02
3.000E+06	1.102E+05	2.205E+05	3.000E+03	1.203E+01	3.000E-19	1.071E-02	3.410E-03
6.800E+06	2.499E+05	4.998E+05	6.800E+03	1.811E+01	7.300E-20	2.607E-03	8.298E-04

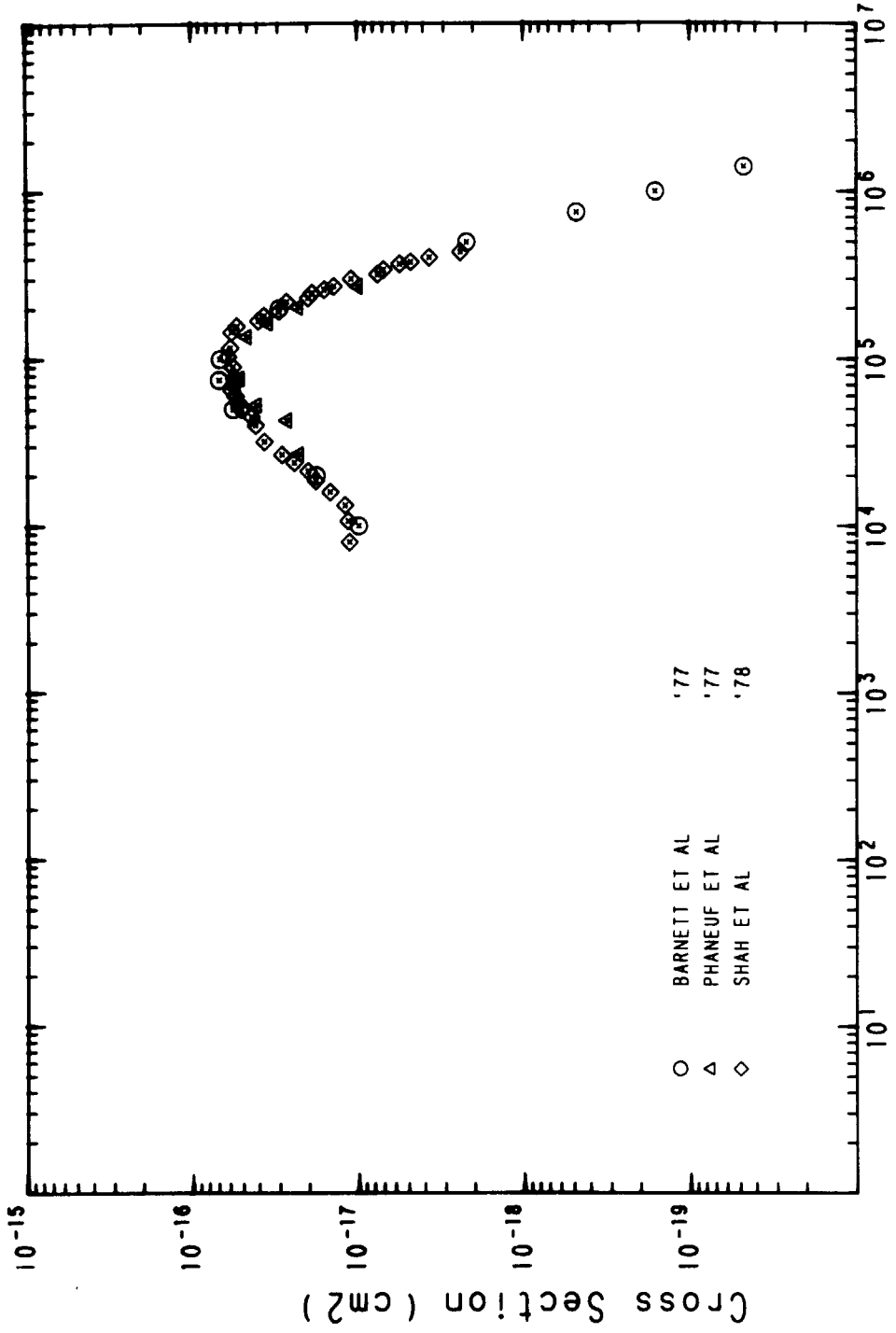

FIG. 7 HE++-H2(2D) ENERGY 8.00(keV) - 1.40(MeV)

TABLE 7

PROCESS : HE++-H2(20)
BARNETT ET AL, ORNL 5206(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
1,000E+04	3,675E+02	7,350E+02	1,000E+01	6,945E-01	1,000E-17	3,571E-01	1,137E-01
2,000E+04	7,350E+02	1,470E+03	2,000E+01	9,822E-01	1,800E-17	6,428E-01	2,046E-01
5,000E+04	1,837E+03	3,675E+03	5,000E+01	1,553E+00	5,700E-17	2,036E+00	6,479E-01
7,500E+04	2,756E+03	5,512E+03	7,500E+01	1,902E+00	6,900E-17	2,464E+00	7,843E-01
1,000E+05	3,675E+03	7,350E+03	1,000E+02	2,196E+00	6,800E-17	2,428E+00	7,730E-01
2,000E+05	7,350E+03	1,470E+04	2,000E+02	3,106E+00	3,000E-17	1,071E+00	3,410E-01
5,000E+05	1,837E+04	3,675E+04	5,000E+02	4,911E+00	2,200E-18	7,856E-02	2,501E-02
7,500E+05	2,756E+04	5,512E+04	7,500E+02	6,015E+00	4,800E-19	1,714E-02	5,456E-03
1,000E+06	3,675E+04	7,350E+04	1,000E+03	6,945E+00	1,600E-19	5,714E-03	1,819E-03
1,400E+06	5,145E+04	1,029E+05	1,400E+03	8,218E+00	4,700E-20	1,678E-03	5,343E-04

PROCESS : HE++-H2(20)
PHANEUF ET AL, PHYS,REV, A16 1867(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2,693E+04	9,896E+02	1,979E+03	2,693E+01	1,140E+00	2,300E-17	8,213E-01	2,614E-01
4,293E+04	1,578E+03	3,155E+03	4,293E+01	1,439E+00	2,700E-17	9,642E-01	3,069E-01
5,307E+04	1,950E+03	3,900E+03	5,307E+01	1,600E+00	4,100E-17	1,464E+00	4,661E-01
7,653E+04	2,812E+03	5,625E+03	7,653E+01	1,921E+00	5,200E-17	1,857E+00	5,911E-01
1,360E+05	4,998E+03	9,996E+03	1,360E+02	2,561E+00	4,700E-17	1,678E+00	5,343E-01
1,640E+05	6,027E+03	1,205E+04	1,640E+02	2,813E+00	3,500E-17	1,250E+00	3,978E-01
2,040E+05	7,497E+03	1,499E+04	2,040E+02	3,137E+00	2,300E-17	8,213E-01	2,614E-01
2,707E+05	9,948E+03	1,990E+04	2,707E+02	3,614E+00	1,000E-17	3,571E-01	1,137E-01

TABLE 7 - CONTINUED

PROCESS : HE++-H2(20)
SHAH ET AL. J.PHYS.B 11 121(1978)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
8.000E+03	2.940E+02	5.880E+02	8.000E+00	6.212E-01	1.140E-17	4.071E-01	1.296E-01
1.070E+04	3.932E+02	7.864E+02	1.070E+01	7.184E-01	1.160E-17	4.142E-01	1.319E-01
1.330E+04	4.888E+02	9.775E+02	1.330E+01	8.010E-01	1.210E-17	4.321E-01	1.375E-01
1.600E+04	5.880E+02	1.176E+03	1.600E+01	8.785E-01	1.490E-17	5.321E-01	1.694E-01
1.870E+04	6.872E+02	1.374E+03	1.870E+01	9.498E-01	1.820E-17	6.499E-01	2.069E-01
2.130E+04	7.827E+02	1.565E+03	2.130E+01	1.014E+00	2.020E-17	7.214E-01	2.296E-01
2.400E+04	8.820E+02	1.764E+03	2.400E+01	1.076E+00	2.450E-17	8.749E-01	2.785E-01
2.670E+04	9.812E+02	1.962E+03	2.670E+01	1.135E+00	2.900E-17	1.036E+00	3.296E-01
3.200E+04	1.176E+03	2.352E+03	3.200E+01	1.242E+00	3.700E-17	1.321E+00	4.206E-01
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	4.170E-17	1.489E+00	4.740E-01
4.490E+04	1.650E+03	3.300E+03	4.490E+01	1.472E+00	4.400E-17	1.571E+00	5.002E-01
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	5.100E-17	1.821E+00	5.797E-01
5.490E+04	2.017E+03	4.035E+03	5.490E+01	1.627E+00	5.300E-17	1.893E+00	6.025E-01
6.000E+04	2.205E+03	4.410E+03	6.000E+01	1.701E+00	5.500E-17	1.964E+00	6.252E-01
6.490E+04	2.385E+03	4.770E+03	6.490E+01	1.769E+00	5.800E-17	2.071E+00	6.593E-01
7.000E+04	2.572E+03	5.145E+03	7.000E+01	1.838E+00	5.700E-17	2.036E+00	6.479E-01
7.750E+04	2.848E+03	5.696E+03	7.750E+01	1.934E+00	5.600E-17	2.000E+00	6.366E-01
9.000E+04	3.307E+03	6.615E+03	9.000E+01	2.084E+00	5.700E-17	2.036E+00	6.479E-01
1.033E+05	3.796E+03	7.592E+03	1.033E+02	2.232E+00	6.100E-17	2.178E+00	6.934E-01
1.167E+05	4.289E+03	8.577E+03	1.167E+02	2.373E+00	5.900E-17	2.107E+00	6.707E-01
1.447E+05	5.318E+03	1.064E+04	1.447E+02	2.642E+00	5.800E-17	2.071E+00	6.593E-01
1.573E+05	5.781E+03	1.156E+04	1.573E+02	2.755E+00	5.400E-17	1.928E+00	6.138E-01
1.693E+05	6.222E+03	1.244E+04	1.693E+02	2.858E+00	4.000E-17	1.428E+00	4.547E-01
1.813E+05	6.663E+03	1.333E+04	1.813E+02	2.957E+00	3.700E-17	1.321E+00	4.206E-01
1.933E+05	7.103E+03	1.421E+04	1.933E+02	3.054E+00	3.000E-17	1.071E+00	3.410E-01
2.200E+05	8.085E+03	1.617E+04	2.200E+02	3.258E+00	2.700E-17	9.642E-01	3.069E-01
2.320E+05	8.526E+03	1.705E+04	2.320E+02	3.345E+00	2.000E-17	7.142E-01	2.273E-01
2.480E+05	9.114E+03	1.823E+04	2.480E+02	3.459E+00	1.900E-17	6.785E-01	2.160E-01
2.600E+05	9.555E+03	1.911E+04	2.600E+02	3.542E+00	1.600E-17	5.714E-01	1.819E-01
2.720E+05	9.996E+03	1.999E+04	2.720E+02	3.622E+00	1.400E-17	4.999E-01	1.591E-01
3.007E+05	1.105E+04	2.210E+04	3.007E+02	3.809E+00	1.100E-17	3.928E-01	1.250E-01
3.213E+05	1.181E+04	2.361E+04	3.213E+02	3.937E+00	7.600E-18	2.714E-01	8.639E-02
3.420E+05	1.257E+04	2.514E+04	3.420E+02	4.062E+00	7.000E-18	2.500E-01	7.957E-02
3.700E+05	1.360E+04	2.719E+04	3.700E+02	4.225E+00	5.600E-18	2.000E-01	6.366E-02
3.807E+05	1.399E+04	2.798E+04	3.807E+02	4.285E+00	4.800E-18	1.714E-01	5.456E-02
4.053E+05	1.489E+04	2.979E+04	4.053E+02	4.422E+00	3.700E-18	1.321E-01	4.206E-02
4.360E+05	1.602E+04	3.204E+04	4.360E+02	4.586E+00	2.400E-18	8.571E-02	2.728E-02

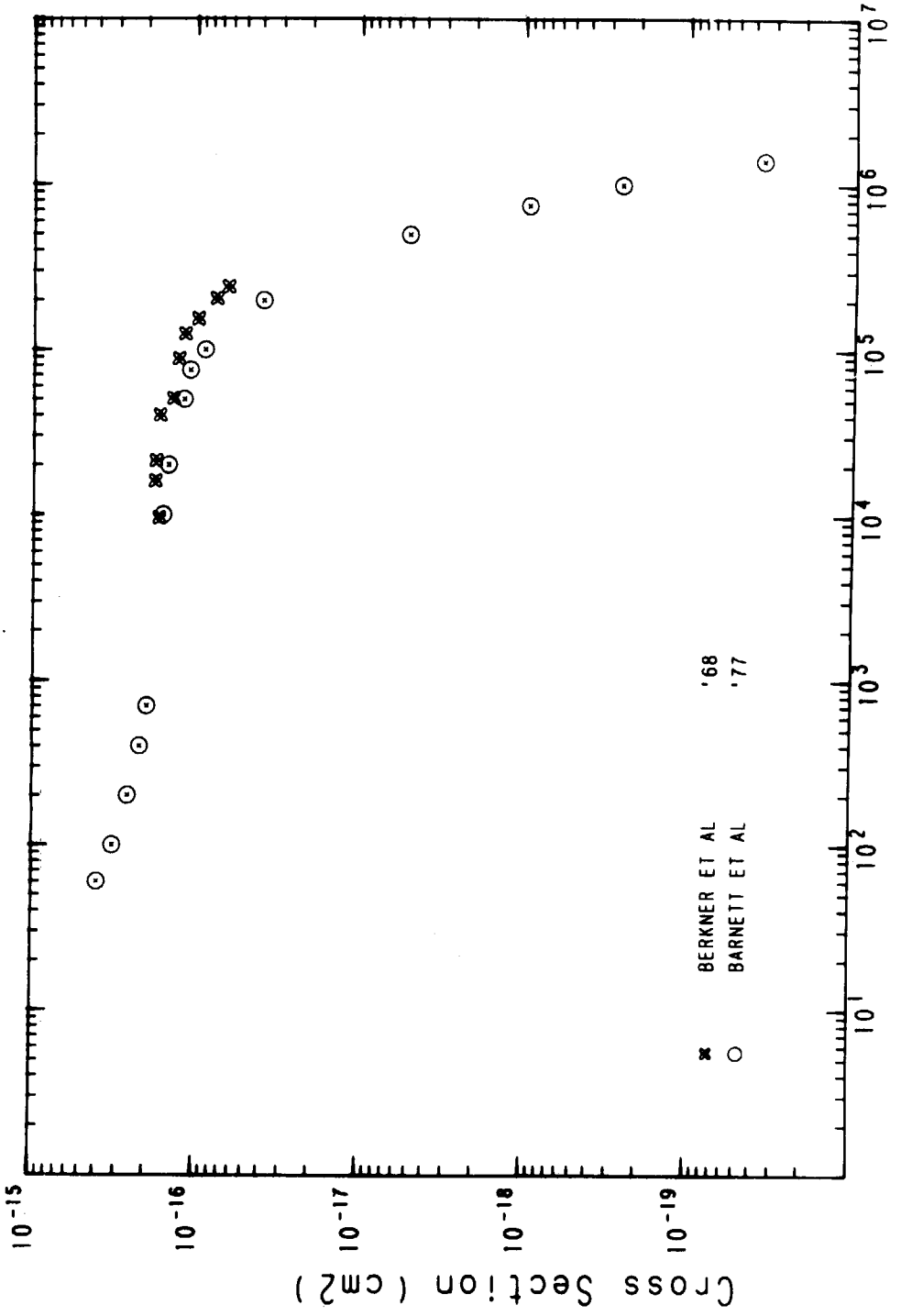

FIG. 8 HE++-HE(20) ENERGY 60.00(eV) - 1.40(MeV)

TABLE 8

PROCESS : HE++-HE(20)
BERKNER, PHYS. REV. 166 44 (1968)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
9.600E+03	3.528E+02	7.056E+02	9.600E+00	6.805E-01	1.700E-16	6.071E+00	1.932E+00
1.600E+04	5.880E+02	1.176E+03	1.600E+01	8.785E-01	1.800E-16	6.428E+00	2.046E+00
2.130E+04	7.827E+02	1.565E+03	2.130E+01	1.014E+00	1.800E-16	6.428E+00	2.046E+00
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	1.700E-16	6.071E+00	1.932E+00
5.070E+04	1.863E+03	3.726E+03	5.070E+01	1.564E+00	1.400E-16	5.000E+00	1.591E+00
8.800E+04	3.234E+03	6.468E+03	8.800E+01	2.060E+00	1.300E-16	4.642E+00	1.478E+00
1.253E+05	4.605E+03	9.209E+03	1.253E+02	2.459E+00	1.200E-16	4.285E+00	1.364E+00
1.547E+05	5.685E+03	1.137E+04	1.547E+02	2.732E+00	1.000E-16	3.571E+00	1.137E+00
2.053E+05	7.544E+03	1.509E+04	2.053E+02	3.147E+00	7.700E-17	2.750E+00	8.753E-01
2.413E+05	8.867E+03	1.773E+04	2.413E+02	3.412E+00	6.500E-17	2.321E+00	7.389E-01

PROCESS : HE++-HE(20)
BARNETT ET AL. ORNL 5206 (1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
6.000E+01	2.205E+00	4.410E+00	6.000E-02	5.380E-02	4.000E-16	1.428E+01	4.547E+00
1.000E+02	3.675E+00	7.350E+00	1.000E-01	6.945E-02	3.200E-16	1.143E+01	3.637E+00
2.000E+02	7.350E+00	1.470E+01	2.000E-01	9.822E-02	2.600E-16	9.285E+00	2.955E+00
4.000E+02	1.470E+01	2.940E+01	4.000E-01	1.389E-01	2.200E-16	7.856E+00	2.501E+00
7.000E+02	2.572E+01	5.145E+01	7.000E-01	1.838E-01	2.000E-16	7.142E+00	2.273E+00
1.000E+04	3.675E+02	7.350E+02	1.000E+01	6.945E-01	1.600E-16	5.714E+00	1.819E+00
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	1.500E-16	5.357E+00	1.705E+00
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	1.200E-16	4.285E+00	1.364E+00
7.500E+04	2.756E+03	5.512E+03	7.500E+01	1.902E+00	1.100E-16	3.928E+00	1.250E+00
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	9.000E-17	3.214E+00	1.023E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	4.000E-17	1.428E+00	4.547E-01
5.000E+05	1.837E+04	3.675E+04	5.000E+02	4.911E+00	5.100E-18	1.821E-01	5.797E-02
7.500E+05	2.756E+04	5.512E+04	7.500E+02	6.015E+00	9.500E-19	3.393E-02	1.080E-02
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	2.600E-19	9.285E-03	2.955E-03
1.400E+06	5.145E+04	1.029E+05	1.400E+03	8.218E+00	3.600E-20	1.286E-03	4.092E-04

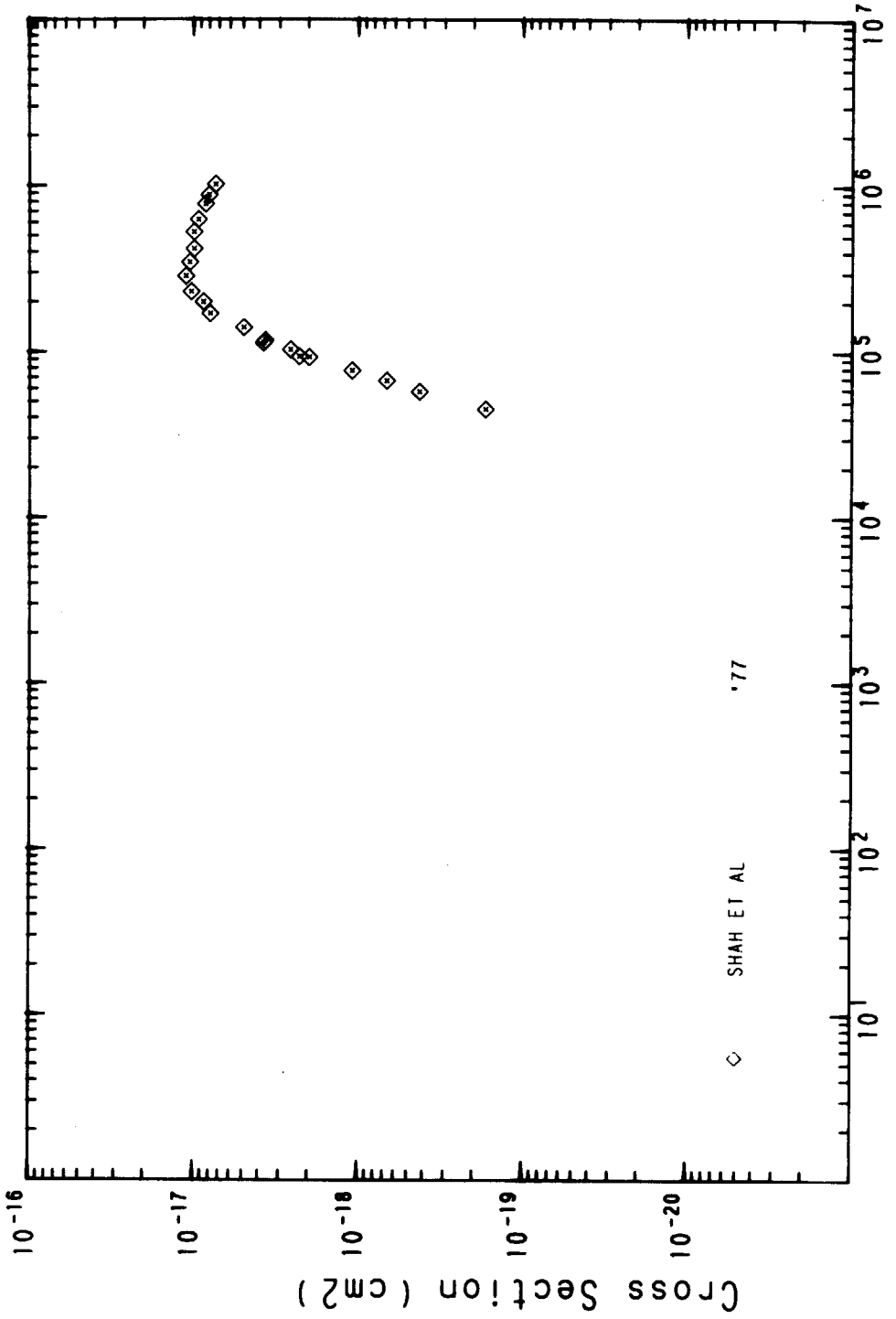

FIG. 9 HE+-H(12) ENERGY 45.00(keV) - 1.02(MeV)

TABLE 9

PROCESS : HE+-H (12)
SHAH ET AL, J,PHYS,B 10 L723(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
4,500E+04	1,654E+03	3,307E+03	4,500E+01	1,473E+00	1,700E-19	6,071E-03	1,932E-03
5,750E+04	2,113E+03	4,226E+03	5,750E+01	1,665E+00	4,300E-19	1,536E-02	4,888E-03
6,700E+04	2,462E+03	4,924E+03	6,700E+01	1,798E+00	6,800E-19	2,428E-02	7,730E-03
7,700E+04	2,830E+03	5,659E+03	7,700E+01	1,927E+00	1,100E-18	3,928E-02	1,250E-02
9,250E+04	3,399E+03	6,798E+03	9,250E+01	2,112E+00	2,000E-18	7,142E-02	2,273E-02
9,350E+04	3,436E+03	6,872E+03	9,350E+01	2,124E+00	2,300E-18	8,213E-02	2,614E-02
1,030E+05	3,785E+03	7,570E+03	1,030E+02	2,229E+00	2,600E-18	9,285E-02	2,955E-02
1,130E+05	4,153E+03	8,305E+03	1,130E+02	2,335E+00	3,800E-18	1,357E-01	4,319E-02
1,170E+05	4,300E+03	8,599E+03	1,170E+02	2,376E+00	3,700E-18	1,321E-01	4,206E-02
1,400E+05	5,145E+03	1,029E+04	1,400E+02	2,599E+00	5,000E-18	1,786E-01	5,684E-02
1,700E+05	6,247E+03	1,249E+04	1,700E+02	2,864E+00	8,000E-18	2,857E-01	9,094E-02
2,000E+05	7,350E+03	1,470E+04	2,000E+02	3,106E+00	8,800E-18	3,143E-01	1,000E-01
2,300E+05	8,452E+03	1,690E+04	2,300E+02	3,331E+00	1,040E-17	3,714E-01	1,182E-01
2,850E+05	1,047E+04	2,095E+04	2,850E+02	3,708E+00	1,120E-17	4,000E-01	1,273E-01
3,450E+05	1,268E+04	2,536E+04	3,450E+02	4,080E+00	1,060E-17	3,785E-01	1,205E-01
4,160E+05	1,529E+04	3,057E+04	4,160E+02	4,480E+00	1,000E-17	3,571E-01	1,137E-01
5,250E+05	1,929E+04	3,859E+04	5,250E+02	5,032E+00	1,000E-17	3,571E-01	1,137E-01
6,250E+05	2,297E+04	4,594E+04	6,250E+02	5,491E+00	9,400E-18	3,357E-01	1,069E-01
7,750E+05	2,848E+04	5,696E+04	7,750E+02	6,114E+00	8,500E-18	3,035E-01	9,662E-02
8,800E+05	3,234E+04	6,468E+04	8,800E+02	6,515E+00	8,100E-18	2,893E-01	9,207E-02
1,020E+06	3,748E+04	7,497E+04	1,020E+03	7,015E+00	7,400E-18	2,643E-01	8,412E-02

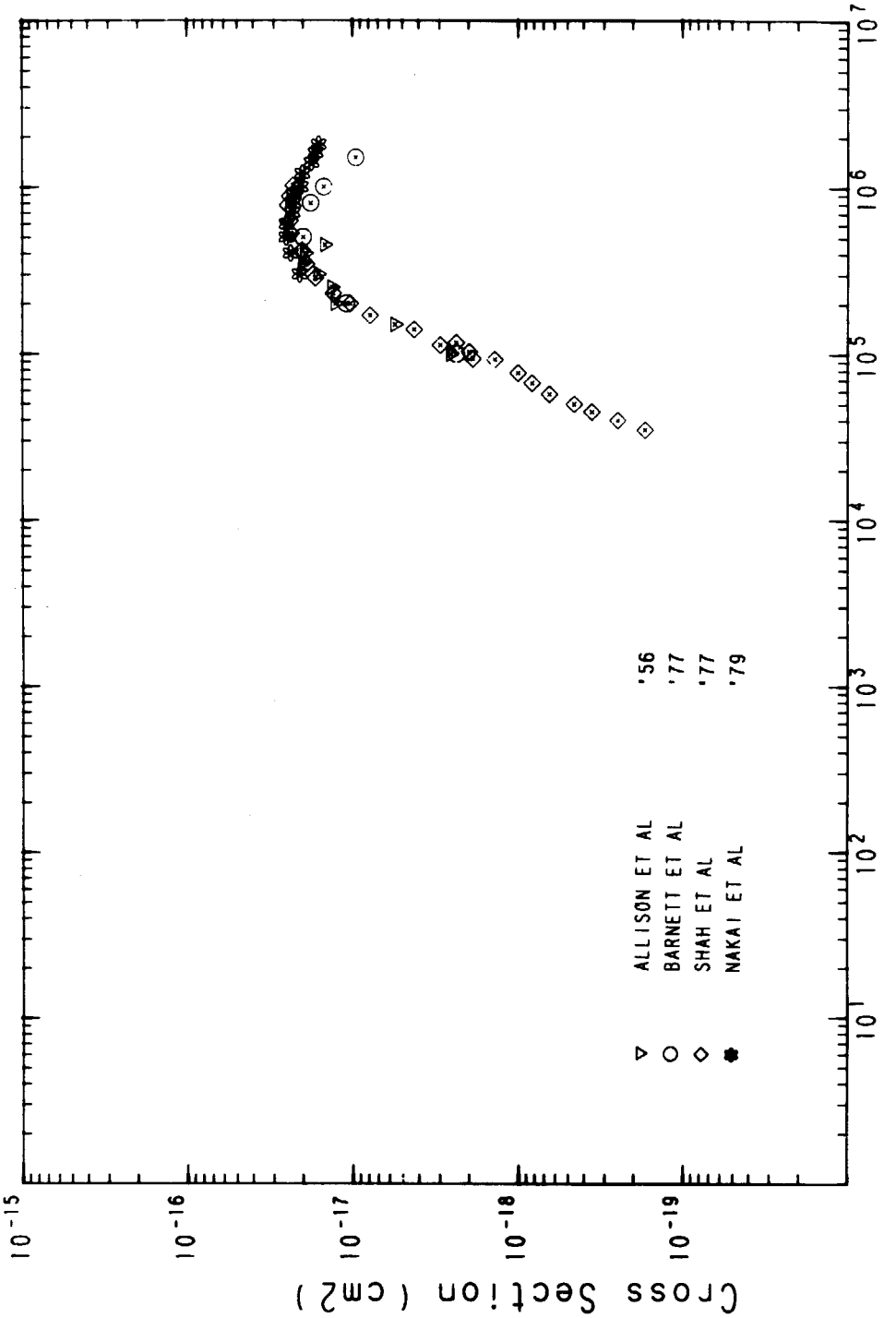

FIG. 10 HE+-H2(12) ENERGY 35.00(keV) - 1.80(MeV)

TABLE 10

PROCESS : HE+-H2(12)
ALLISON ET AL, PHYS,REV,102 1041(1956)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
			------		----------		
1,000E+02	3,675E+00	7,350E+00	1,000E-01	6,945E-02	2,600E-18	9,285E-02	2,955E-02
1,500E+02	5,512E+00	1,102E+01	1,500E-01	8,506E-02	5,600E-18	2,000E-01	6,366E-02
2,000E+02	7,350E+00	1,470E+01	2,000E-01	9,822E-02	1,280E-17	4,571E-01	1,455E-01
2,500E+02	9,187E+00	1,837E+01	2,500E-01	1,098E-01	1,340E-17	4,785E-01	1,523E-01
3,000E+02	1,102E+01	2,205E+01	3,000E-01	1,203E-01	1,620E-17	5,785E-01	1,841E-01
3,500E+02	1,286E+01	2,572E+01	3,500E-01	1,299E-01	2,000E-17	7,142E-01	2,273E-01
4,000E+02	1,470E+01	2,940E+01	4,000E-01	1,389E-01	1,940E-17	6,928E-01	2,205E-01
4,500E+02	1,654E+01	3,307E+01	4,500E-01	1,473E-01	1,480E-17	5,285E-01	1,682E-01

PROCESS : HE+-H2(12)
BARNETT ET AL, ORNL-5206(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
			------		----------		
1,000E+05	3,675E+03	7,350E+03	1,000E+02	2,196E+00	2,400E-18	8,571E-02	2,728E-02
2,000E+05	7,350E+03	1,470E+04	2,000E+02	3,106E+00	1,100E-17	3,928E-01	1,250E-01
5,000E+05	1,837E+04	3,675E+04	5,000E+02	4,911E+00	2,000E-17	7,142E-01	2,273E-01
8,000E+05	2,940E+04	5,880E+04	8,000E+02	6,212E+00	1,800E-17	6,428E-01	2,046E-01
1,000E+06	3,675E+04	7,350E+04	1,000E+03	6,945E+00	1,500E-17	5,357E-01	1,705E-01
1,500E+06	5,512E+04	1,102E+05	1,500E+03	8,506E+00	9,600E-18	3,428E-01	1,091E-01

TABLE 10 - CONTINUED

PROCESS : HE+-H2(12)
SHAH ET AL, J.PHYS.B.18 L723(1978)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
			------		----------		
3.500E+04	1.286E+03	2.572E+03	3.500E+01	1.299E+00	1.700E-19	6.071E-03	1.932E-03
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	2.500E-19	8.928E-03	2.842E-03
4.500E+04	1.654E+03	3.307E+03	4.500E+01	1.473E+00	3.600E-19	1.286E-02	4.092E-03
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	4.600E-19	1.643E-02	5.229E-03
5.750E+04	2.113E+03	4.226E+03	5.750E+01	1.665E+00	6.500E-19	2.321E-02	7.389E-03
6.700E+04	2.462E+03	4.924E+03	6.700E+01	1.798E+00	8.300E-19	2.964E-02	9.435E-03
7.700E+04	2.830E+03	5.659E+03	7.700E+01	1.927E+00	1.010E-18	3.607E-02	1.148E-02
9.250E+04	3.399E+03	6.798E+03	9.250E+01	2.112E+00	1.400E-18	5.000E-02	1.591E-02
9.350E+04	3.436E+03	6.872E+03	9.350E+01	2.124E+00	1.900E-18	6.785E-02	2.160E-02
1.030E+05	3.785E+03	7.570E+03	1.030E+02	2.229E+00	2.000E-18	7.142E-02	2.273E-02
1.130E+05	4.153E+03	8.305E+03	1.130E+02	2.335E+00	3.000E-18	1.071E-01	3.410E-02
1.170E+05	4.300E+03	8.599E+03	1.170E+02	2.376E+00	2.400E-18	8.571E-02	2.728E-02
1.400E+05	5.145E+03	1.029E+04	1.400E+02	2.599E+00	4.300E-18	1.536E-01	4.888E-02
1.700E+05	6.247E+03	1.249E+04	1.700E+02	2.864E+00	7.900E-18	2.821E-01	8.980E-02
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	1.040E-17	3.714E-01	1.182E-01
2.300E+05	8.452E+03	1.690E+04	2.300E+02	3.331E+00	1.320E-17	4.714E-01	1.500E-01
2.850E+05	1.047E+04	2.095E+04	2.850E+02	3.708E+00	1.690E-17	6.035E-01	1.921E-01
3.450E+05	1.268E+04	2.536E+04	3.450E+02	4.080E+00	1.910E-17	6.821E-01	2.171E-01
4.160E+05	1.529E+04	3.057E+04	4.160E+02	4.480E+00	2.030E-17	7.249E-01	2.308E-01
5.250E+05	1.929E+04	3.859E+04	5.250E+02	5.032E+00	2.370E-17	8.463E-01	2.694E-01
6.250E+05	2.297E+04	4.594E+04	6.250E+02	5.491E+00	2.400E-17	8.571E-01	2.728E-01
7.750E+05	2.848E+04	5.696E+04	7.750E+02	6.114E+00	2.490E-17	8.892E-01	2.830E-01
8.800E+05	3.234E+04	6.468E+04	8.800E+02	6.515E+00	2.420E-17	8.642E-01	2.751E-01
1.020E+06	3.748E+04	7.497E+04	1.020E+03	7.015E+00	2.300E-17	8.213E-01	2.614E-01

PROCESS : HE+-H2(12)
NAKAI ET AL, JAERI(UNPUBLISHED) (1979)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
			------		----------		
3.000E+05	1.102E+04	2.205E+04	3.000E+02	3.804E+00	2.100E-17	7.499E-01	2.387E-01
4.000E+05	1.470E+04	2.940E+04	4.000E+02	4.393E+00	2.380E-17	8.499E-01	2.705E-01
5.000E+05	1.837E+04	3.675E+04	5.000E+02	4.911E+00	2.530E-17	9.035E-01	2.876E-01
6.000E+05	2.205E+04	4.410E+04	6.000E+02	5.380E+00	2.520E-17	8.999E-01	2.865E-01
7.000E+05	2.572E+04	5.143E+04	7.000E+02	5.811E+00	2.320E-17	8.285E-01	2.637E-01
8.000E+05	2.940E+04	5.880E+04	8.000E+02	6.212E+00	2.290E-17	8.178E-01	2.603E-01
9.000E+05	3.307E+04	6.615E+04	9.000E+02	6.589E+00	2.290E-17	8.178E-01	2.603E-01
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	2.070E-17	7.392E-01	2.353E-01
1.200E+06	4.410E+04	8.820E+04	1.200E+03	7.608E+00	2.020E-17	7.214E-01	2.296E-01
1.400E+06	5.145E+04	1.029E+05	1.400E+03	8.218E+00	1.780E-17	6.357E-01	2.023E-01
1.600E+06	5.880E+04	1.176E+05	1.600E+03	8.785E+00	1.680E-17	5.999E-01	1.910E-01
1.800E+06	6.615E+04	1.323E+05	1.800E+03	9.318E+00	1.610E-17	5.749E-01	1.830E-01

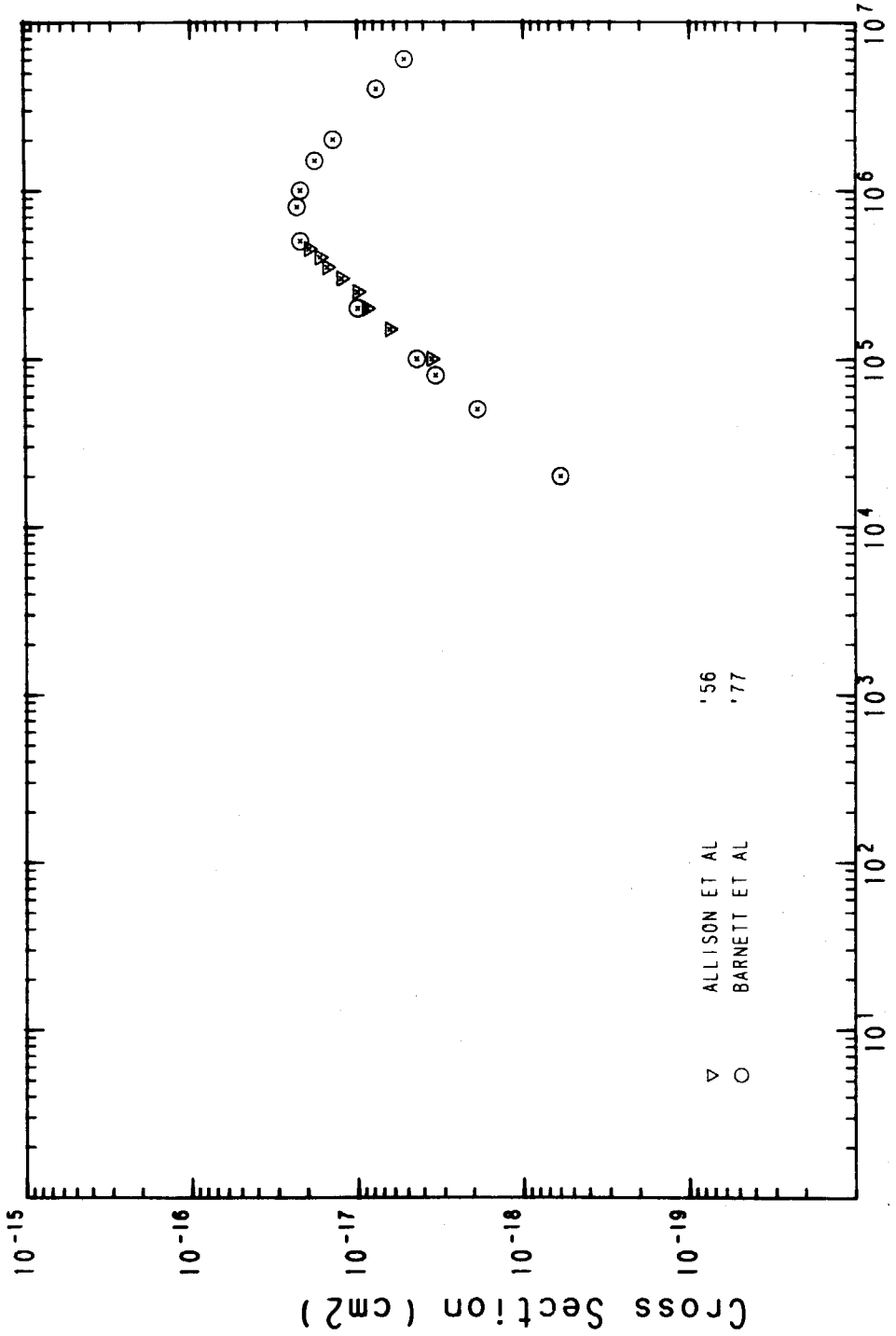

FIG. 11 HE+-HE(12) ENERGY 20.00(keV) - 6.00(MeV)

TABLE 11

PROCESS : HE+-HE(12)
ALLISON ET AL, PHYS,REV,102 1041(1956)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
1,000E+02	3,675E+00	7,350E+00	1,000E-01	6,945E-02	3,600E-18	1,286E-01	4,092E-02
1,500E+02	5,512E+00	1,102E+01	1,500E-01	8,506E-02	6,400E-18	2,285E-01	7,275E-02
2,000E+02	7,350E+00	1,470E+01	2,000E-01	9,822E-02	8,800E-18	3,143E-01	1,000E-01
2,500E+02	9,187E+00	1,837E+01	2,500E-01	1,098E-01	1,000E-17	3,571E-01	1,137E-01
3,000E+02	1,102E+01	2,205E+01	3,000E-01	1,203E-01	1,250E-17	4,464E-01	1,421E-01
3,500E+02	1,286E+01	2,572E+01	3,500E-01	1,299E-01	1,520E-17	5,428E-01	1,728E-01
4,000E+02	1,470E+01	2,940E+01	4,000E-01	1,389E-01	1,680E-17	5,999E-01	1,910E-01
4,500E+02	1,654E+01	3,307E+01	4,500E-01	1,473E-01	1,950E-17	6,964E-01	2,217E-01

PROCESS : HE+-HE(12)
BARNETT ET AL, ORNL 5206 (1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2,000E+04	7,350E+02	1,470E+03	2,000E+01	9,822E-01	6,000E-19	2,143E-02	6,820E-03
5,000E+04	1,837E+03	3,675E+03	5,000E+01	1,553E+00	1,900E-18	6,785E-02	2,160E-02
8,000E+04	2,940E+03	5,880E+03	8,000E+01	1,964E+00	3,400E-18	1,214E-01	3,865E-02
1,000E+05	3,675E+03	7,350E+03	1,000E+02	2,196E+00	4,400E-18	1,571E-01	5,002E-02
2,000E+05	7,350E+03	1,470E+04	2,000E+02	3,106E+00	1,000E-17	3,571E-01	1,137E-01
5,000E+05	1,837E+04	3,675E+04	5,000E+02	4,911E+00	2,200E-17	7,856E-01	2,501E-01
8,000E+05	2,940E+04	5,880E+04	8,000E+02	6,212E+00	2,300E-17	8,213E-01	2,614E-01
1,000E+06	3,675E+04	7,350E+04	1,000E+03	6,945E+00	2,200E-17	7,856E-01	2,501E-01
1,500E+06	5,512E+04	1,102E+05	1,500E+03	8,506E+00	1,800E-17	6,428E-01	2,046E-01
2,000E+06	7,350E+04	1,470E+05	2,000E+03	9,822E+00	1,400E-17	4,999E-01	1,591E-01
4,000E+06	1,470E+05	2,940E+05	4,000E+03	1,389E+01	7,700E-18	2,750E-01	8,753E-02
6,000E+06	2,205E+05	4,410E+05	6,000E+03	1,701E+01	5,200E-18	1,857E-01	5,911E-02

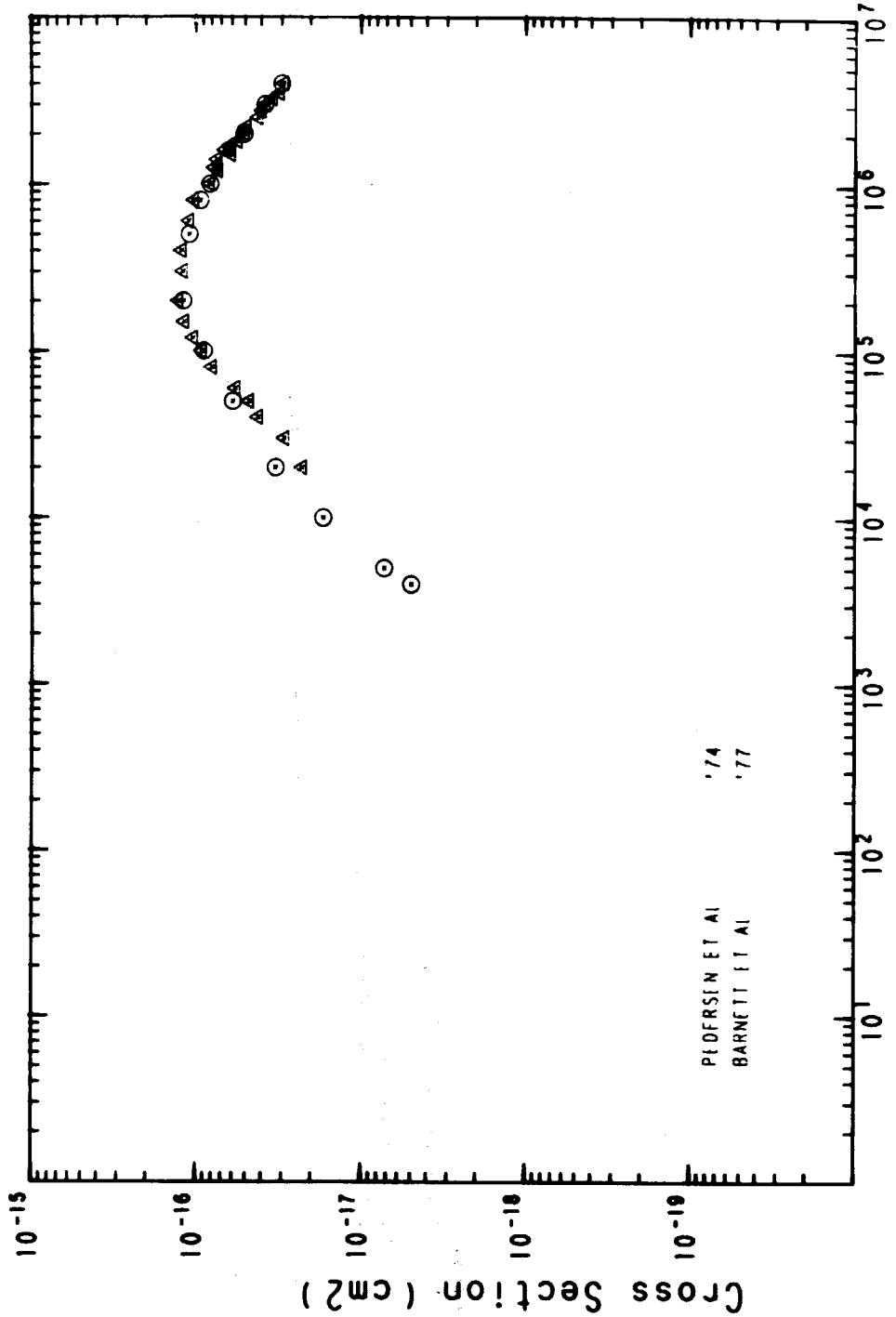

FIG. 13 HE-H2(01) ENERGY 4.00(keV) - 4.00(MeV)

TABLE 13

PROCESS : HE-H2(01)
PEDERSEN ET AL. J.PHYS.B7 132(1974)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(FV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	2.280E-17	8.142E-01	2.592E-01
3.000E+04	1.102E+03	2.205E+03	3.000E+01	1.203E+00	2.930E-17	1.046E+00	3.331E-01
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	4.240E-17	1.514E+00	4.820E-01
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	4.790E-17	1.711E+00	5.445E-01
6.000E+04	2.205E+03	4.410E+03	6.000E+01	1.701E+00	5.800E-17	2.071E+00	6.593E-01
8.000E+04	2.940E+03	5.880E+03	8.000E+01	1.964E+00	8.030E-17	2.868E+00	9.128E-01
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	9.260E-17	3.307E+00	1.053E+00
1.200E+05	4.410E+03	8.820E+03	1.200E+02	2.406E+00	1.050E-16	3.750E+00	1.194E+00
1.500E+05	5.512E+03	1.102E+04	1.500E+02	2.690E+00	1.190E-16	4.250E+00	1.353E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	1.290E-16	4.607E+00	1.466E+00
3.000E+05	1.102E+04	2.205E+04	3.000E+02	3.804E+00	1.210E-16	4.321E+00	1.375E+00
4.000E+05	1.470E+04	2.940E+04	4.000E+02	4.393E+00	1.230E-16	4.392E+00	1.398E+00
6.000E+05	2.205E+04	4.410E+04	6.000E+02	5.380E+00	1.110E-16	3.964E+00	1.262E+00
8.000E+05	2.940E+04	5.880E+04	8.000E+02	6.212E+00	1.030E-16	3.678E+00	1.171E+00
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	8.260E-17	2.950E+00	9.389E-01
1.200E+06	4.410E+04	8.820E+04	1.200E+03	7.608E+00	7.380E-17	2.635E+00	8.389E-01
1.250E+06	4.594E+04	9.187E+04	1.250E+03	7.765E+00	7.760E-17	2.771E+00	8.821E-01
1.400E+06	5.145E+04	1.029E+05	1.400E+03	8.218E+00	7.470E-17	2.668E+00	8.491E-01
1.500E+06	5.512E+04	1.102E+05	1.500E+03	8.506E+00	6.170E-17	2.203E+00	7.013E-01
1.600E+06	5.880E+04	1.176E+05	1.600E+03	8.785E+00	6.670E-17	2.382E+00	7.582E-01
1.700E+06	6.247E+04	1.249E+05	1.700E+03	9.056E+00	6.220E-17	2.221E+00	7.070E-01
1.800E+06	6.615E+04	1.323E+05	1.800E+03	9.318E+00	5.610E-17	2.003E+00	6.377E-01
2.000E+06	7.350E+04	1.470E+05	2.000E+03	9.822E+00	5.100E-17	1.821E+00	5.797E-01
2.200E+06	8.085E+04	1.617E+05	2.200E+03	1.030E+01	4.960E-17	1.771E+00	5.638E-01
2.500E+06	9.187E+04	1.837E+05	2.500E+03	1.098E+01	4.200E-17	1.500E+00	4.774E-01
2.750E+06	1.011E+05	2.021E+05	2.750E+03	1.152E+01	4.000E-17	1.428E+00	4.547E-01
3.000E+06	1.102E+05	2.205E+05	3.000E+03	1.203E+01	3.780E-17	1.350E+00	4.297E-01
3.250E+06	1.194E+05	2.389E+05	3.250E+03	1.252E+01	3.430E-17	1.225E+00	3.899E-01
3.500E+06	1.286E+05	2.572E+05	3.500E+03	1.299E+01	3.100E-17	1.107E+00	3.524E-01
4.000E+06	1.470E+05	2.940E+05	4.000E+03	1.389E+01	2.930E-17	1.046E+00	3.331E-01

TABLE 13 - CONTINUED

PROCESS : HE-H2(01)
BARNETT ET AL. ORNL-5206(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
4.000E+03	1.470E+02	2.940E+02	4.000E+00	4.393E-01	5.000E-18	1.786E-01	5.684E-02
5.000E+03	1.837E+02	3.675E+02	5.000E+00	4.911E-01	7.300E-18	2.607E-01	8.298E-02
1.000E+04	3.675E+02	7.350E+02	1.000E+01	6.945E-01	1.700E-17	6.071E-01	1.932E-01
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	3.300E-17	1.178E+00	3.751E-01
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	6.000E-17	2.143E+00	6.820E-01
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	9.000E-17	3.214E+00	1.023E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	1.200E-16	4.285E+00	1.364E+00
5.000E+05	1.837E+04	3.675E+04	5.000E+02	4.911E+00	1.100E-16	3.928E+00	1.250E+00
8.000E+05	2.940E+04	5.880E+04	8.000E+02	6.212E+00	9.400E-17	3.357E+00	1.069E+00
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	8.200E-17	2.928E+00	9.321E-01
2.000E+06	7.350E+04	1.470E+05	2.000E+03	9.822E+00	5.100E-17	1.821E+00	5.797E-01
3.000E+06	1.102E+05	2.205E+05	3.000E+03	1.203E+01	3.800E-17	1.357E+00	4.319E-01
4.000E+06	1.470E+05	2.940E+05	4.000E+03	1.3[illegible]E+01	3.000E-17	1.071E+00	3.410E-01

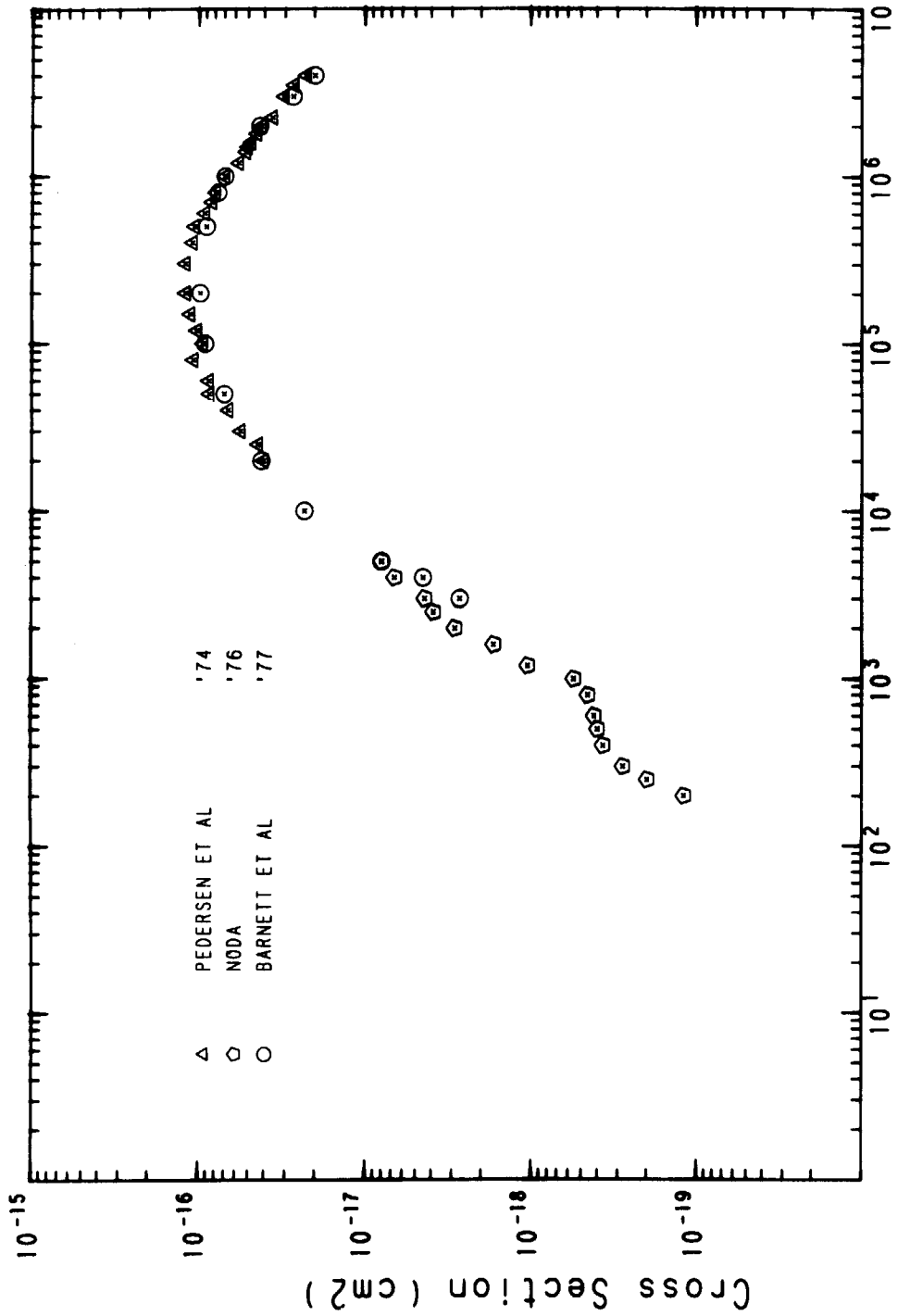
Cross Section (cm2)
Projectile Energy (eV)
PEDERSEN ET AL '74
NODA '76
BARNETT ET AL '77
HE-HE(01) ENERGY 200.00(eV) - 4.00(MeV)

FIG. 14

TABLE 14

PROCESS : HE-HE(01)
PEDERSEN ET AL. J.PHYS.B7 132 (1974)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	4.080E-17	1.457E+00	4.638E-01
2.500E+04	9.187E+02	1.837E+03	2.500E+01	1.098E+00	4.410E-17	1.575E+00	5.013E-01
3.000E+04	1.102E+03	2.205E+03	3.000E+01	1.203E+00	5.620E-17	2.007E+00	6.388E-01
4.000E+04	1.470E+03	2.940E+03	4.000E+01	1.389E+00	6.650E-17	2.375E+00	7.559E-01
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	8.630E-17	3.082E+00	9.810E-01
6.000E+04	2.205E+03	4.410E+03	6.000E+01	1.701E+00	8.700E-17	3.107E+00	9.889E-01
8.000E+04	2.940E+03	5.880E+03	8.000E+01	1.964E+00	1.080E-16	3.857E+00	1.228E+00
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	9.500E-17	3.393E+00	1.080E+00
1.200E+05	4.410E+03	8.820E+03	1.200E+02	2.406E+00	1.030E-16	3.678E+00	1.171E+00
1.500E+05	5.512E+03	1.102E+04	1.500E+02	2.690E+00	1.130E-16	4.035E+00	1.284E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	1.200E-16	4.285E+00	1.364E+00
3.000E+05	1.102E+04	2.205E+04	3.000E+02	3.804E+00	1.200E-16	4.285E+00	1.364E+00
4.000E+05	1.470E+04	2.940E+04	4.000E+02	4.393E+00	1.090E-16	3.892E+00	1.239E+00
5.000E+05	1.837E+04	3.675E+04	5.000E+02	4.911E+00	1.060E-16	3.785E+00	1.205E+00
6.000E+05	2.205E+04	4.410E+04	6.000E+02	5.380E+00	9.250E-17	3.303E+00	1.051E+00
7.000E+05	2.572E+04	5.145E+04	7.000E+02	5.811E+00	8.400E-17	3.000E+00	9.548E-01
8.000E+05	2.940E+04	5.880E+04	8.000E+02	6.212E+00	8.000E-17	2.857E+00	9.094E-01
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	7.040E-17	2.514E+00	8.002E-01
1.200E+06	4.410E+04	8.820E+04	1.200E+03	7.608E+00	5.800E-17	2.071E+00	6.593E-01
1.400E+06	5.145E+04	1.029E+05	1.400E+03	8.218E+00	5.250E-17	1.875E+00	5.968E-01
1.500E+06	5.512E+04	1.102E+05	1.500E+03	8.506E+00	5.120E-17	1.828E+00	5.820E-01
1.600E+06	5.880E+04	1.176E+05	1.600E+03	8.785E+00	4.880E-17	1.743E+00	5.547E-01
1.800E+06	6.615E+04	1.323E+05	1.800E+03	9.318E+00	4.500E-17	1.607E+00	5.115E-01
2.000E+06	7.350E+04	1.470E+05	2.000E+03	9.822E+00	4.210E-17	1.503E+00	4.786E-01
2.250E+06	8.268E+04	1.654E+05	2.250E+03	1.042E+01	3.610E-17	1.289E+00	4.104E-01
3.000E+06	1.102E+05	2.205E+05	3.000E+03	1.203E+01	3.070E-17	1.096E+00	3.490E-01
3.500E+06	1.286E+05	2.572E+05	3.500E+03	1.299E+01	2.680E-17	9.570E-01	3.046E-01
4.000E+06	1.470E+05	2.940E+05	4.000E+03	1.389E+01	2.260E-17	8.071E-01	2.569E-01

TABLE 14 - CONTINUED

PROCESS : HE-HE(01)
NODA, J.PHYS.SOC.JPN 41 625 (1976)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2.000E+02	7.350E+00	1.470E+01	2.000E-01	9.822E-02	1.200E-19	4.285E-03	1.364E-03
2.500E+02	9.187E+00	1.837E+01	2.500E-01	1.098E-01	2.000E-19	7.142E-03	2.273E-03
3.000E+02	1.102E+01	2.205E+01	3.000E-01	1.203E-01	2.800E-19	9.999E-03	3.183E-03
4.000E+02	1.470E+01	2.940E+01	4.000E-01	1.389E-01	3.700E-19	1.321E-02	4.206E-03
5.000E+02	1.837E+01	3.675E+01	5.000E-01	1.553E-01	4.000E-19	1.428E-02	4.547E-03
6.000E+02	2.205E+01	4.410E+01	6.000E-01	1.701E-01	4.200E-19	1.500E-02	4.774E-03
8.000E+02	2.940E+01	5.880E+01	8.000E-01	1.964E-01	4.600E-19	1.643E-02	5.229E-03
1.000E+03	3.675E+01	7.350E+01	1.000E+00	2.196E-01	5.600E-19	2.000E-02	6.366E-03
1.200E+03	4.410E+01	8.820E+01	1.200E+00	2.406E-01	1.060E-18	3.785E-02	1.205E-02
1.600E+03	5.880E+01	1.176E+02	1.600E+00	2.778E-01	1.700E-18	6.071E-02	1.932E-02
2.000E+03	7.350E+01	1.470E+02	2.000E+00	3.106E-01	2.900E-18	1.036E-01	3.296E-02
2.500E+03	9.187E+01	1.837E+02	2.500E+00	3.473E-01	3.900E-18	1.393E-01	4.433E-02
3.000E+03	1.102E+02	2.205E+02	3.000E+00	3.804E-01	4.400E-18	1.571E-01	5.002E-02
4.000E+03	1.470E+02	2.940E+02	4.000E+00	4.393E-01	6.700E-18	2.393E-01	7.616E-02
5.000E+03	1.837E+02	3.675E+02	5.000E+00	4.911E-01	8.000E-18	2.857E-01	9.094E-02

PROCESS : HE-HE(01)
BARNETT ET AL, ORNL-5206(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
3.000E+03	1.102E+02	2.205E+02	3.000E+00	3.804E-01	2.700E-18	9.642E-02	3.069E-02
4.000E+03	1.470E+02	2.940E+02	4.000E+00	4.393E-01	4.500E-18	1.607E-01	5.115E-02
5.000E+03	1.837E+02	3.675E+02	5.000E+00	4.911E-01	8.000E-18	2.857E-01	9.094E-02
1.000E+04	3.675E+02	7.350E+02	1.000E+01	6.945E-01	2.300E-17	8.213E-01	2.614E-01
2.000E+04	7.350E+02	1.470E+03	2.000E+01	9.822E-01	4.200E-17	1.500E+00	4.774E-01
5.000E+04	1.837E+03	3.675E+03	5.000E+01	1.553E+00	7.000E-17	2.500E+00	7.957E-01
1.000E+05	3.675E+03	7.350E+03	1.000E+02	2.196E+00	9.200E-17	3.285E+00	1.046E+00
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	9.800E-17	3.500E+00	1.114E+00
5.000E+05	1.837E+04	3.675E+04	5.000E+02	4.911E+00	9.000E-17	3.214E+00	1.023E+00
8.000E+05	2.940E+04	5.880E+04	8.000E+02	6.212E+00	7.700E-17	2.750E+00	8.753E-01
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	7.000E-17	2.500E+00	7.957E-01
2.000E+06	7.350E+04	1.470E+05	2.000E+03	9.822E+00	4.300E-17	1.536E+00	4.888E-01
3.000E+06	1.102E+05	2.205E+05	3.000E+03	1.203E+01	2.700E-17	9.642E-01	3.069E-01
4.000E+06	1.470E+05	2.940E+05	4.000E+03	1.389E+01	2.000E-17	7.142E-01	2.273E-01

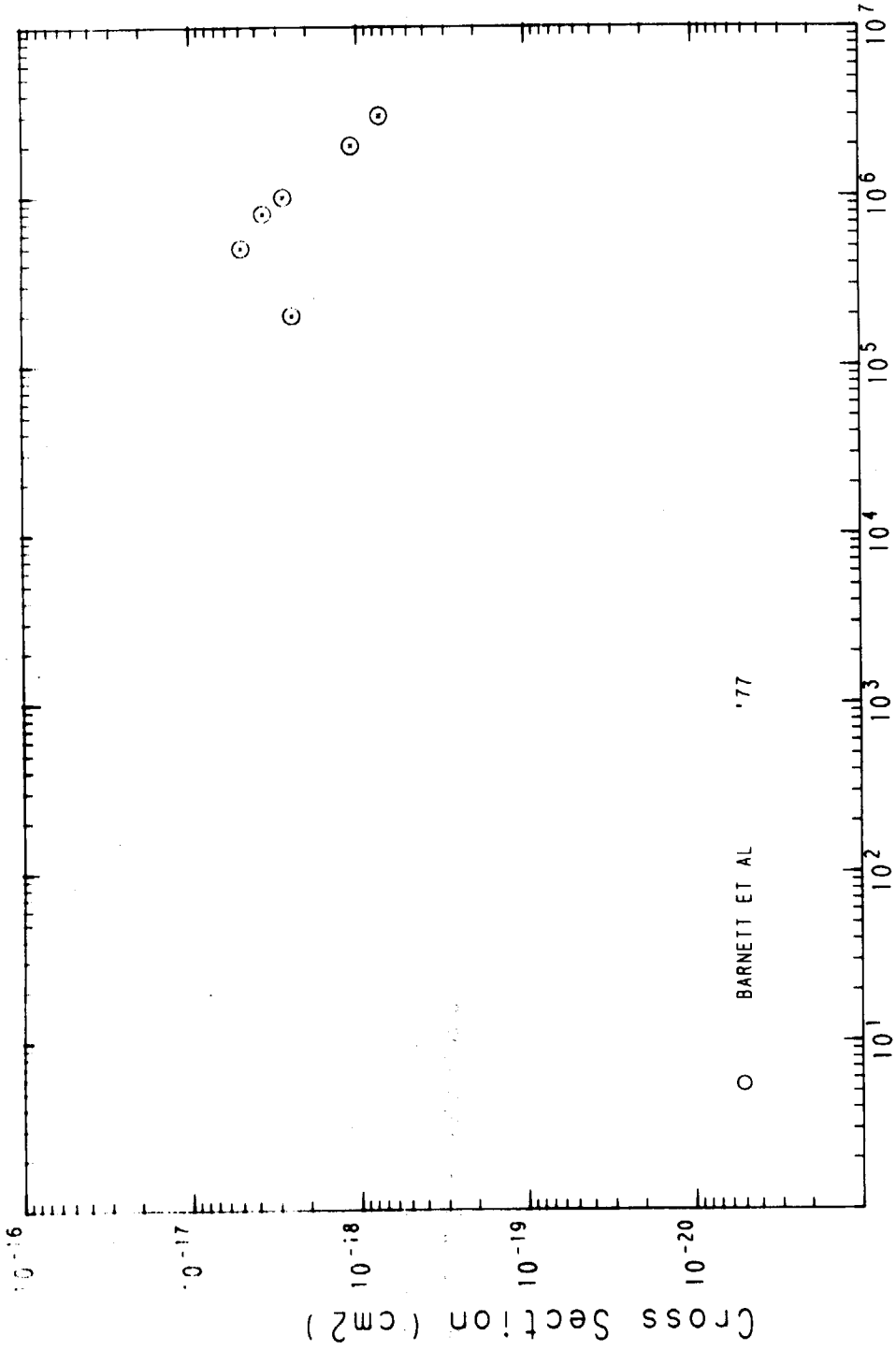

FIG. 16 HE-H2(02) ENERGY 200.00(keV) - 3.00(MeV)

Table 16

PROCESS : HE-H2(02)
BARNETT ET AL, ORNL-5206(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM,
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO,

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2,000E+05	7,350E+03	1,470E+04	2,000E+02	3,106E+00	2,500E-18	8,928E-02	2,842E-02
5,000E+05	1,837E+04	3,675E+04	5,000E+02	4,911E+00	5,000E-18	1,786E-01	5,684E-02
8,000E+05	2,940E+04	5,880E+04	8,000E+02	6,212E+00	3,700E-18	1,321E-01	4,206E-02
1,000E+06	3,675E+04	7,350E+04	1,000E+03	6,945E+00	2,800E-18	9,999E-02	3,183E-02
2,000E+06	7,350E+04	1,470E+05	2,000E+03	9,822E+00	1,100E-18	3,928E-02	1,250E-02
3,000E+06	1,102E+05	2,205E+05	3,000E+03	1,203E+01	7,400E-19	2,643E-02	8,412E-03

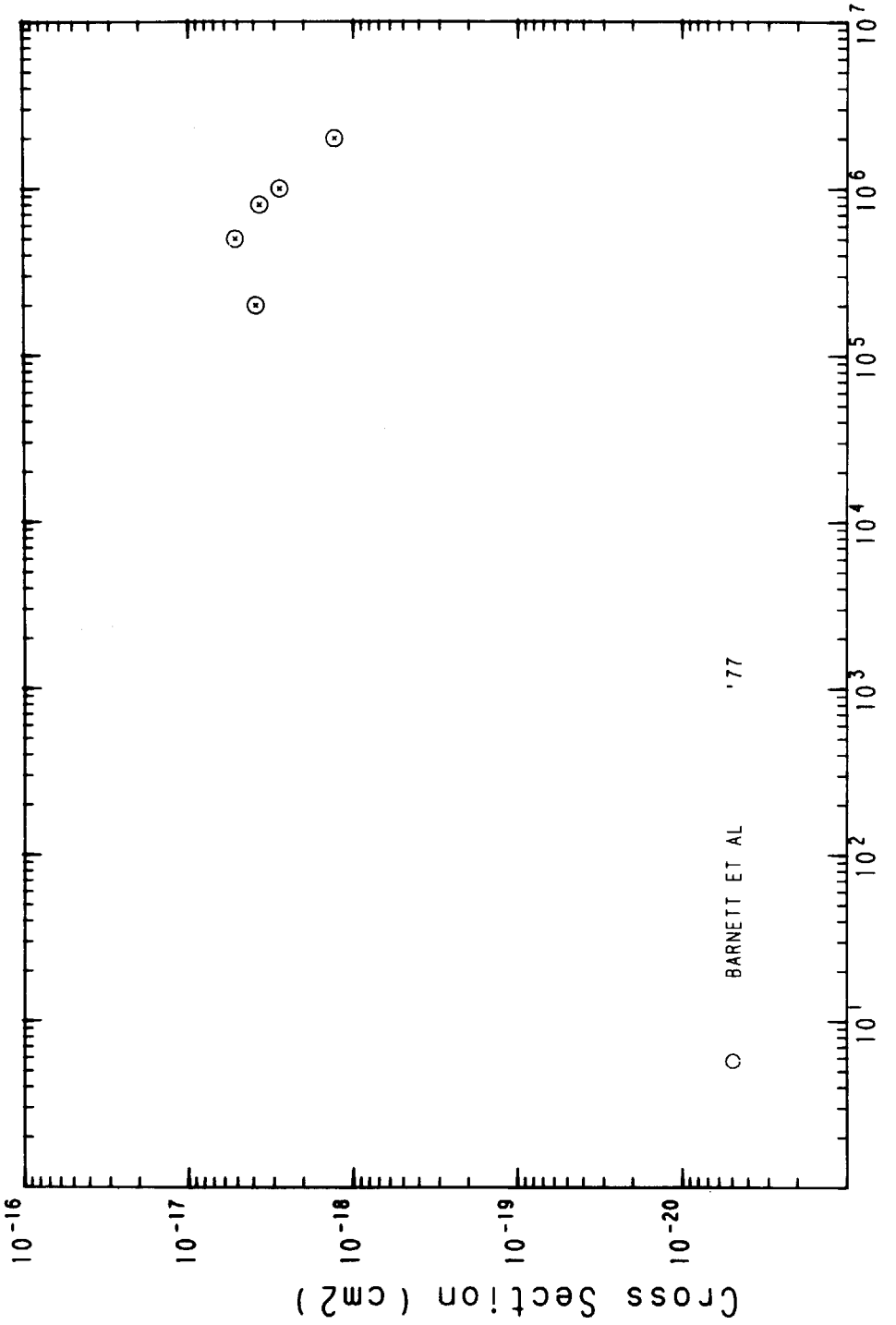
Cross Section (cm2)
Projectile Energy (eV)
BARNETT ET AL '77
HE-HE(02) ENERGY 200.00(keV) - 2.00(MeV)

FIG. 17

TABLE 17

PROCESS : HE-HE(02)
BARNETT ET AL. ORNL 5206(1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2.000E+05	7.350E+03	1.470E+04	2.000E+02	3.106E+00	3.900E-18	1.393E-01	4.433E-02
5.000E+05	1.837E+04	3.675E+04	5.000E+02	4.911E+00	5.200E-18	1.857E-01	5.911E-02
8.000E+05	2.940E+04	5.880E+04	8.000E+02	6.212E+00	3.700E-18	1.321E-01	4.206E-02
1.000E+06	3.675E+04	7.350E+04	1.000E+03	6.945E+00	2.800E-18	9.999E-02	3.183E-02
2.000E+06	7.350E+04	1.470E+05	2.000E+03	9.822E+00	1.300E-18	4.642E-02	1.478E-02

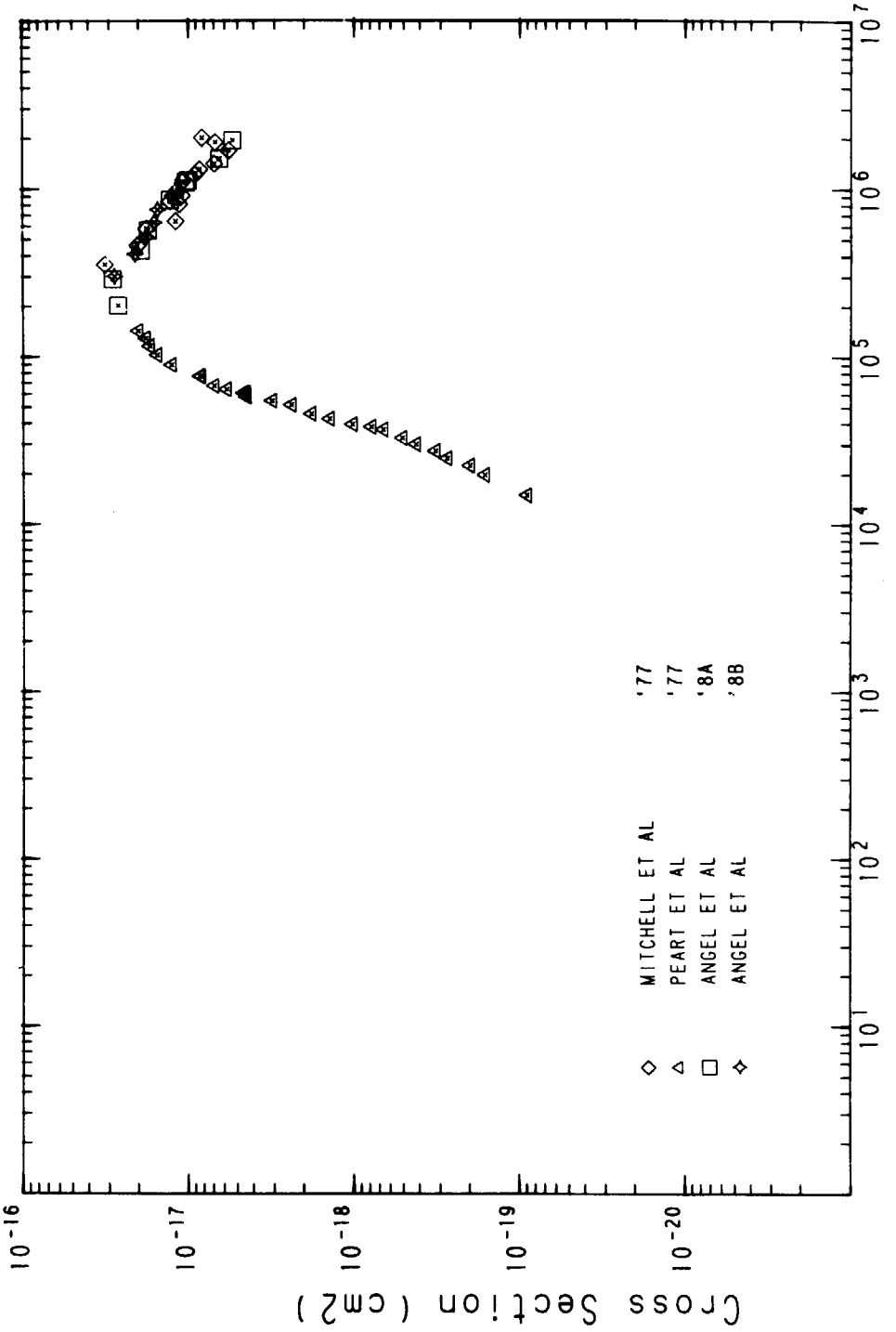

FIG. 18 HE+-H+(12) ENERGY 14.90(keV) - 2.01(MeV)

TABLE 18

PROCESS : HE+-H+(12)
MITCHELL ET AL. J. PHYS. B10 1897 (1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
3.550E+05	1.305E+04	2.609E+04	3.550E+02	4.138E+00	3.200E-17	1.143E+00	3.637E-01
4.600E+05	1.690E+04	3.381E+04	4.600E+02	4.711E+00	2.040E-17	7.285E-01	2.319E-01
5.800E+05	2.131E+04	4.263E+04	5.800E+02	5.290E+00	1.800E-17	6.428E-01	2.046E-01
6.400E+05	2.352E+04	4.704E+04	6.400E+02	5.556E+00	1.200E-17	4.285E-01	1.364E-01
8.100E+05	2.977E+04	5.953E+04	8.100E+02	6.251E+00	1.140E-17	4.071E-01	1.296E-01
8.400E+05	3.087E+04	6.174E+04	8.400E+02	6.366E+00	1.300E-17	4.642E-01	1.478E-01
9.100E+05	3.344E+04	6.688E+04	9.100E+02	6.626E+00	1.100E-17	3.928E-01	1.250E-01
9.800E+05	3.601E+04	7.203E+04	9.800E+02	6.876E+00	1.170E-17	4.178E-01	1.330E-01
1.100E+06	4.042E+04	8.085E+04	1.100E+03	7.284E+00	1.100E-17	3.928E-01	1.250E-01
1.210E+06	4.447E+04	8.893E+04	1.210E+03	7.640E+00	9.200E-18	3.285E-01	1.046E-01
1.300E+06	4.777E+04	9.555E+04	1.300E+03	7.919E+00	8.600E-18	3.071E-01	9.776E-02
1.405E+06	5.163E+04	1.033E+05	1.405E+03	8.233E+00	7.000E-18	2.500E-01	7.957E-02
1.690E+06	6.210E+04	1.242E+05	1.690E+03	9.029E+00	5.700E-18	2.036E-01	6.479E-02
1.885E+06	6.927E+04	1.385E+05	1.885E+03	9.536E+00	6.900E-18	2.464E-01	7.843E-02
2.010E+06	7.386E+04	1.477E+05	2.010E+03	9.847E+00	8.300E-18	2.964E-01	9.435E-02

PROCESS : HE+-H+(12)
PEART ET AL. J. PHYS. B10 2675 (1977)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
1.490E+04	5.476E+02	1.095E+03	1.490E+01	8.478E-01	9.100E-20	3.250E-03	1.034E-03
1.965E+04	7.221E+02	1.444E+03	1.965E+01	9.736E-01	1.640E-19	5.857E-03	1.864E-03
2.235E+04	8.213E+02	1.643E+03	2.235E+01	1.038E+00	2.020E-19	7.214E-03	2.296E-03
2.465E+04	9.059E+02	1.812E+03	2.465E+01	1.090E+00	2.760E-19	9.856E-03	3.137E-03
2.725E+04	1.001E+03	2.003E+03	2.725E+01	1.147E+00	3.240E-19	1.157E-02	3.683E-03
2.985E+04	1.097E+03	2.194E+03	2.985E+01	1.200E+00	4.250E-19	1.518E-02	4.831E-03
3.255E+04	1.196E+03	2.392E+03	3.255E+01	1.253E+00	5.140E-19	1.836E-02	5.843E-03
3.655E+04	1.343E+03	2.686E+03	3.655E+01	1.328E+00	6.700E-19	2.393E-02	7.616E-03
3.795E+04	1.395E+03	2.789E+03	3.795E+01	1.353E+00	7.930E-19	2.832E-02	9.014E-03
3.930E+04	1.444E+03	2.888E+03	3.930E+01	1.377E+00	1.030E-18	3.678E-02	1.171E-02
4.245E+04	1.560E+03	3.120E+03	4.245E+01	1.431E+00	1.410E-18	5.035E-02	1.603E-02
4.545E+04	1.670E+03	3.340E+03	4.545E+01	1.481E+00	1.820E-18	6.499E-02	2.069E-02
5.150E+04	1.893E+03	3.785E+03	5.150E+01	1.576E+00	2.400E-18	8.571E-02	2.728E-02
5.460E+04	2.006E+03	4.013E+03	5.460E+01	1.623E+00	3.130E-18	1.118E-01	3.558E-02
5.765E+04	2.119E+03	4.237E+03	5.765E+01	1.668E+00	4.460E-18	1.593E-01	5.070E-02
6.075E+04	2.232E+03	4.465E+03	6.075E+01	1.712E+00	4.640E-18	1.657E-01	5.274E-02
6.075E+04	2.232E+03	4.465E+03	6.075E+01	1.712E+00	4.490E-18	1.603E-01	5.104E-02
6.390E+04	2.348E+03	4.696E+03	6.390E+01	1.756E+00	5.880E-18	2.100E-01	6.684E-02
6.705E+04	2.464E+03	4.928E+03	6.705E+01	1.798E+00	7.010E-18	2.503E-01	7.968E-02
7.655E+04	2.813E+03	5.626E+03	7.655E+01	1.922E+00	8.450E-18	3.018E-01	9.605E-02
7.655E+04	2.813E+03	5.626E+03	7.655E+01	1.922E+00	8.560E-18	3.057E-01	9.730E-02
8.940E+04	3.285E+03	6.571E+03	8.940E+01	2.077E+00	1.270E-17	4.535E-01	1.444E-01
1.024E+05	3.765E+03	7.530E+03	1.025E+02	2.223E+00	1.550E-17	5.535E-01	1.762E-01
1.156E+05	4.250E+03	8.500E+03	1.156E+02	2.362E+00	1.720E-17	6.142E-01	1.955E-01
1.290E+05	4.741E+03	9.481E+03	1.290E+02	2.495E+00	1.820E-17	6.499E-01	2.069E-01
1.424E+05	5.235E+03	1.047E+04	1.425E+02	2.621E+00	2.020E-17	7.214E-01	2.296E-01

TABLE 18 - CONTINUED

PROCESS : HE+-H+(12)
ANGEL ET AL. J. PHYS. B11 L49 (1978)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
2,020E+05	7,423E+03	1,485E+04	2,020E+02	3,122E+00	2,660E-17	9,499E-01	3,024E-01
2,900E+05	1,066E+04	2,131E+04	2,900E+02	3,740E+00	2,870E-17	1,025E+00	3,262E-01
4,300E+05	1,580E+04	3,160E+04	4,300E+02	4,554E+00	1,940E-17	6,928E-01	2,205E-01
5,660E+05	2,080E+04	4,160E+04	5,660E+02	5,225E+00	1,760E-17	6,285E-01	2,001E-01
8,565E+05	3,148E+04	6,295E+04	8,565E+02	6,428E+00	1,300E-17	4,642E-01	1,478E-01
1,092E+06	4,015E+04	8,030E+04	1,092E+03	7,260E+00	1,040E-17	3,714E-01	1,182E-01
1,118E+06	4,108E+04	8,217E+04	1,118E+03	7,344E+00	1,010E-17	3,607E-01	1,148E-01
1,508E+06	5,544E+04	1,109E+05	1,508E+03	8,530E+00	6,500E-18	2,321E-01	7,389E-02
1,930E+06	7,092E+04	1,418E+05	1,930E+03	9,649E+00	5,400E-18	1,928E-01	6,138E-02

PROCESS : HE+-H+(12)
ANGEL ET AL. J. PHYS. B11 L297 (1978)

INPUT DATA ARE DESCRIBED IN LAB SYSTEM.
DO YOU WANT DATA CONVERTED INTO LAB SYSTEM? NO.

E(EV)	E(AU)	E(RY)	E(KEV)	V(10(8)*CM/SEC)	SIGMA(CM(2))	SIGMA(AU)	SIGMA(PAI*A0(2))
3,020E+05	1,110E+04	2,220E+04	3,020E+02	3,817E+00	2,794E-17	9,978E-01	3,176E-01
4,100E+05	1,507E+04	3,013E+04	4,100E+02	4,447E+00	2,103E-17	7,510E-01	2,390E-01
5,180E+05	1,904E+04	3,807E+04	5,180E+02	4,999E+00	1,804E-17	6,442E-01	2,051E-01
6,300E+05	2,315E+04	4,630E+04	6,300E+02	5,513E+00	1,617E-17	5,774E-01	1,838E-01
7,500E+05	2,756E+04	5,512E+04	7,500E+02	6,015E+00	1,542E-17	5,507E-01	1,753E-01
9,100E+05	3,344E+04	6,688E+04	9,100E+02	6,626E+00	1,250E-17	4,464E-01	1,421E-01

6. References of Data of Barnett et al

Process 2. $He^+ + H_2 \rightarrow He$

Allison (1956), Barnett (1958), Gilbody (1963), De Heer (1966), Pivovar (1962), Stedeford (1955), Wittkower (1967).

Process 3. $He^+ + He \rightarrow He$

Allison (1956), Barnett (1958), Fedorenko (1960), Galli (1962), De Heer (1966), Gilbody (1956), Gilbody (1963), Hayden (1964), Mahdevan (1968), Pivovar (1962), Potter (1954), Shelton (1971), Stedeford (1954).

Process 4. $He^{++} + H \rightarrow He^+$

Fite (1962), Bayfield (1975), Shah (1974).

Process 5. $He^{++} + H_2 \rightarrow He^+$

Allison (1956), Allison (1958), Baragiola (1973), Bayfield (1975), Hvelplund (1976), Pivovar (1962), Pivovar (1962a), Shah (1974).

Process 6. $He^{++} + He \rightarrow He^+$

Afrosimov (1975), Allison (1958), Bayfield (1975), Barkner (1968), Hertel (1964), Hvelplund (1976), Nikolaev (1961), Pivovar (1962), Pivovar (1962a), Shah (1974)

Process 7. $He^{++} + H_2 \rightarrow He$

Allison (1956), Allison (1958), Baragiola (1973), Bayfield (1975), Hvelplund (1976), Pivovar (1962), Pivovar (1962a), Shah (1974).

Process 8. $He^{++} + He \rightarrow He$

Afrosimov (1975), Allison (1958), Bayfield (1975), Barkner (1968), Hertel (1964), Hvelplund (1976), Nikolaev (1961), Pivovar (1962), Pivovar (1962a), Shah (1974).

Process 10. $He^+ + H_2 \rightarrow He^{++}$

Allison (1956), Allison (1958), Dehmel (1973), Pivovar (1962).

Process 11. $He^+ + He \rightarrow He^{++}$

Allison (1956), Allison (1958), Dehmel (1973), Dmitriev (1962), Fedorenko (1956), Jones (1959), Lee (1964), Pivovar (1962).

Process 13. $He + H_2 \rightarrow He^+$

Allison (1958a), Barnett (1958), Fogel (1960), Gilbody (1968), Gilbody (1970), Pedersen (1974), Tawara (1971), Wittkower (1967).

Process 14. $He + He \rightarrow He^+$

Allison (1958a), Barnett (1958), Fogel (1960), Gilbody (1968), Gilbody (1970), Hvelplund (1974), Pedersen (1974), Tawara (1971), Williams (1971), Wittkower (1967).

Process 16. $He + H_2 \rightarrow He^{++}$

Hvelplund (1974), Pedersen (1974).

Process 17. $He + He \rightarrow He^{++}$

Hvelplund (1974), Pedersen (1974).

7. List of References

1. V.V.Afrosimov, G.A.Leiko, Yu.A.Mamov and M.N.Panov ; Sov. Phys. – JETP 40, 661(1975).
2. S.K.Allison, J.Guesas and P.G.Murphy ; Phys, Rev. 102, 1041 (1956).
3. S.K.Allison, Phys. Rev. 109, 76(1958).
4. S.K.Allison, Rev, Mod. Phys. 30, 1137(1958a).
5. G.C.Angel, K.F.Dunn, E.C.Sewell and H.B.Gilbody ; J.Phys. B 11, L49(1978).
6. G.C.Angel, E.C.Sewell, K.F.Dunn and H.B.Gilbody J.Phys. B 11, L297(1978).
7. R.A.Baragiola and I.B.Nemirovsky ; Nucl. Instr, Method ; 110, 511(1973).
8. C.F.Barnett, J.A.Ray, E.Ricci, M.I.Wilker, E.W.McDaniel, E.W.Thomas and H.B.Gilbody ; Atomic Data for Controlled Fusion Research ; ORNL-5206(Vol 1)(1977).
9. C.F.Barnett and P.H.Stier ; Phys. Rev. 109.385(1958).
10. J.E.Bayfield and G.A.Khayrallah ; Phys. Rev. A11, 920(1975).
11. J.E.Bayfield and G.A.Khayrallah ; Phys. Rev. A12, 869(1975a).
12. K.H.Berkner, R.V.Pyle, J.W.Strearns and J.C.Warren ; Phys. Rev. 166, 44(1968).
13. F.J.DeHeer, J.Schutten and H.Moustafa ; Physica. 32, 1793 (1966).
14. R.C.Dehmel, H.K.Chau and H.H.Fleischman ; Atomic Data 5, 231 (1973).
15. I.S.Dmitriev, V.S.Nikolaev, L.N.Fateeva and Y.A.Teplova ; Sov. Phys.-JETP 15, 11(1965).
16. N.V.Fedorenko, V.V.Afrosimov and D.M.Kaminker ; Sov. Phys.-Tech. Phys. 1, 1861(1956).
17. N.V.Fedorenko, L.G.Filippenko and J.P.Flaks; Sov. Phys.-Tech. Phys. 5, 45(1960).
18. W.L.Fite, A.C.H.Smith and R.F.Stebbings ; Proc. Roy. Soc. A 268, 527(1962).
19. Ya.M.Fogel', V.A.Ankudinov and D.V.Pilipenko ; Sov. Phys. -JETP 11, 18(1960).

20. A.Galli, A.Giardiui- Guideni, G.G.Volpi ; Nuovo Cimento 26, 845(1962).

21. H.B.Gilbody, J.B.Hasted ; Proc. Roy. Soc. A238, 334(1957).

22. H.B.Gilbody, J.B.Hasted, J.V.Ireland, A.R.Lee, E.W.Thomas and A.S.Whiteman ; Proc, Roy. Soc. A274, 40(1963).

23. H.B.Gilbady, R.Browning, G.Levy, A.I.McIntosh and K.F.Dunn; J.Phys. B 1, 863(1968).

24. H.B.Gilbody, K.F.Dunn, R.Browning and C.J.Latimer ; J.Phys. B 3, 1105(1970).

25. H.B.Gilbody, K.F.Dunn, R.Browning and C.J.Latimer ; J.Phys. B 4, 800(1971).

26. H.C.Hayden and N.G.Utterback ; Phys, Rev. A 135, 1575(1964).

27. R.H.Hegerberg. Thorarian Stefasson and M.T.Elford ; J.Phys. B 11, 133(1978).

28. H.Helm ; J.Phys. B 10, 3688(1977).

29. G.R.Hertel and W.S.Koski ; J.Chem. Phys 40, 3452(1964).

30. P.Hvelplund and E.Horsdal- Pedersen ; Phys, Rev. A 9, 2434 (1974).

31. P.Hvelplund, J.Heinemeier, E.Horsdal- Pederden and F.R.Simpson ; J.Phys. B 9, 491(1976).

32. P.R.Jones, F.B.Ziemba, H.A.Moses and E.Everhart ; Phys. Rev. 113, 182(1959).

33. A.R.Lee and H.B.Gilbody, 3rd Int. Conf. on Phys. of Electronic and Atomic Collisions (London, 1963) North- Holland Publishing Co.(Amsterdam) p. 692(1964).

34. P.Mahadevan and G.O.Magnuson ; Phys. Rev. 171, 103(1968).

35. J.B.Mitchell, K.F.Dunn, G.C.Angel, R.Browning and H.B.Gilbody ; J.Phys. B 10, 1897(1977).

36. Y.Nakai, M.Sataka, A.Yagishita, K.Ozawa, T.Shirai and A.Kikuchi; JAERI. unpublished (1979).

37. V.S.Nikolaev, L.N.Fateeva, I.S.Dmitriev and Ya.A.Teplova ; Sov. Phys.-JETP 13, 695(1961).

38. N.Noda ; J.Phys. Soc. Japan 41, 625(1976).

39. W.L.Nutt. R.W.Mccullough, K.Brady. M.B.Shah and H.B.Gilbody ; J.Phys. B 11, 1457(1978).

40. B.Peart, R.Gray and K.T.Dolder ; J.Phys. B 10, 2675(1977).

41. E.H.Pederson and P.Hvelplund ; J.Phys. B 7, 132(1974).

42. R.A.Phaneuf, F.W.Meyer, R.E.Olson and A.Salop ; Phys. Rev.

A 16, 1867(1977).

43. L.I.Pivovar, M.T.Novikov and V.M.Tabaev ; Sov. Phys. -JETP 14, 20(1962).

44. R.F.Potter ; J.Chem. Phys. 22, 974(1954).

45. M.B.Shah and H.B.Gilbody ; J.Phys. B 7, 256(1974).

46. M.B.Shah and H.B.Gilbody ; J.Phys. B 7, 630(1974a).

47. M.B.Shah and H.B.Gilbody ; J.Phys. B 11, 121(1978).

48. M.B.Shah, T.V.Goffe and H.B.Gilbody ; J.Phys. B 10, L723 (1977).

49. W.N.Shelton and P.A.Stoycheff ; Phys. Rev. A 3, 613(1971).

50. J.B.H.Stedeford and J.B.Hasted ; Proc. Roy. Soc. A 227, 466 (1955).

51. H.Tawara ; J.Phys. Soc. Japan 31, 236(1971).

52. H.Tawara ; J.Phys. Soc. Japan 31, 871(1971a).

53. G.O.Taylor, E.W.Thomas and D.W.Martin ; Phys. Rev. A 2, 1785 (1970).

54. W.L.Williams and F.M.Goldberg, 7th Int. Conf. on the Phys. of Electronic and Atomic Collisions. North Holland Publishing Co. Amsterdam (1971).

55. A.B.Wittkower, G.Levy and H.Gilbody ; Proc. Phys. Soc. 91, 862 (1967).