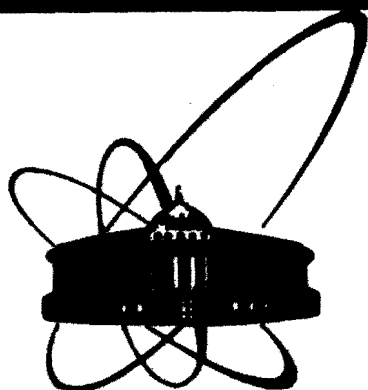


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**СООБЩЕНИЯ
ОБЪЕДИНЕННОГО
ИНСТИТУТА
ЯДЕРНЫХ
ИССЛЕДОВАНИЙ
ДУБНА**

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M.Bubak, M.P.Faifman*

**CROSS SECTIONS FOR HYDROGEN
MUONIC ATOMIC PROCESSES
IN TWO-LEVEL APPROXIMATION
OF THE ADIABATIC FRAMEWORK**

* I.V.Kurchatov Institute of Atomic Energy,
Moscow, USSR

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1. INTRODUCTION

To understand the muon-catalysed fusion in mixtures of hydrogen isotopes the knowledge of cross sections (or rates) for low energy scattering of muonic hydrogen on hydrogen nuclei is indispensable ^{/1-3/}. The following scattering processes are possible

$$\text{elastic scattering: } a\mu + b \rightarrow a\mu + b, \quad (1)$$

$$\text{isotopic exchange: } a\mu + b \rightarrow a + b\mu, \quad (2)$$

$$\text{spin-flip: } a\mu(F) + a \rightarrow a\mu(F') + a, \quad (3)$$

where $a\mu$ - the hydrogen muonic atom in the ground state (1S), $a, b = \{p, d, t\}$ - the hydrogen nuclei, F, F' - the total spin of a muonic atom.

For the description of the above processes it is natural to use the adiabatic representation (see review ^{/4/}) which consists in expanding the wave function of a three-body system over a complete set of solutions of the two-center Coulomb problem. As a result, the problem of collisions in the three-body system is reduced to the multichannel scattering problem with a great number of closed channels. In Ref. ^{/5,8/} an algorithm has been developed for an accurate numerical solution of this task, but till now only a few calculations ^{/5-8/} have been completed because of inevitable complexity of computations.

On the other hand, the cross sections of (1) ÷ (3) can be obtained using the effective two-level approximation (so-called "simple approach" ^{/9/}) with an accuracy of about 10 ÷ 20%. We have applied this method to elaborate the complete set of phase-shifts and cross sections of reactions (1-3) in a broad collision energy range ($0.001 \leq \epsilon \leq 50$ eV).

2. TWO-CHANNEL SCATTERING PROBLEM

Calculations of phase-shifts and cross sections of scattering of muonic hydrogen on hydrogen nuclei in the two-level approximation of the adiabatic method consist in finding

the solution of a system of two coupled equations ^{/10-15/}

$$\left[\frac{d^2}{dR^2} + k_1^2 - \frac{J(J+1)}{R^2} \right] \chi_1 = V_{11} \chi_1 + V_{12} \chi_2, \quad (4a)$$

$$\left[\frac{d^2}{dR^2} + k_2^2 - \frac{J(J+1)}{R^2} \right] \chi_2 = V_{21} \chi_1 + V_{22} \chi_2,$$

or in matrix notation

$$\mathcal{L}\chi = V\chi, \quad \mathcal{L}_i = \left(\frac{d^2}{dR^2} + k_i^2 - \frac{J(J+1)}{R^2} \right) \delta_{ij}. \quad (4b)$$

Here R is the distance between hydrogen nuclei; J is the total angular momentum of a three-body system; k_1, k_2 are the momenta in the respective reaction channels, determined in the following way ^{/9/} (in the units $e = \hbar = m_a = 1$; see Table 1):

$$k_1^2 = 2M\epsilon, \quad k_2^2 = 2M(\epsilon - \Delta E),$$

$$M = \frac{M_a}{m_a}, \quad M_a^{-1} = (m_\mu + M_a)^{-1} + M_b^{-1}, \quad m_a^{-1} = m_\mu^{-1} + M_a^{-1}, \quad (5)$$

$$\Delta E = E_b - E_a = \frac{m_\mu}{2} \left[\left(1 + \frac{m_\mu}{M_a} \right)^{-1} - \left(1 + \frac{m_\mu}{M_b} \right)^{-1} \right],$$

where m_μ is the muon mass, M_a and M_b are the masses of a and b nuclei ($M_a \geq M_b$), ΔE is the difference between the ground state energy levels of the muonic atoms $a\mu$ and $b\mu$ (if $M_a = M_b$, then $\Delta E = \Delta E^{hfs}$ - the difference between two hyperfine state levels of $a\mu$ -atom), and ϵ is the collision energy related to the level corresponding to a heavier muonic atom (see Fig.1).

The effective potentials V_{ij} ($(i,j) = 1,2$) for eq.(4a, 4b) are related to the potentials of two-center problem $U_{\alpha\beta}$

$$V = AUA^{-1}. \quad (6)$$

($\alpha, \beta = g, u$) via transformation ^{/4/}
The matrix elements $U_{\alpha\beta}$ have been calculated in Ref. ^{/16/}. The matrix A transforming the adiabatic basis set into the physical one is chosen in such a way that for $R \rightarrow \infty$ the wave

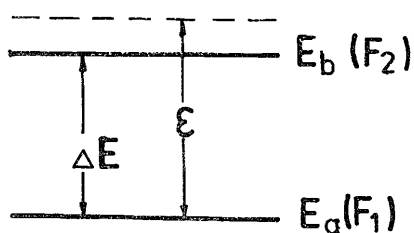


Fig.1.

Table 1.

General properties of analysed three-body systems.

	$p\mu + p$	$d\mu + d$	$t\mu + t$	$p\mu + d$ $d\mu + p$	$p\mu + t$ $t\mu + p$	$d\mu + t$ $t\mu + d$
m_a (m_e)	185.841	195.742	199.273	195.742	199.273	199.273
$a_m \cdot 10^{-11}$ (cm)	2.84747	2.70344	2.65554	2.70344	2.65554	2.65554
ϵ_a (eV)	5057.06	5326.47	5422.56	5326.47	5422.56	5422.56
M (m_a)	5.20343	9.63265	14.0470	6.36580	6.97033	11.2072
ΔE (eV)	0.1820	0.0485	0.2373	134.709	182.751	48.0420

The above values have been calculated using Eqs.(5) and relations:

$$a_m = \frac{\hbar^2}{m_a e^2}, \quad \epsilon_a = \frac{m_a e^4}{\hbar^2},$$

The masses are ^{/20/}: $m_\mu = 206.769 m_e$, $M_p = 1836.152 m_e$; $M_d = 3670.481 m_e$, $M_t = 5496.318 m_e$, m_e - the electron mass.

function χ_1 in (4a) corresponds to the muonic atom in the state with the energy E_a , and χ_2 - to the one with E_b . For processes (1) and (2) where hydrogen isotopes with different masses take part, the matrix A assumes the form ^{/10/}

$$A = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix}. \quad (7)$$

For processes (3) the form of the matrix A depends on the value of the total spin $\vec{S} = \vec{S}_a + \vec{S}_b + \vec{S}_\mu$ of the three-body system: two nuclei with the spin S_a and S_b ($S_a = S_b$) and the muon with the spin $S_\mu = 1/2$. The wave function χ_1 (eq.4a) for $R \rightarrow \infty$ describes the muonic atom $a\mu$ in its lower hyperfine state $F_1 = S_a - S_\mu$ and χ_2 - in its upper hf state $F_2 = S_a + S_\mu$ (see Fig.1). It is also necessary to take into account identity of nuclei in this system. The matrix A for processes (3) has been determined in ^{/19/} and is shown in Table 2.

The solution of equations (4a, b) was obtained using the phase function method ^{/10-15/} in which the scattering

Table 2.

Matrix A for scattering processes taking into account a hyperfine structure of muonic atoms

		$p\mu + p, t\mu + t$		$d\mu + d$		
J	S	1/2	3/2	1/2	3/2	5/2
J-even		$\frac{1}{2} \begin{pmatrix} 1 & \sqrt{3} \\ \sqrt{3} & 1 \end{pmatrix}$	$\begin{pmatrix} 0 & 0 \\ 0 & -1 \end{pmatrix}$	$\frac{1}{\sqrt{3}} \begin{pmatrix} 1 & \sqrt{2} \\ \sqrt{2} & 1 \end{pmatrix}$	$\frac{1}{\sqrt{6}} \begin{pmatrix} \sqrt{3} & -1 \\ -1 & \sqrt{3} \end{pmatrix}$	$\begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}$
J-odd		$\frac{1}{2} \begin{pmatrix} -\sqrt{3} & 1 \\ 1 & \sqrt{3} \end{pmatrix}$	$\begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}$	$\frac{1}{\sqrt{3}} \begin{pmatrix} -\sqrt{2} & 1 \\ 1 & \sqrt{2} \end{pmatrix}$	$\frac{1}{\sqrt{6}} \begin{pmatrix} -1 & \sqrt{3} \\ \sqrt{3} & -1 \end{pmatrix}$	$\begin{pmatrix} 0 & 0 \\ 0 & -1 \end{pmatrix}$

matrix. S can be found by solving the system of three nonlinear equations

$$T'(R) = -[u + T(R)v]V[u + vT(R)], \quad (8)$$

with asymptotic behaviour: $T(\infty) = T$. The reaction matrix T is related to the scattering one S in the following way

$$S = (1 + iT)(1 - iT)^{-1}. \quad (9)$$

The diagonal matrices u and v are formed from two linearly independent solutions of differential equations

$$\mathcal{L}\chi = 0. \quad (10)$$

When the collision energy $\epsilon > \Delta E$ (both reaction channels are open), the functions u and v are

$$u_1 = \frac{1}{\sqrt{k_1}} j_J(k_1 \cdot R) \xrightarrow{R \rightarrow \infty} \frac{1}{\sqrt{k_1}} \sin(k_1 R - \frac{\pi J}{2}), \quad (11)$$

$$v_1 = -\frac{1}{\sqrt{k}} n_J(k_1 \cdot R) \xrightarrow{R \rightarrow \infty} \frac{1}{\sqrt{k_1}} \cos(k_1 R - \frac{\pi J}{2}),$$

where j_J and n_J are the Riccati-Bessel spherical functions. In this case the cross sections are given by ^{/10/}

$$\sigma_{ij} = \frac{4\pi}{k_1^2} \sum_J (2J+1) \frac{\delta_{ij} D_J^2 + (t_{ij}^J)^2}{(D_J - 1)^2 + (t_{11}^J + t_{22}^J)^2},$$

$$D_J = t_{11}^J t_{22}^J - (t_{12}^J)^2. \quad (12)$$

When the collision energy $\epsilon < \Delta E$ (the channel b is closed; $k_1 = k > 0$, $k_2^2 = -\kappa^2 < 0$), the functions u and v are

$$u_1 = \frac{1}{\sqrt{k}} j_J(kR), \quad v_1 = -\frac{1}{\sqrt{k}} n_J(kR),$$

$$u_2 = (-1)^{J+1} \frac{1}{\sqrt{2\kappa}} [j_J(1\kappa R) - i n_J(1\kappa R)] \xrightarrow{R \rightarrow \infty} \frac{1}{\sqrt{2\kappa}} e^{\kappa R}, \quad (13)$$

$$v_2 = (-1)^{J+1} \frac{1}{\sqrt{2\kappa}} [j_J(1\kappa R) + i n_J(1\kappa R)] \xrightarrow{R \rightarrow \infty} \frac{1}{\sqrt{2\kappa}} e^{-\kappa R}$$

and in this case the elastic scattering cross section equals

$$\sigma_{11} = \frac{4\pi}{k^2} \sum_J (2J+1) \frac{(t_{11}^J)^2}{1 + (t_{11}^J)^2}. \quad (14)$$

In processes (3) the total spin S of the three-body system is conserved. Taking into account the statistical weights

$$W_{FS} = \frac{2S+1}{(2F+1)(2S_b+1)} \quad (15)$$

of the states with different values of S one obtains the formula for cross sections of reactions(3)

$$\sigma_{FF'} = \sum_S W_{FS} \cdot \sigma_{FF'}^S. \quad (16)$$

Equations (8) have been numerically integrated in the interval $0 \leq R \leq R_0$ and the contribution from the interval $R_0 \leq R < \infty$ has been estimated with an accuracy $\sim 1\%$ using the formulae ^{/12-15/}:

for $\epsilon > \Delta E$

$$t_{11} = t_{11}(R_0) + \frac{3M}{4k_1 R_0^3} [1 + t_{11}^2(R_0)] [1 + \frac{k_1}{k_2} t_{12}^2(R_0)],$$

$$t_{12} = t_{12}(R_0) \left\{ 1 + \frac{3M}{4k_1 k_2 R_0^3} [k_2 t_{11}(R_0) + k_1 t_{22}(R_0)] \right\}, \quad (17)$$

$$t_{22} = t_{22}(R_0) + \frac{3M}{4k_2 R_0^3} [1 + t_{22}^2(R_0)] \left[1 + \frac{k_2}{k_1} t_{12}^2(R_0) \right],$$

for $\epsilon < \Delta E$

$$t_{11} = t_{11}(R_0) + \frac{3M}{4k_1 R_0^3} [1 + t_{11}^2(R_0)],$$

The point R_0 has been chosen to fulfil the condition: $k_1 R_0 > 1$.

3. DESCRIPTION OF TABLES AND FIGURES

The tables contain elements $t_{ij}^J(\epsilon)$ or the reaction matrix T obtained as the solutions of (8). The following notation is adopted:

- P, D, T - the hydrogen isotope nuclei p, d, t, respectively,
- M - the muon,
- J - the angular momentum of a three-body system,
- E (eV) - the collision energy ϵ in electronvolts, for $\epsilon < \Delta E$, E is related to the lower energy level, and for $\epsilon > \Delta E$ - to the upper one,
- T(J) - the matrix elements t_{ij}^J which determine cross sections (14),
- T11, T12, T22 - the matrix elements t_{11}^J , t_{12}^J , t_{22}^J determining cross sections (12).

Scattering processes (1-3) are indicated in the tables in the following way:

- $aM + b \rightarrow aM + b$ - elastic scattering processes (1) when collision energy $\epsilon < \Delta E$,
- $bM + a, aM + b$ - the elastic scattering processes $aM + b \rightarrow aM + b$, and $bM + a \rightarrow bM + a$ ($\epsilon > \Delta E$) and the isotopic exchange reactions $bM + a \rightarrow aM + b$,
- $aM(F = F_1) + a \rightarrow aM(F = F_1) + a$ - the elastic scattering of $a\mu$ -atoms in the hyperfine state F_1

when spin-flip is forbidden,
 $aM(F = F_2) + a, aM(F = F_1) + a$ - the elastic scattering processes $aM(F = F_{1,2}) + a \rightarrow aM(F = F_{1,2}) + a$, ($\epsilon > \Delta E^{hfs}$) and the spin-flip reactions $aM(F = F_2) + a \rightarrow aM(F = F_1) + a$.

Figures 2-21 show the dependence of the partial cross sections for scattering processes (1-3) on the collision energy E (eV). Let us note that the cross sections σ_{ij}^J of processes (3) are calculated using eq. (16).

4. CONCLUSIONS

Comparison of the values of phases and cross sections presented in this paper with available results of the multichannel approach⁵⁻⁷ have shown that for the most of processes (1-3) they differ by less than 10%. The exception is the elastic scattering of $\rho\mu$ -atoms on p-nuclei in the lower hf state^{6,9}, where the accuracy is significantly worse.

The presented set of phases and cross sections provides valuable information for the analysis of μCF in any mixtures of hydrogen isotopes. Nevertheless, the rigorous analysis of experimental data in μCF will be possible when the calculations of cross sections in the multichannel approach⁵ are completed. Note that one should also take into account the electron screening¹⁷ and the molecular structure¹⁸ corrections.

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TABLE 3. $PM(F=0) + P \rightarrow PM(F=0) + P, S = 1/2$

E_γ (EV)	T (J=0)	T (J=1)	E_γ (EV)	T (J=0)	T (J=1)
0.001	0.296E-02	0.934E-05	0.050	0.209E-01	0.468E-03
0.002	0.417E-02	0.185E-04	0.060	0.232E-01	0.558E-03
0.003	0.509E-02	0.288E-04	0.070	0.255E-01	0.646E-03
0.004	0.586E-02	0.391E-04	0.080	0.277E-01	0.734E-03
0.005	0.654E-02	0.493E-04	0.090	0.300E-01	0.821E-03
0.006	0.715E-02	0.593E-04	0.100	0.323E-01	0.906E-03
0.007	0.771E-02	0.691E-04	0.110	0.348E-01	0.992E-03
0.008	0.823E-02	0.787E-04	0.120	0.374E-01	0.108E-02
0.009	0.872E-02	0.883E-04	0.130	0.401E-01	0.116E-02
0.010	0.918E-02	0.977E-04	0.140	0.432E-01	0.124E-02
0.020	0.130E-01	0.193E-03	0.150	0.466E-01	0.132E-02
0.030	0.159E-01	0.286E-03	0.160	0.507E-01	0.141E-02
0.040	0.185E-01	0.378E-03	0.170	0.559E-01	0.149E-02
			0.180	0.647E-01	0.157E-02

TABLE 4. $PM(F=0) + P \rightarrow PM(F=1) + P, S = 1/2$

E_γ (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
0.001	0.710E-01	0.661E-01	0.267E-01	0.159E-02	-0.251E-05	0.929E-05
0.002	0.711E-01	0.786E-01	0.377E-01	0.160E-02	-0.425E-05	0.183E-04
0.003	0.713E-01	0.871E-01	0.462E-01	0.161E-02	-0.578E-05	0.285E-04
0.004	0.714E-01	0.937E-01	0.532E-01	0.162E-02	-0.720E-05	0.387E-04
0.005	0.715E-01	0.991E-01	0.595E-01	0.162E-02	-0.854E-05	0.487E-04
0.006	0.716E-01	0.104E+00	0.651E-01	0.163E-02	-0.984E-05	0.585E-04
0.007	0.717E-01	0.108E+00	0.702E-01	0.164E-02	-0.111E-04	0.680E-04
0.008	0.718E-01	0.112E+00	0.750E-01	0.165E-02	-0.123E-04	0.774E-04
0.009	0.720E-01	0.115E+00	0.795E-01	0.166E-02	-0.135E-04	0.867E-04
0.010	0.721E-01	0.118E+00	0.837E-01	0.166E-02	-0.147E-04	0.959E-04
0.020	0.732E-01	0.142E+00	0.117E+00	0.174E-02	-0.256E-04	0.187E-03
0.030	0.742E-01	0.158E+00	0.143E+00	0.182E-02	-0.360E-04	0.276E-03
0.040	0.751E-01	0.171E+00	0.164E+00	0.190E-02	-0.462E-04	0.363E-03
0.050	0.760E-01	0.182E+00	0.182E+00	0.198E-02	-0.564E-04	0.448E-03
0.060	0.769E-01	0.192E+00	0.198E+00	0.205E-02	-0.668E-04	0.531E-03
0.070	0.777E-01	0.201E+00	0.213E+00	0.213E-02	-0.772E-04	0.612E-03
0.080	0.784E-01	0.209E+00	0.226E+00	0.221E-02	-0.879E-04	0.692E-03
0.090	0.791E-01	0.216E+00	0.239E+00	0.228E-02	-0.987E-04	0.771E-03
0.100	0.798E-01	0.223E+00	0.250E+00	0.236E-02	-0.110E-03	0.848E-03
0.200	0.844E-01	0.276E+00	0.336E+00	0.308E-02	-0.231E-03	0.156E-02
0.300	0.864E-01	0.313E+00	0.392E+00	0.377E-02	-0.372E-03	0.219E-02
0.400	0.866E-01	0.341E+00	0.433E+00	0.442E-02	-0.529E-03	0.275E-02
0.500	0.854E-01	0.364E+00	0.465E+00	0.504E-02	-0.702E-03	0.325E-02

TABLE 4. PM(F=0) + P, PM(F=1) + P, S = 1/2

E _v (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
0.600	0.833E-01	0.383E+00	0.489E+00	0.563E-02	-0.889E-03	0.370E-02
0.700	0.805E-01	0.399E+00	0.509E+00	0.619E-02	-0.109E-02	0.410E-02
0.800	0.771E-01	0.413E+00	0.524E+00	0.673E-02	-0.130E-02	0.445E-02
0.900	0.732E-01	0.425E+00	0.537E+00	0.724E-02	-0.152E-02	0.476E-02
1.000	0.690E-01	0.435E+00	0.547E+00	0.773E-02	-0.175E-02	0.504E-02
1.100	0.645E-01	0.445E+00	0.555E+00	0.820E-02	-0.199E-02	0.528E-02
1.200	0.597E-01	0.453E+00	0.561E+00	0.864E-02	-0.224E-02	0.549E-02
1.300	0.548E-01	0.460E+00	0.566E+00	0.907E-02	-0.250E-02	0.567E-02
1.400	0.496E-01	0.466E+00	0.570E+00	0.948E-02	-0.276E-02	0.581E-02
1.500	0.444E-01	0.472E+00	0.572E+00	0.986E-02	-0.303E-02	0.593E-02
1.600	0.391E-01	0.478E+00	0.574E+00	0.102E-01	-0.331E-02	0.602E-02
1.700	0.336E-01	0.482E+00	0.575E+00	0.106E-01	-0.360E-02	0.608E-02
1.800	0.281E-01	0.487E+00	0.576E+00	0.109E-01	-0.389E-02	0.612E-02
1.900	0.226E-01	0.491E+00	0.575E+00	0.112E-01	-0.410E-02	0.614E-02
2.000	0.170E-01	0.494E+00	0.575E+00	0.115E-01	-0.449E-02	0.613E-02
3.000	-0.395E-01	0.518E+00	0.550E+00	0.138E-01	-0.775E-02	0.493E-02
4.000	-0.949E-01	0.530E+00	0.511E+00	0.149E-01	-0.113E-01	0.209E-02
5.000	-0.148E+00	0.537E+00	0.468E+00	0.150E-01	-0.151E-01	-0.198E-02
6.000	-0.199E+00	0.543E+00	0.424E+00	0.143E-01	-0.190E-01	-0.703E-02
7.000	-0.249E+00	0.549E+00	0.381E+00	0.129E-01	-0.230E-01	-0.129E-01
8.000	-0.297E+00	0.554E+00	0.340E+00	0.110E-01	-0.270E-01	-0.193E-01
9.000	-0.344E+00	0.560E+00	0.301E+00	0.852E-02	-0.310E-01	-0.263E-01
10.000	-0.390E+00	0.566E+00	0.262E+00	0.562E-02	-0.350E-01	-0.337E-01

TABLE 5. PM(F=1) + P --> PM(F=1) + P, S = 3/2

E _v (EV)	T (J=0)		T (J=1)		E _v (EV)	T (J=0)		T (J=1)	
	T (J=0)	T (J=1)	T (J=1)	T (J=0)		T (J=0)	T (J=1)	T (J=0)	T (J=1)
0.001	-0.458E-02	0.915E-05	0.915E-05	0.915E-05	0.600	-0.132E+00	0.496E-02	0.600	-0.132E+00
0.002	-0.650E-02	0.192E-04	0.192E-04	0.192E-04	0.700	-0.144E+00	0.568E-02	0.700	-0.144E+00
0.003	-0.799E-02	0.297E-04	0.297E-04	0.297E-04	0.800	-0.155E+00	0.638E-02	0.800	-0.155E+00
0.004	-0.924E-02	0.399E-04	0.399E-04	0.399E-04	0.900	-0.165E+00	0.706E-02	0.900	-0.165E+00
0.005	-0.104E-01	0.499E-04	0.499E-04	0.499E-04	1.000	-0.176E+00	0.772E-02	1.000	-0.176E+00
0.006	-0.114E-01	0.596E-04	0.596E-04	0.596E-04	1.100	-0.185E+00	0.836E-02	1.100	-0.185E+00
0.007	-0.123E-01	0.693E-04	0.693E-04	0.693E-04	1.200	-0.195E+00	0.899E-02	1.200	-0.195E+00
0.008	-0.132E-01	0.790E-04	0.790E-04	0.790E-04	1.300	-0.204E+00	0.959E-02	1.300	-0.204E+00
0.009	-0.140E-01	0.887E-04	0.887E-04	0.887E-04	1.400	-0.213E+00	0.102E-01	1.400	-0.213E+00
0.010	-0.148E-01	0.985E-04	0.985E-04	0.985E-04	1.500	-0.221E+00	0.108E-01	1.500	-0.221E+00
0.020	-0.212E-01	0.195E-03	0.195E-03	0.195E-03	1.600	-0.230E+00	0.113E-01	1.600	-0.230E+00
0.030	-0.261E-01	0.291E-03	0.291E-03	0.291E-03	1.700	-0.238E+00	0.119E-01	1.700	-0.238E+00
0.040	-0.304E-01	0.385E-03	0.385E-03	0.385E-03	1.800	-0.246E+00	0.124E-01	1.800	-0.246E+00
0.050	-0.342E-01	0.479E-03	0.479E-03	0.479E-03	1.900	-0.254E+00	0.129E-01	1.900	-0.254E+00
0.060	-0.376E-01	0.571E-03	0.571E-03	0.571E-03	2.000	-0.262E+00	0.134E-01	2.000	-0.262E+00
0.070	-0.408E-01	0.663E-03	0.663E-03	0.663E-03	3.000	-0.332E+00	0.178E-01	3.000	-0.332E+00
0.080	-0.439E-01	0.755E-03	0.755E-03	0.755E-03	4.000	-0.394E+00	0.211E-01	4.000	-0.394E+00
0.090	-0.467E-01	0.846E-03	0.846E-03	0.846E-03	5.000	-0.452E+00	0.236E-01	5.000	-0.452E+00
0.100	-0.494E-01	0.936E-03	0.936E-03	0.936E-03	6.000	-0.507E+00	0.253E-01	6.000	-0.507E+00
0.200	-0.718E-01	0.181E-02	0.181E-02	0.181E-02	7.000	-0.559E+00	0.263E-01	7.000	-0.559E+00
0.300	-0.897E-01	0.264E-02	0.264E-02	0.264E-02	8.000	-0.611E+00	0.268E-01	8.000	-0.611E+00
0.400	-0.105E+00	0.344E-02	0.344E-02	0.344E-02	9.000	-0.661E+00	0.267E-01	9.000	-0.661E+00
0.500	-0.119E+00	0.421E-02	0.421E-02	0.421E-02	10.000	-0.710E+00	0.262E-01	10.000	-0.710E+00

TABLE 6. PM + D , DM + P

E _r (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
	0.001	-0.108E+01	0.659E-01	-0.572E-02	-0.850E+00	0.338E-03
0.002	-0.108E+01	0.703E-01	-0.818E-02	-0.850E+00	0.569E-03	0.914E-04
0.003	-0.108E+01	0.867E-01	-0.101E-01	-0.850E+00	0.771E-03	0.951E-04
0.004	-0.108E+01	0.931E-01	-0.117E-01	-0.850E+00	0.956E-03	0.862E-04
0.005	-0.108E+01	0.985E-01	-0.131E-01	-0.850E+00	0.113E-02	0.910E-04
0.006	-0.108E+01	0.103E+00	-0.143E-01	-0.850E+00	0.130E-02	0.984E-04
0.007	-0.108E+01	0.107E+00	-0.155E-01	-0.850E+00	0.146E-02	0.107E-03
0.008	-0.108E+01	0.111E+00	-0.166E-01	-0.850E+00	0.161E-02	0.118E-03
0.009	-0.108E+01	0.114E+00	-0.177E-01	-0.850E+00	0.176E-02	0.129E-03
0.010	-0.108E+01	0.117E+00	-0.187E-01	-0.850E+00	0.190E-02	0.141E-03
0.020	-0.109E+01	0.139E+00	-0.267E-01	-0.850E+00	0.320E-02	0.285E-03
0.030	-0.109E+01	0.154E+00	-0.331E-01	-0.850E+00	0.433E-02	0.442E-03
0.040	-0.109E+01	0.165E+00	-0.386E-01	-0.850E+00	0.538E-02	0.597E-03
0.050	-0.109E+01	0.175E+00	-0.434E-01	-0.850E+00	0.636E-02	0.747E-03
0.060	-0.109E+01	0.183E+00	-0.479E-01	-0.850E+00	0.729E-02	0.891E-03
0.070	-0.109E+01	0.190E+00	-0.520E-01	-0.850E+00	0.818E-02	0.103E-02
0.080	-0.109E+01	0.196E+00	-0.559E-01	-0.850E+00	0.904E-02	0.117E-02
0.090	-0.109E+01	0.202E+00	-0.596E-01	-0.850E+00	0.988E-02	0.130E-02
0.100	-0.109E+01	0.207E+00	-0.631E-01	-0.850E+00	0.107E-01	0.143E-02
0.200	-0.110E+01	0.246E+00	-0.923E-01	-0.849E+00	0.180E-01	0.268E-02
0.300	-0.110E+01	0.272E+00	-0.116E+00	-0.849E+00	0.243E-01	0.380E-02
0.400	-0.111E+01	0.292E+00	-0.136E+00	-0.848E+00	0.301E-01	0.483E-02
0.500	-0.111E+01	0.309E+00	-0.154E+00	-0.848E+00	0.355E-01	0.577E-02
0.600	-0.112E+01	0.323E+00	-0.171E+00	-0.847E+00	0.407E-01	0.664E-02

TABLE 6. PM + D , DM + P

E _r (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
	0.700	-0.112E+01	0.336E+00	-0.187E+00	-0.847E+00	0.456E-01
0.800	-0.113E+01	0.348E+00	-0.202E+00	-0.846E+00	0.503E-01	0.817E-02
0.900	-0.113E+01	0.359E+00	-0.216E+00	-0.846E+00	0.548E-01	0.885E-02
1.000	-0.114E+01	0.369E+00	-0.230E+00	-0.846E+00	0.592E-01	0.947E-02
1.100	-0.114E+01	0.378E+00	-0.243E+00	-0.845E+00	0.635E-01	0.100E-01
1.200	-0.115E+01	0.387E+00	-0.256E+00	-0.845E+00	0.676E-01	0.106E-01
1.300	-0.115E+01	0.395E+00	-0.268E+00	-0.845E+00	0.717E-01	0.110E-01
1.400	-0.116E+01	0.404E+00	-0.280E+00	-0.844E+00	0.756E-01	0.115E-01
1.500	-0.116E+01	0.411E+00	-0.292E+00	-0.844E+00	0.795E-01	0.118E-01
1.600	-0.117E+01	0.419E+00	-0.303E+00	-0.844E+00	0.832E-01	0.122E-01
1.700	-0.117E+01	0.426E+00	-0.314E+00	-0.843E+00	0.869E-01	0.125E-01
1.800	-0.118E+01	0.433E+00	-0.325E+00	-0.843E+00	0.905E-01	0.128E-01
1.900	-0.118E+01	0.440E+00	-0.336E+00	-0.843E+00	0.941E-01	0.130E-01
2.000	-0.119E+01	0.447E+00	-0.347E+00	-0.842E+00	0.976E-01	0.132E-01
3.000	-0.123E+01	0.509E+00	-0.446E+00	-0.840E+00	0.129E+00	0.135E-01
4.000	-0.128E+01	0.564E+00	-0.537E+00	-0.840E+00	0.157E+00	0.113E-01
5.000	-0.134E+01	0.619E+00	-0.624E+00	-0.840E+00	0.182E+00	0.709E-02
6.000	-0.139E+01	0.673E+00	-0.711E+00	-0.841E+00	0.204E+00	0.139E-02
7.000	-0.145E+01	0.729E+00	-0.797E+00	-0.843E+00	0.225E+00	-0.556E-02
8.000	-0.151E+01	0.787E+00	-0.886E+00	-0.846E+00	0.244E+00	-0.135E-01
9.000	-0.157E+01	0.849E+00	-0.977E+00	-0.850E+00	0.261E+00	-0.224E-01
10.000	-0.164E+01	0.915E+00	-0.107E+01	-0.854E+00	0.278E+00	-0.319E-01

TABLE 7. PM + T, TM + P

E _v (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
0.001	-0.249E+01	0.689E-01	-0.540E-02	-0.113E+01	0.309E-03	0.126E-03
0.002	-0.249E+01	0.106E+00	-0.773E-02	-0.113E+01	0.655E-03	0.988E-04
0.003	-0.249E+01	0.117E+00	-0.953E-02	-0.113E+01	0.887E-03	0.939E-04
0.004	-0.249E+01	0.126E+00	-0.110E-01	-0.113E+01	0.110E-02	0.970E-04
0.005	-0.249E+01	0.133E+00	-0.124E-01	-0.113E+01	0.130E-02	0.104E-03
0.006	-0.249E+01	0.139E+00	-0.136E-01	-0.113E+01	0.149E-02	0.115E-03
0.007	-0.249E+01	0.144E+00	-0.147E-01	-0.113E+01	0.168E-02	0.127E-03
0.008	-0.249E+01	0.149E+00	-0.158E-01	-0.113E+01	0.185E-02	0.140E-03
0.009	-0.249E+01	0.154E+00	-0.168E-01	-0.113E+01	0.202E-02	0.155E-03
0.010	-0.249E+01	0.158E+00	-0.177E-01	-0.113E+01	0.219E-02	0.170E-03
0.020	-0.249E+01	0.188E+00	-0.255E-01	-0.113E+01	0.368E-02	0.350E-03
0.030	-0.249E+01	0.207E+00	-0.317E-01	-0.113E+01	0.499E-02	0.543E-03
0.040	-0.250E+01	0.223E+00	-0.370E-01	-0.113E+01	0.619E-02	0.731E-03
0.050	-0.250E+01	0.235E+00	-0.418E-01	-0.113E+01	0.732E-02	0.911E-03
0.060	-0.250E+01	0.246E+00	-0.461E-01	-0.112E+01	0.839E-02	0.108E-02
0.070	-0.250E+01	0.256E+00	-0.502E-01	-0.112E+01	0.942E-02	0.125E-02
0.080	-0.250E+01	0.264E+00	-0.540E-01	-0.112E+01	0.104E-01	0.141E-02
0.090	-0.250E+01	0.272E+00	-0.577E-01	-0.112E+01	0.114E-01	0.157E-02
0.100	-0.250E+01	0.279E+00	-0.611E-01	-0.112E+01	0.123E-01	0.173E-02
0.200	-0.251E+01	0.331E+00	-0.902E-01	-0.112E+01	0.207E-01	0.322E-02
0.300	-0.252E+01	0.366E+00	-0.114E+00	-0.112E+01	0.280E-01	0.454E-02
0.400	-0.254E+01	0.393E+00	-0.134E+00	-0.112E+01	0.346E-01	0.574E-02
0.500	-0.255E+01	0.415E+00	-0.153E+00	-0.112E+01	0.408E-01	0.682E-02

TABLE 7. PM + T, TM + P

E _v (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
0.600	-0.256E+01	0.435E+00	-0.170E+00	-0.112E+01	0.467E-01	0.779E-02
0.700	-0.257E+01	0.452E+00	-0.186E+00	-0.112E+01	0.523E-01	0.868E-02
0.800	-0.258E+01	0.468E+00	-0.201E+00	-0.112E+01	0.577E-01	0.949E-02
0.900	-0.259E+01	0.482E+00	-0.216E+00	-0.112E+01	0.629E-01	0.102E-01
1.000	-0.260E+01	0.496E+00	-0.230E+00	-0.112E+01	0.679E-01	0.109E-01
1.100	-0.261E+01	0.509E+00	-0.243E+00	-0.112E+01	0.727E-01	0.114E-01
1.200	-0.262E+01	0.521E+00	-0.256E+00	-0.112E+01	0.775E-01	0.120E-01
1.300	-0.263E+01	0.532E+00	-0.269E+00	-0.112E+01	0.820E-01	0.124E-01
1.400	-0.264E+01	0.543E+00	-0.281E+00	-0.111E+01	0.865E-01	0.128E-01
1.500	-0.265E+01	0.554E+00	-0.294E+00	-0.111E+01	0.909E-01	0.132E-01
1.600	-0.266E+01	0.565E+00	-0.305E+00	-0.111E+01	0.951E-01	0.135E-01
1.700	-0.267E+01	0.575E+00	-0.317E+00	-0.111E+01	0.993E-01	0.137E-01
1.800	-0.268E+01	0.584E+00	-0.328E+00	-0.111E+01	0.103E+00	0.139E-01
1.900	-0.269E+01	0.594E+00	-0.340E+00	-0.111E+01	0.107E+00	0.140E-01
2.000	-0.270E+01	0.603E+00	-0.351E+00	-0.111E+01	0.111E+00	0.141E-01
3.000	-0.280E+01	0.689E+00	-0.454E+00	-0.111E+01	0.147E+00	0.130E-01
4.000	-0.291E+01	0.769E+00	-0.550E+00	-0.110E+01	0.178E+00	0.875E-02
5.000	-0.302E+01	0.849E+00	-0.643E+00	-0.110E+01	0.205E+00	0.261E-02
6.000	-0.314E+01	0.930E+00	-0.735E+00	-0.110E+01	0.229E+00	-0.624E-02
7.000	-0.326E+01	0.102E+01	-0.829E+00	-0.110E+01	0.251E+00	-0.161E-01
8.000	-0.340E+01	0.111E+01	-0.926E+00	-0.111E+01	0.271E+00	-0.270E-01
9.000	-0.354E+01	0.120E+01	-0.103E+01	-0.111E+01	0.290E+00	-0.389E-01
10.000	-0.370E+01	0.131E+01	-0.113E+01	-0.111E+01	0.308E+00	-0.514E-01

TABLE 8. DM + P --> DM + P

E _r (EV)	T (J=0)	T (J=1)	T (J=2)	T (J=3)
0.001	0.232E-02	0.110E-03	0.114E-03	0.114E-03
0.002	0.319E-02	0.901E-04	0.809E-04	0.809E-04
0.003	0.384E-02	0.827E-04	0.662E-04	0.660E-04
0.004	0.442E-02	0.824E-04	0.575E-04	0.572E-04
0.005	0.490E-02	0.859E-04	0.517E-04	0.512E-04
0.006	0.534E-02	0.917E-04	0.475E-04	0.467E-04
0.007	0.573E-02	0.992E-04	0.444E-04	0.433E-04
0.008	0.610E-02	0.108E-03	0.420E-04	0.405E-04
0.009	0.643E-02	0.117E-03	0.402E-04	0.382E-04
0.010	0.675E-02	0.128E-03	0.388E-04	0.362E-04
0.020	0.916E-02	0.252E-03	0.382E-04	0.263E-04
0.030	0.108E-01	0.388E-03	0.499E-04	0.232E-04
0.040	0.121E-01	0.524E-03	0.682E-04	0.235E-04
0.050	0.132E-01	0.654E-03	0.900E-04	0.262E-04
0.060	0.140E-01	0.780E-03	0.114E-03	0.308E-04
0.070	0.148E-01	0.902E-03	0.138E-03	0.369E-04
0.080	0.155E-01	0.102E-02	0.161E-03	0.441E-04
0.090	0.161E-01	0.114E-02	0.184E-03	0.522E-04
0.100	0.166E-01	0.125E-02	0.207E-03	0.607E-04
0.200	0.195E-01	0.235E-02	0.409E-03	0.138E-03
0.300	0.204E-01	0.336E-02	0.610E-03	0.203E-03
0.400	0.202E-01	0.428E-02	0.824E-03	0.274E-03
0.500	0.194E-01	0.513E-02	0.103E-02	0.342E-03
0.600	0.183E-01	0.592E-02	0.124E-02	0.409E-03
0.700	0.168E-01	0.666E-02	0.145E-02	0.478E-03
0.800	0.151E-01	0.735E-02	0.166E-02	0.547E-03
0.900	0.133E-01	0.798E-02	0.187E-02	0.615E-03
1.000	0.114E-01	0.857E-02	0.209E-02	0.683E-03
1.100	0.932E-02	0.913E-02	0.230E-02	0.752E-03
1.200	0.720E-02	0.964E-02	0.252E-02	0.821E-03
1.300	0.502E-02	0.101E-01	0.274E-02	0.889E-03
1.400	0.279E-02	0.106E-01	0.295E-02	0.957E-03
1.500	0.515E-03	0.110E-01	0.318E-02	0.103E-02
1.600	-0.179E-02	0.113E-01	0.340E-02	0.109E-02
1.700	-0.412E-02	0.117E-01	0.362E-02	0.116E-02
1.800	-0.647E-02	0.120E-01	0.385E-02	0.123E-02
1.900	-0.883E-02	0.123E-01	0.407E-02	0.130E-02
2.000	-0.112E-01	0.125E-01	0.430E-02	0.137E-02
3.000	-0.352E-01	0.137E-01	0.669E-02	0.206E-02

TABLE 8. DM + P --> DM + P

E _r (EV)	T (J=0)	T (J=1)	T (J=2)	T (J=3)
4.000	-0.588E-01	0.129E-01	0.929E-02	0.275E-02
5.000	-0.817E-01	0.105E-01	0.121E-01	0.344E-02
6.000	-0.104E+00	0.701E-02	0.153E-01	0.413E-02
7.000	-0.125E+00	0.252E-02	0.188E-01	0.483E-02
8.000	-0.145E+00	-0.276E-02	0.226E-01	0.553E-02
9.000	-0.165E+00	-0.867E-02	0.269E-01	0.624E-02
10.000	-0.184E+00	-0.151E-01	0.314E-01	0.695E-02
12.000	-0.221E+00	-0.292E-01	0.425E-01	0.839E-02
14.000	-0.256E+00	-0.445E-01	0.560E-01	0.986E-02
16.000	-0.289E+00	-0.606E-01	0.724E-01	0.113E-01
18.000	-0.322E+00	-0.772E-01	0.924E-01	0.129E-01
20.000	-0.352E+00	-0.942E-01	0.117E+00	0.144E-01
22.000	-0.382E+00	-0.111E+00	0.147E+00	0.160E-01
24.000	-0.411E+00	-0.129E+00	0.185E+00	0.177E-01
26.000	-0.440E+00	-0.146E+00	0.231E+00	0.194E-01
28.000	-0.467E+00	-0.163E+00	0.290E+00	0.211E-01
30.000	-0.494E+00	-0.181E+00	0.365E+00	0.229E-01
32.000	-0.520E+00	-0.198E+00	0.463E+00	0.248E-01
34.000	-0.546E+00	-0.215E+00	0.595E+00	0.267E-01
36.000	-0.572E+00	-0.232E+00	0.779E+00	0.287E-01
38.000	-0.597E+00	-0.249E+00	0.105E+01	0.308E-01
40.000	-0.622E+00	-0.266E+00	0.148E+01	0.330E-01
42.000	-0.646E+00	-0.282E+00	0.226E+01	0.353E-01
44.000	-0.670E+00	-0.299E+00	0.408E+01	0.376E-01
46.000	-0.694E+00	-0.315E+00	0.129E+02	0.401E-01
48.000	-0.718E+00	-0.331E+00	-0.155E+02	0.426E-01
50.000	-0.741E+00	-0.348E+00	-0.537E+01	0.453E-01

TABLE 9. $DM(F=1/2) + D \rightarrow DM(F=1/2) + D, S = 1/2$

E_γ (EV)	T (J=0)	T (J=1)	E_γ (EV)	T (J=0)	T (J=1)
0.001	-0.667E-02	0.248E-04	0.009	-0.209E-01	0.149E-03
0.002	-0.952E-02	0.490E-04	0.010	-0.221E-01	0.157E-03
0.003	-0.117E-01	0.704E-04	0.015	-0.274E-01	0.178E-03
0.004	-0.136E-01	0.884E-04	0.020	-0.319E-01	0.174E-03
0.005	-0.153E-01	0.104E-03	0.025	-0.360E-01	0.148E-03
0.006	-0.168E-01	0.117E-03	0.030	-0.398E-01	0.104E-03
0.007	-0.183E-01	0.129E-03	0.035	-0.433E-01	0.415E-04
0.008	-0.196E-01	0.139E-03	0.040	-0.465E-01	-0.360E-04
			0.045	-0.496E-01	-0.128E-03

TABLE 10a. $DM(F=1/2) + D \rightarrow DM(F=3/2) + D, S = 1/2$

E_γ (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
0.001	-0.523E-01	-0.439E-02	-0.783E-02	-0.222E-03	0.603E-04	0.272E-04
0.002	-0.529E-01	-0.524E-02	-0.112E-01	-0.244E-03	0.103E-03	0.559E-04
0.003	-0.534E-01	-0.583E-02	-0.137E-01	-0.267E-03	0.141E-03	0.830E-04
0.004	-0.540E-01	-0.629E-02	-0.159E-01	-0.290E-03	0.178E-03	0.108E-03
0.005	-0.546E-01	-0.668E-02	-0.179E-01	-0.314E-03	0.213E-03	0.131E-03
0.006	-0.551E-01	-0.702E-02	-0.197E-01	-0.338E-03	0.248E-03	0.153E-03
0.007	-0.557E-01	-0.733E-02	-0.213E-01	-0.363E-03	0.282E-03	0.174E-03
0.008	-0.562E-01	-0.761E-02	-0.229E-01	-0.388E-03	0.315E-03	0.194E-03
0.009	-0.568E-01	-0.787E-02	-0.243E-01	-0.414E-03	0.349E-03	0.214E-03
0.010	-0.573E-01	-0.811E-02	-0.257E-01	-0.440E-03	0.382E-03	0.233E-03
0.020	-0.626E-01	-0.100E-01	-0.371E-01	-0.724E-03	0.719E-03	0.389E-03
0.030	-0.676E-01	-0.114E-01	-0.461E-01	-0.105E-02	0.107E-02	0.496E-03
0.040	-0.723E-01	-0.126E-01	-0.530E-01	-0.141E-02	0.144E-02	0.563E-03
0.050	-0.768E-01	-0.137E-01	-0.608E-01	-0.190E-02	0.184E-02	0.599E-03
0.060	-0.811E-01	-0.147E-01	-0.671E-01	-0.223E-02	0.225E-02	0.606E-03
0.070	-0.852E-01	-0.156E-01	-0.731E-01	-0.268E-02	0.268E-02	0.588E-03
0.080	-0.893E-01	-0.164E-01	-0.786E-01	-0.316E-02	0.313E-02	0.547E-03
0.090	-0.932E-01	-0.172E-01	-0.839E-01	-0.366E-02	0.359E-02	0.485E-03
0.100	-0.969E-01	-0.180E-01	-0.890E-01	-0.418E-02	0.407E-02	0.405E-03
0.200	-0.130E+00	-0.241E-01	-0.131E+00	-0.104E-01	0.943E-02	-0.120E-02
0.300	-0.159E+00	-0.289E-01	-0.165E+00	-0.178E-01	0.155E-01	-0.379E-02
0.400	-0.184E+00	-0.330E-01	-0.195E+00	-0.259E-01	0.219E-01	-0.700E-02
0.500	-0.207E+00	-0.367E-01	-0.222E+00	-0.345E-01	0.285E-01	-0.106E-01

TABLE 10a. $DM(F=1/2) + D$, $DM(F=3/2) + D$, $S = 1/2$

E_ν (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
0.600	-0.229E+00	-0.401E-01	-0.247E+00	-0.433E-01	0.351E-01	-0.146E-01
0.700	-0.250E+00	-0.433E-01	-0.270E+00	-0.523E-01	0.417E-01	-0.107E-01
0.800	-0.269E+00	-0.463E-01	-0.292E+00	-0.613E-01	0.403E-01	-0.230E-01
0.900	-0.288E+00	-0.492E-01	-0.314E+00	-0.704E-01	0.548E-01	-0.274E-01
1.000	-0.306E+00	-0.520E-01	-0.334E+00	-0.795E-01	0.611E-01	-0.319E-01
1.100	-0.324E+00	-0.547E-01	-0.354E+00	-0.885E-01	0.674E-01	-0.365E-01
1.200	-0.341E+00	-0.574E-01	-0.373E+00	-0.975E-01	0.735E-01	-0.411E-01
1.300	-0.358E+00	-0.600E-01	-0.392E+00	-0.106E+00	0.795E-01	-0.457E-01
1.400	-0.374E+00	-0.626E-01	-0.410E+00	-0.115E+00	0.854E-01	-0.504E-01
1.500	-0.390E+00	-0.652E-01	-0.428E+00	-0.124E+00	0.912E-01	-0.551E-01
1.600	-0.406E+00	-0.677E-01	-0.446E+00	-0.133E+00	0.969E-01	-0.599E-01
1.700	-0.421E+00	-0.702E-01	-0.463E+00	-0.142E+00	0.102E+00	-0.646E-01
1.800	-0.437E+00	-0.728E-01	-0.480E+00	-0.150E+00	0.108E+00	-0.694E-01
1.900	-0.452E+00	-0.753E-01	-0.497E+00	-0.159E+00	0.113E+00	-0.742E-01
2.000	-0.466E+00	-0.778E-01	-0.514E+00	-0.167E+00	0.110E+00	-0.789E-01
3.000	-0.608E+00	-0.104E+00	-0.674E+00	-0.248E+00	0.166E+00	-0.127E+00
4.000	-0.745E+00	-0.133E+00	-0.831E+00	-0.325E+00	0.207E+00	-0.175E+00
5.000	-0.893E+00	-0.167E+00	-0.993E+00	-0.400E+00	0.244E+00	-0.223E+00
6.000	-0.103E+01	-0.207E+00	-0.117E+01	-0.473E+00	0.279E+00	-0.272E+00
7.000	-0.118E+01	-0.258E+00	-0.135E+01	-0.547E+00	0.314E+00	-0.321E+00
8.000	-0.135E+01	-0.321E+00	-0.157E+01	-0.621E+00	0.348E+00	-0.371E+00
9.000	-0.154E+01	-0.401E+00	-0.191E+01	-0.697E+00	0.384E+00	-0.422E+00
10.000	-0.176E+01	-0.508E+00	-0.210E+01	-0.776E+00	0.421E+00	-0.475E+00

TABLE 10a. $DM(F=1/2) + D$, $DM(F=3/2) + D$, $S = 1/2$

E_ν (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
12.000	-0.232E+01	-0.852E+00	-0.291E+01	-0.944E+00	0.501E+00	-0.586E+00
14.000	-0.326E+01	-0.160E+01	-0.436E+01	-0.113E+01	0.595E+00	-0.706E+00
16.000	-0.546E+01	-0.395E+01	-0.818E+01	-0.135E+01	0.709E+00	-0.841E+00
18.000	-0.396E+02	-0.511E+02	-0.746E+02	-0.160E+01	0.851E+00	-0.996E+00
20.000	0.204E+01	0.918E+01	0.840E+01	-0.192E+01	0.104E+01	-0.118E+01
22.000	-0.185E+01	0.645E+01	0.263E+01	-0.233E+01	0.128E+01	-0.141E+01
24.000	-0.551E+01	0.736E+01	-0.403E+00	-0.288E+01	0.164E+01	-0.172E+01
26.000	-0.179E+02	0.153E+02	-0.725E+01	-0.370E+01	0.217E+01	-0.216E+01
28.000	0.332E+02	-0.215E+02	0.182E+02	-0.504E+01	0.308E+01	-0.285E+01
30.000	0.986E+01	-0.524E+01	0.621E+01	-0.772E+01	0.492E+01	-0.422E+01
32.000	0.605E+01	-0.278E+01	0.412E+01	-0.159E+02	0.106E+02	-0.830E+01
34.000	0.445E+01	-0.182E+01	0.318E+01	0.936E+03	-0.327E+03	0.347E+03
36.000	0.355E+01	-0.133E+01	0.262E+01	0.149E+02	-0.112E+02	0.696E+01
38.000	0.297E+01	-0.103E+01	0.225E+01	0.754E+01	-0.604E+01	0.326E+01
40.000	0.256E+01	-0.839E+00	0.197E+01	0.501E+01	-0.430E+01	0.196E+01
42.000	0.225E+01	-0.704E+00	0.176E+01	0.371E+01	-0.344E+01	0.127E+01
44.000	0.201E+01	-0.605E+00	0.158E+01	0.292E+01	-0.293E+01	0.834E+00
46.000	0.181E+01	-0.531E+00	0.144E+01	0.237E+01	-0.261E+01	0.519E+00
48.000	0.165E+01	-0.473E+00	0.132E+01	0.197E+01	-0.239E+01	0.272E+00
50.000	0.151E+01	-0.426E+00	0.121E+01	0.165E+01	-0.224E+01	0.665E-01

TABLE 10b. $DM(F=1/2) + D$, $DM(F=3/2) + D$, $S = 1/2$

E_{γ} (eV)	J = 2			J = 3		
	T11	T12	T22	T11	T12	T22
1.000	0.489E-02	0.179E-03	0.479E-02	0.164E-02	-0.157E-05	0.157E-02
1.100	0.535E-02	0.224E-03	0.528E-02	0.180E-02	-0.217E-05	0.172E-02
1.200	0.581E-02	0.277E-03	0.578E-02	0.196E-02	-0.291E-05	0.188E-02
1.300	0.627E-02	0.336E-03	0.627E-02	0.212E-02	-0.383E-05	0.204E-02
1.400	0.672E-02	0.401E-03	0.678E-02	0.228E-02	-0.492E-05	0.220E-02
1.500	0.717E-02	0.474E-03	0.728E-02	0.243E-02	-0.623E-05	0.235E-02
1.600	0.762E-02	0.554E-03	0.778E-02	0.259E-02	-0.777E-05	0.251E-02
1.700	0.807E-02	0.641E-03	0.829E-02	0.275E-02	-0.955E-05	0.267E-02
1.800	0.852E-02	0.735E-03	0.881E-02	0.291E-02	-0.116E-04	0.283E-02
1.900	0.896E-02	0.838E-03	0.932E-02	0.307E-02	-0.140E-04	0.298E-02
2.000	0.940E-02	0.947E-03	0.984E-02	0.323E-02	-0.166E-04	0.314E-02
3.000	0.137E-01	0.250E-02	0.152E-01	0.485E-02	-0.664E-04	0.472E-02
4.000	0.177E-01	0.492E-02	0.209E-01	0.652E-02	-0.177E-03	0.631E-02
5.000	0.214E-01	0.826E-02	0.270E-01	0.827E-02	-0.377E-03	0.792E-02
6.000	0.248E-01	0.125E-01	0.334E-01	0.101E-01	-0.699E-03	0.954E-02
7.000	0.280E-01	0.177E-01	0.403E-01	0.121E-01	-0.118E-02	0.112E-01
8.000	0.309E-01	0.238E-01	0.475E-01	0.143E-01	-0.185E-02	0.129E-01
9.000	0.336E-01	0.308E-01	0.551E-01	0.167E-01	-0.276E-02	0.146E-01
10.000	0.360E-01	0.386E-01	0.631E-01	0.193E-01	-0.394E-02	0.164E-01
12.000	0.404E-01	0.564E-01	0.801E-01	0.257E-01	-0.736E-02	0.204E-01
14.000	0.442E-01	0.768E-01	0.983E-01	0.340E-01	-0.126E-01	0.250E-01
16.000	0.474E-01	0.994E-01	0.117E+00	0.452E-01	-0.203E-01	0.307E-01

TABLE 10b.

 $DM(F=1/2) + D$, $DM(F=3/2) + D$, $S = 1/2$

E_{γ} (eV)	J = 2			J = 3		
	T11	T12	T22	T11	T12	T22
18.000	0.499E-01	0.124E+00	0.137E+00	0.608E-01	-0.316E-01	0.382E-01
20.000	0.519E-01	0.149E+00	0.157E+00	0.830E-01	-0.481E-01	0.487E-01
22.000	0.531E-01	0.175E+00	0.177E+00	0.116E+00	-0.729E-01	0.643E-01
24.000	0.536E-01	0.201E+00	0.196E+00	0.169E+00	-0.112E+00	0.895E-01
26.000	0.531E-01	0.227E+00	0.214E+00	0.263E+00	-0.181E+00	0.135E+00
28.000	0.517E-01	0.253E+00	0.230E+00	0.464E+00	-0.325E+00	0.233E+00
30.000	0.493E-01	0.278E+00	0.246E+00	0.115E+01	-0.809E+00	0.570E+00
32.000	0.457E-01	0.302E+00	0.259E+00	-0.383E+01	0.274E+01	-0.187E+01
34.000	0.410E-01	0.325E+00	0.271E+00	-0.111E+01	0.775E+00	-0.559E+00
36.000	0.352E-01	0.347E+00	0.280E+00	-0.665E+00	0.457E+00	-0.349E+00
38.000	0.282E-01	0.368E+00	0.288E+00	-0.508E+00	0.341E+00	-0.265E+00
40.000	0.201E-01	0.307E+00	0.294E+00	-0.429E+00	0.281E+00	-0.230E+00
42.000	0.110E-01	0.405E+00	0.297E+00	-0.384E+00	0.243E+00	-0.211E+00
44.000	0.726E-03	0.422E+00	0.299E+00	-0.355E+00	0.218E+00	-0.201E+00
46.000	-0.105E-01	0.438E+00	0.299E+00	-0.336E+00	0.198E+00	-0.195E+00
48.000	-0.226E-01	0.453E+00	0.297E+00	-0.324E+00	0.184E+00	-0.193E+00
50.000	-0.356E-01	0.466E+00	0.294E+00	-0.315E+00	0.171E+00	-0.193E+00

TABLE 11. $DM(F=1/2) + D \rightarrow DM(F=1/2) + D, S = 3/2$

E_r (EV)	T (J=0)	T (J=1)	E_r (EV)	T (J=0)	T (J=1)
0.001	-0.843E-02	0.283E-04	0.009	-0.261E-01	0.243E-03
0.002	-0.120E-01	0.589E-04	0.010	-0.276E-01	0.267E-03
0.003	-0.148E-01	0.887E-04	0.015	-0.341E-01	0.381E-03
0.004	-0.171E-01	0.117E-03	0.020	-0.398E-01	0.485E-03
0.005	-0.192E-01	0.143E-03	0.025	-0.448E-01	0.582E-03
0.006	-0.211E-01	0.169E-03	0.030	-0.493E-01	0.671E-03
0.007	-0.229E-01	0.194E-03	0.035	-0.536E-01	0.754E-03
0.008	-0.246E-01	0.219E-03	0.040	-0.575E-01	0.832E-03
			0.045	-0.613E-01	0.904E-03

TABLE 12a. $DM(F=1/2) + D, DM(F=3/2) + D, S = 3/2$

E_r (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
0.001	-0.645E-01	0.347E-02	-0.606E-02	0.965E-03	-0.485E-04	0.237E-04
0.002	-0.652E-01	0.414E-02	-0.866E-02	0.978E-03	-0.827E-04	0.459E-04
0.003	-0.659E-01	0.461E-02	-0.107E-01	0.991E-03	-0.114E-03	0.647E-04
0.004	-0.666E-01	0.497E-02	-0.124E-01	0.100E-02	-0.143E-03	0.797E-04
0.005	-0.673E-01	0.528E-02	-0.140E-01	0.102E-02	-0.171E-03	0.916E-04
0.006	-0.680E-01	0.555E-02	-0.154E-01	0.103E-02	-0.199E-03	0.101E-03
0.007	-0.687E-01	0.579E-02	-0.167E-01	0.104E-02	-0.226E-03	0.109E-03
0.008	-0.693E-01	0.602E-02	-0.179E-01	0.105E-02	-0.253E-03	0.115E-03
0.009	-0.700E-01	0.622E-02	-0.190E-01	0.106E-02	-0.280E-03	0.119E-03
0.010	-0.706E-01	0.641E-02	-0.201E-01	0.108E-02	-0.307E-03	0.122E-03
0.020	-0.770E-01	0.792E-02	-0.292E-01	0.110E-02	-0.577E-03	0.777E-04
0.030	-0.829E-01	0.905E-02	-0.365E-01	0.127E-02	-0.860E-03	-0.719E-04
0.040	-0.886E-01	0.100E-01	-0.428E-01	0.135E-02	-0.116E-02	-0.304E-03
0.050	-0.939E-01	0.108E-01	-0.485E-01	0.142E-02	-0.148E-02	-0.605E-03
0.060	-0.991E-01	0.116E-01	-0.537E-01	0.147E-02	-0.181E-02	-0.966E-03
0.070	-0.104E+00	0.123E-01	-0.585E-01	0.151E-02	-0.215E-02	-0.138E-02
0.080	-0.109E+00	0.130E-01	-0.631E-01	0.155E-02	-0.251E-02	-0.184E-02
0.090	-0.113E+00	0.136E-01	-0.675E-01	0.157E-02	-0.288E-02	-0.234E-02
0.100	-0.116E+00	0.142E-01	-0.717E-01	0.158E-02	-0.326E-02	-0.289E-02
0.200	-0.157E+00	0.190E-01	-0.107E+00	0.130E-02	-0.755E-02	-0.990E-02
0.300	-0.191E+00	0.228E-01	-0.136E+00	0.457E-03	-0.124E-01	-0.188E-01
0.400	-0.220E+00	0.261E-01	-0.161E+00	-0.779E-03	-0.175E-01	-0.288E-01
0.500	-0.247E+00	0.290E-01	-0.184E+00	-0.231E-02	-0.228E-01	-0.394E-01

TABLE 12a. $DM(F=1/2) + D$, $DM(F=3/2) + D$, $S = 3/2$

E_{γ} (eV)	$J = 0$			$J = 1$		
	T11	T12	T22	T11	T12	T22
0.600	-0.273E+00	0.317E-01	-0.205E+00	-0.407E-02	-0.280E-01	-0.504E-01
0.700	-0.297E+00	0.342E-01	-0.225E+00	-0.601E-02	-0.333E-01	-0.616E-01
0.800	-0.319E+00	0.366E-01	-0.244E+00	-0.810E-02	-0.385E-01	-0.728E-01
0.900	-0.341E+00	0.389E-01	-0.262E+00	-0.103E-01	-0.437E-01	-0.842E-01
1.000	-0.362E+00	0.411E-01	-0.280E+00	-0.126E-01	-0.487E-01	-0.955E-01
1.100	-0.383E+00	0.432E-01	-0.296E+00	-0.151E-01	-0.537E-01	-0.107E+00
1.200	-0.403E+00	0.453E-01	-0.313E+00	-0.176E-01	-0.586E-01	-0.118E+00
1.300	-0.422E+00	0.474E-01	-0.329E+00	-0.202E-01	-0.633E-01	-0.129E+00
1.400	-0.441E+00	0.495E-01	-0.344E+00	-0.228E-01	-0.680E-01	-0.140E+00
1.500	-0.460E+00	0.515E-01	-0.360E+00	-0.255E-01	-0.726E-01	-0.151E+00
1.600	-0.478E+00	0.535E-01	-0.375E+00	-0.283E-01	-0.770E-01	-0.162E+00
1.700	-0.496E+00	0.555E-01	-0.389E+00	-0.311E-01	-0.814E-01	-0.172E+00
1.800	-0.514E+00	0.575E-01	-0.404E+00	-0.340E-01	-0.857E-01	-0.183E+00
1.900	-0.532E+00	0.595E-01	-0.418E+00	-0.369E-01	-0.899E-01	-0.193E+00
2.000	-0.550E+00	0.615E-01	-0.432E+00	-0.398E-01	-0.940E-01	-0.204E+00
3.000	-0.719E+00	0.821E-01	-0.565E+00	-0.711E-01	-0.131E+00	-0.302E+00
4.000	-0.886E+00	0.105E+00	-0.691E+00	-0.105E+00	-0.164E+00	-0.394E+00
5.000	-0.106E+01	0.132E+00	-0.817E+00	-0.140E+00	-0.193E+00	-0.482E+00
6.000	-0.125E+01	0.164E+00	-0.946E+00	-0.176E+00	-0.221E+00	-0.568E+00
7.000	-0.146E+01	0.204E+00	-0.108E+01	-0.213E+00	-0.248E+00	-0.653E+00
8.000	-0.169E+01	0.253E+00	-0.123E+01	-0.251E+00	-0.276E+00	-0.740E+00

TABLE 12a.

 $DM(F=1/2) + D$, $DM(F=3/2) + D$, $S = 3/2$

E_{γ} (eV)	$J = 0$			$J = 1$		
	T11	T12	T22	T11	T12	T22
9.000	-0.197E+01	0.317E+00	-0.139E+01	-0.289E+00	-0.304E+00	-0.829E+00
10.000	-0.230E+01	0.402E+00	-0.157E+01	-0.329E+00	-0.333E+00	-0.920E+00
12.000	-0.324E+01	0.674E+00	-0.201E+01	-0.411E+00	-0.396E+00	-0.112E+01
14.000	-0.498E+01	0.127E+01	-0.268E+01	-0.490E+00	-0.471E+00	-0.134E+01
16.000	-0.972E+01	0.314E+01	-0.403E+01	-0.593E+00	-0.560E+00	-0.159E+01
18.000	-0.104E+03	0.450E+02	-0.233E+02	-0.690E+00	-0.673E+00	-0.190E+01
20.000	0.116E+02	-0.713E+01	-0.131E+01	-0.819E+00	-0.818E+00	-0.228E+01
22.000	0.494E+01	-0.504E+01	-0.417E+01	-0.962E+00	-0.101E+01	-0.277E+01
24.000	0.226E+01	-0.574E+01	-0.811E+01	-0.114E+01	-0.129E+01	-0.345E+01
26.000	-0.162E+01	-0.118E+02	-0.230E+02	-0.139E+01	-0.171E+01	-0.445E+01
28.000	0.107E+02	0.175E+02	0.423E+02	-0.177E+01	-0.243E+01	-0.610E+01
30.000	0.434E+01	0.417E+01	0.119E+02	-0.248E+01	-0.387E+01	-0.939E+01
32.000	0.312E+01	0.220E+01	0.709E+01	-0.452E+01	-0.830E+01	-0.193E+02
34.000	0.253E+01	0.144E+01	0.512E+01	0.295E+03	0.408E+03	0.374E+04
36.000	0.215E+01	0.105E+01	0.404E+01	0.307E+01	0.096E+01	0.191E+02
38.000	0.198E+01	0.016E+00	0.335E+01	0.114E+01	0.480E+01	0.972E+01
40.000	0.167E+01	0.663E+00	0.286E+01	0.449E+00	0.342E+01	0.655E+01
42.000	0.150E+01	0.556E+00	0.250E+01	0.648E-01	0.273E+01	0.494E+01
44.000	0.137E+01	0.478E+00	0.223E+01	-0.197E+00	0.233E+01	0.396E+01
46.000	0.125E+01	0.419E+00	0.200E+01	-0.398E+00	0.207E+01	0.330E+01
48.000	0.115E+01	0.373E+00	0.182E+01	-0.568E+00	0.189E+01	0.281E+01
50.000	0.106E+01	0.337E+00	0.167E+01	-0.720E+00	0.177E+01	0.244E+01

TABLE 12b. $DM(F=1/2) + D$, $DM(F=3/2) + D$, $S = 3/2$

E_r (EV)	J = 2			J = 3		
	T11	T12	T22	T11	T12	T22
1.000	0.510E-02	-0.141E-03	0.461E-02	0.164E-02	0.124E-05	0.157E-02
1.100	0.561E-02	-0.178E-03	0.506E-02	0.180E-02	0.171E-05	0.173E-02
1.200	0.612E-02	-0.219E-03	0.550E-02	0.196E-02	0.230E-05	0.188E-02
1.300	0.664E-02	-0.266E-03	0.593E-02	0.211E-02	0.302E-05	0.204E-02
1.400	0.717E-02	-0.318E-03	0.637E-02	0.227E-02	0.389E-05	0.220E-02
1.500	0.770E-02	-0.375E-03	0.679E-02	0.243E-02	0.492E-05	0.236E-02
1.600	0.823E-02	-0.438E-03	0.722E-02	0.258E-02	0.614E-05	0.252E-02
1.700	0.876E-02	-0.507E-03	0.764E-02	0.274E-02	0.755E-05	0.268E-02
1.800	0.932E-02	-0.582E-03	0.805E-02	0.290E-02	0.917E-05	0.284E-02
1.900	0.988E-02	-0.662E-03	0.846E-02	0.305E-02	0.110E-04	0.300E-02
2.000	0.104E-01	-0.749E-03	0.886E-02	0.321E-02	0.131E-04	0.316E-02
3.000	0.164E-01	-0.197E-02	0.126E-01	0.478E-02	0.524E-04	0.479E-02
4.000	0.230E-01	-0.389E-02	0.158E-01	0.655E-02	0.140E-03	0.650E-02
5.000	0.302E-01	-0.653E-02	0.183E-01	0.786E-02	0.248E-03	0.851E-02
6.000	0.382E-01	-0.991E-02	0.203E-01	0.937E-02	0.553E-03	0.103E-01
7.000	0.469E-01	-0.140E-01	0.216E-01	0.109E-01	0.931E-03	0.124E-01
8.000	0.563E-01	-0.188E-01	0.224E-01	0.123E-01	0.146E-02	0.148E-01
9.000	0.664E-01	-0.244E-01	0.226E-01	0.137E-01	0.218E-02	0.175E-01
10.000	0.772E-01	-0.305E-01	0.224E-01	0.151E-01	0.312E-02	0.204E-01
12.000	0.101E+00	-0.446E-01	0.205E-01	0.178E-01	0.582E-02	0.281E-01
14.000	0.126E+00	-0.608E-01	0.171E-01	0.206E-01	0.995E-02	0.382E-01
16.000	0.153E+00	-0.786E-01	0.123E-01	0.236E-01	0.161E-01	0.521E-01
18.000	0.181E+00	-0.977E-01	0.633E-02	0.271E-01	0.250E-01	0.715E-01

TABLE 12b.

 $DM(F=1/2) + D$, $DM(F=3/2) + D$, $S = 3/2$

E_r (EV)	J = 2			J = 3		
	T11	T12	T22	T11	T12	T22
20.000	0.210E+00	-0.118E+00	-0.668E-03	0.318E-01	0.380E-01	0.994E-01
22.000	0.239E+00	-0.138E+00	-0.862E-02	0.387E-01	0.575E-01	0.141E+00
24.000	0.267E+00	-0.159E+00	-0.174E-01	0.499E-01	0.885E-01	0.208E+00
26.000	0.295E+00	-0.180E+00	-0.271E-01	0.709E-01	0.142E+00	0.325E+00
28.000	0.320E+00	-0.200E+00	-0.376E-01	0.118E+00	0.256E+00	0.573E+00
30.000	0.344E+00	-0.220E+00	-0.489E-01	0.282E+00	0.631E+00	0.141E+01
32.000	0.366E+00	-0.239E+00	-0.609E-01	-0.962E+00	-0.227E+01	-0.500E+01
34.000	0.386E+00	-0.257E+00	-0.738E-01	-0.290E+00	-0.620E+00	-0.139E+01
36.000	0.403E+00	-0.274E+00	-0.873E-01	-0.101E+00	-0.363E+00	-0.829E+00
38.000	0.418E+00	-0.291E+00	-0.102E+00	-0.146E+00	-0.271E+00	-0.629E+00
40.000	0.431E+00	-0.306E+00	-0.117E+00	-0.132E+00	-0.223E+00	-0.529E+00
42.000	0.441E+00	-0.320E+00	-0.132E+00	-0.126E+00	-0.193E+00	-0.470E+00
44.000	0.448E+00	-0.334E+00	-0.148E+00	-0.124E+00	-0.172E+00	-0.432E+00
46.000	0.454E+00	-0.346E+00	-0.165E+00	-0.126E+00	-0.157E+00	-0.406E+00
48.000	0.458E+00	-0.358E+00	-0.183E+00	-0.129E+00	-0.145E+00	-0.388E+00
50.000	0.459E+00	-0.369E+00	-0.200E+00	-0.133E+00	-0.136E+00	-0.375E+00

TABLE 13a. $DM(F=3/2) + D \rightarrow DM(F=3/2) + D, S = 5/2$

E_r (EV)	T (J=0)	T (J=1)	E_r (EV)	T (J=0)	T (J=1)
0.001	-0.900E-02	0.305E-04	1.600	-0.493E+00	0.725E-02
0.002	-0.128E-01	0.637E-04	1.700	-0.512E+00	0.643E-02
0.003	-0.158E-01	0.951E-04	1.800	-0.531E+00	0.551E-02
0.004	-0.183E-01	0.126E-03	1.900	-0.550E+00	0.452E-02
0.005	-0.205E-01	0.156E-03	2.000	-0.568E+00	0.344E-02
0.006	-0.226E-01	0.186E-03	3.000	-0.747E+00	-0.109E-01
0.007	-0.244E-01	0.216E-03	4.000	-0.925E+00	-0.298E-01
0.008	-0.262E-01	0.246E-03	5.000	-0.111E+01	-0.516E-01
0.009	-0.278E-01	0.276E-03	6.000	-0.131E+01	-0.753E-01
0.010	-0.294E-01	0.305E-03	7.000	-0.154E+01	-0.100E+00
0.020	-0.423E-01	0.591E-03	8.000	-0.179E+01	-0.126E+00
0.030	-0.525E-01	0.864E-03	9.000	-0.209E+01	-0.152E+00
0.040	-0.612E-01	0.113E-02	10.000	-0.246E+01	-0.178E+00
0.050	-0.690E-01	0.138E-02	12.000	-0.351E+01	-0.232E+00
0.060	-0.761E-01	0.163E-02	14.000	-0.549E+01	-0.286E+00
0.070	-0.827E-01	0.187E-02	16.000	-0.109E+02	-0.340E+00
0.080	-0.890E-01	0.210E-02	18.000	-0.104E+03	-0.395E+00
0.090	-0.949E-01	0.233E-02	20.000	0.151E+02	-0.451E+00
0.100	-0.100E+00	0.255E-02	22.000	0.725E+01	-0.507E+00
0.200	-0.147E+00	0.448E-02	24.000	0.484E+01	-0.563E+00
0.300	-0.185E+00	0.602E-02	26.000	0.367E+01	-0.621E+00
0.400	-0.218E+00	0.724E-02	28.000	0.296E+01	-0.680E+00
0.500	-0.247E+00	0.820E-02	30.000	0.249E+01	-0.741E+00

TABLE 13a. $DM(F=3/2) + D \rightarrow DM(F=3/2) + D, S = 5/2$

E_r (EV)	T (J=0)	T (J=1)	E_r (EV)	T (J=0)	T (J=1)
0.600	-0.274E+00	0.892E-02	32.000	0.215E+01	-0.804E+00
0.700	-0.300E+00	0.944E-02	34.000	0.189E+01	-0.869E+00
0.800	-0.324E+00	0.977E-02	36.000	0.168E+01	-0.936E+00
0.900	-0.348E+00	0.993E-02	38.000	0.152E+01	-0.101E+01
1.000	-0.370E+00	0.993E-02	40.000	0.130E+01	-0.108E+01
1.100	-0.392E+00	0.979E-02	42.000	0.126E+01	-0.116E+01
1.200	-0.413E+00	0.951E-02	44.000	0.116E+01	-0.124E+01
1.300	-0.434E+00	0.911E-02	46.000	0.106E+01	-0.132E+01
1.400	-0.454E+00	0.860E-02	48.000	0.984E+00	-0.141E+01
1.500	-0.474E+00	0.797E-02	50.000	0.912E+00	-0.151E+01

TABLE 13b. $DM(F=3/2) + D \rightarrow DM(F=3/2) + D, s = 5/2$

E_r (EV)	T (J=2)	T (J=3)	E_r (EV)	T (J=2)	T (J=3)
1.000	0.491E-02	0.157E-02	12.000	0.120E+00	0.152E-01
1.100	0.543E-02	0.172E-02	14.000	0.152E+00	0.161E-01
1.200	0.596E-02	0.188E-02	16.000	0.187E+00	0.164E-01
1.300	0.650E-02	0.204E-02	18.000	0.224E+00	0.159E-01
1.400	0.705E-02	0.219E-02	20.000	0.262E+00	0.148E-01
1.500	0.760E-02	0.235E-02	22.000	0.300E+00	0.129E-01
1.600	0.816E-02	0.251E-02	24.000	0.338E+00	0.103E-01
1.700	0.873E-02	0.266E-02	26.000	0.374E+00	0.711E-02
1.800	0.931E-02	0.282E-02	28.000	0.409E+00	0.323E-02
1.900	0.990E-02	0.297E-02	30.000	0.442E+00	-0.126E-02
2.000	0.105E-01	0.313E-02	32.000	0.473E+00	-0.633E-02
3.000	0.169E-01	0.468E-02	34.000	0.501E+00	-0.119E-01
4.000	0.243E-01	0.619E-02	36.000	0.526E+00	-0.181E-01
5.000	0.327E-01	0.766E-02	38.000	0.548E+00	-0.247E-01
6.000	0.422E-01	0.905E-02	40.000	0.567E+00	-0.317E-01
7.000	0.527E-01	0.104E-01	42.000	0.584E+00	-0.391E-01
8.000	0.642E-01	0.116E-01	44.000	0.597E+00	-0.469E-01
9.000	0.767E-01	0.127E-01	46.000	0.609E+00	-0.550E-01
10.000	0.902E-01	0.137E-01	48.000	0.617E+00	-0.635E-01
			50.000	0.624E+00	-0.722E-01

TABLE 14. $DM + T \rightarrow TM + D$

E_r (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
0.001	0.100E+01	-0.954E-02	-0.289E-02	0.159E+02	0.387E-02	0.168E-03
0.002	0.100E+01	-0.113E-01	-0.425E-02	0.159E+02	0.652E-02	0.148E-03
0.003	0.100E+01	-0.125E-01	-0.531E-02	0.159E+02	0.883E-02	0.160E-03
0.004	0.100E+01	-0.135E-01	-0.622E-02	0.159E+02	0.110E-01	0.184E-03
0.005	0.100E+01	-0.142E-01	-0.705E-02	0.159E+02	0.129E-01	0.215E-03
0.006	0.100E+01	-0.149E-01	-0.782E-02	0.159E+02	0.148E-01	0.251E-03
0.007	0.100E+01	-0.155E-01	-0.853E-02	0.159E+02	0.167E-01	0.290E-03
0.008	0.100E+01	-0.160E-01	-0.922E-02	0.159E+02	0.184E-01	0.331E-03
0.009	0.100E+01	-0.165E-01	-0.987E-02	0.159E+02	0.201E-01	0.375E-03
0.010	0.100E+01	-0.169E-01	-0.105E-01	0.158E+02	0.217E-01	0.419E-03
0.020	0.100E+01	-0.201E-01	-0.160E-01	0.158E+02	0.365E-01	0.895E-03
0.030	0.100E+01	-0.231E-01	-0.206E-01	0.158E+02	0.494E-01	0.137E-02
0.040	0.100E+01	-0.237E-01	-0.247E-01	0.158E+02	0.611E-01	0.182E-02
0.050	0.100E+01	-0.250E-01	-0.286E-01	0.157E+02	0.721E-01	0.227E-02
0.060	0.100E+01	-0.262E-01	-0.322E-01	0.157E+02	0.824E-01	0.271E-02
0.070	0.100E+01	-0.271E-01	-0.356E-01	0.157E+02	0.923E-01	0.315E-02
0.080	0.100E+01	-0.280E-01	-0.389E-01	0.156E+02	0.102E+00	0.360E-02
0.090	0.100E+01	-0.288E-01	-0.420E-01	0.156E+02	0.111E+00	0.404E-02
0.100	0.100E+01	-0.295E-01	-0.451E-01	0.156E+02	0.120E+00	0.449E-02
0.200	0.996E+00	-0.346E-01	-0.721E-01	0.153E+02	0.196E+00	0.879E-02
0.300	0.992E+00	-0.379E-01	-0.952E-01	0.150E+02	0.260E+00	0.129E-01
0.400	0.988E+00	-0.404E-01	-0.116E+00	0.147E+02	0.314E+00	0.168E-01
0.500	0.984E+00	-0.424E-01	-0.135E+00	0.145E+02	0.362E+00	0.205E-01

TABLE 14. DM + T, TM + D

E_{γ} (eV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
0.600	0.980E+00	-0.441E-01	-0.154E+00	0.142E+02	0.404E+00	0.240E-01
0.700	0.976E+00	-0.455E-01	-0.171E+00	0.139E+02	0.442E+00	0.272E-01
0.800	0.972E+00	-0.469E-01	-0.107E+00	0.137E+02	0.476E+00	0.302E-01
0.900	0.968E+00	-0.481E-01	-0.203E+00	0.134E+02	0.507E+00	0.330E-01
1.000	0.964E+00	-0.492E-01	-0.219E+00	0.132E+02	0.535E+00	0.356E-01
1.100	0.960E+00	-0.502E-01	-0.233E+00	0.130E+02	0.561E+00	0.379E-01
1.200	0.956E+00	-0.511E-01	-0.248E+00	0.128E+02	0.584E+00	0.400E-01
1.300	0.952E+00	-0.520E-01	-0.262E+00	0.125E+02	0.605E+00	0.419E-01
1.400	0.948E+00	-0.529E-01	-0.276E+00	0.123E+02	0.624E+00	0.436E-01
1.500	0.945E+00	-0.537E-01	-0.289E+00	0.121E+02	0.642E+00	0.451E-01
1.600	0.941E+00	-0.545E-01	-0.303E+00	0.119E+02	0.657E+00	0.465E-01
1.700	0.937E+00	-0.552E-01	-0.316E+00	0.117E+02	0.672E+00	0.476E-01
1.800	0.933E+00	-0.559E-01	-0.329E+00	0.115E+02	0.685E+00	0.485E-01
1.900	0.929E+00	-0.566E-01	-0.341E+00	0.114E+02	0.697E+00	0.493E-01
2.000	0.926E+00	-0.573E-01	-0.354E+00	0.112E+02	0.708E+00	0.499E-01
3.000	0.890E+00	-0.634E-01	-0.471E+00	0.963E+01	0.770E+00	0.477E-01
4.000	0.855E+00	-0.689E-01	-0.582E+00	0.843E+01	0.785E+00	0.344E-01
5.000	0.823E+00	-0.742E-01	-0.689E+00	0.747E+01	0.776E+00	0.140E-01
6.000	0.791E+00	-0.796E-01	-0.798E+00	0.670E+01	0.758E+00	-0.111E-01
7.000	0.761E+00	-0.853E-01	-0.909E+00	0.606E+01	0.735E+00	-0.392E-01
8.000	0.733E+00	-0.913E-01	-0.102E+01	0.554E+01	0.711E+00	-0.691E-01

TABLE 14. DM + T, TM + D

E_{γ} (eV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
9.000	0.705E+00	-0.979E-01	-0.115E+01	0.509E+01	0.688E+00	-0.100E+00
10.000	0.678E+00	-0.105E+00	-0.128E+01	0.471E+01	0.666E+00	-0.132E+00
12.000	0.627E+00	-0.122E+00	-0.157E+01	0.410E+01	0.626E+00	-0.197E+00
14.000	0.580E+00	-0.143E+00	-0.193E+01	0.362E+01	0.594E+00	-0.264E+00
16.000	0.534E+00	-0.172E+00	-0.240E+01	0.325E+01	0.567E+00	-0.330E+00
18.000	0.491E+00	-0.213E+00	-0.303E+01	0.294E+01	0.546E+00	-0.398E+00
20.000	0.448E+00	-0.274E+00	-0.397E+01	0.269E+01	0.530E+00	-0.466E+00
22.000	0.404E+00	-0.377E+00	-0.553E+01	0.247E+01	0.517E+00	-0.536E+00
24.000	0.355E+00	-0.587E+00	-0.867E+01	0.229E+01	0.508E+00	-0.608E+00
26.000	0.276E+00	-0.125E+01	-0.185E+02	0.213E+01	0.502E+00	-0.681E+00
28.000	0.143E+01	0.162E+02	0.248E+03	0.199E+01	0.498E+00	-0.757E+00
30.000	0.375E+00	0.114E+01	0.167E+02	0.186E+01	0.497E+00	-0.837E+00
32.000	0.309E+00	0.604E+00	0.881E+01	0.175E+01	0.499E+00	-0.920E+00
34.000	0.268E+00	0.410E+00	0.604E+01	0.165E+01	0.502E+00	-0.101E+01
36.000	0.234E+00	0.324E+00	0.461E+01	0.155E+01	0.508E+00	-0.110E+01
38.000	0.203E+00	0.267E+00	0.374E+01	0.147E+01	0.517E+00	-0.120E+01
40.000	0.174E+00	0.229E+00	0.316E+01	0.139E+01	0.528E+00	-0.131E+01
42.000	0.146E+00	0.202E+00	0.273E+01	0.132E+01	0.541E+00	-0.142E+01
44.000	0.120E+00	0.182E+00	0.240E+01	0.125E+01	0.558E+00	-0.155E+01
46.000	0.947E-01	0.166E+00	0.215E+01	0.119E+01	0.577E+00	-0.169E+01
48.000	0.700E-01	0.154E+00	0.194E+01	0.113E+01	0.601E+00	-0.184E+01
50.000	0.459E-01	0.144E+00	0.176E+01	0.107E+01	0.628E+00	-0.201E+01

TABLE 15a.

DM + T , TM + D, J = 2

E, (EV)	T11	T12	T22
0.100	0.512E+00	0.107E-02	0.655E-03
0.200	0.514E+00	0.254E-02	0.132E-02
0.300	0.516E+00	0.422E-02	0.198E-02
0.400	0.518E+00	0.605E-02	0.265E-02
0.500	0.520E+00	0.799E-02	0.332E-02
0.600	0.522E+00	0.100E-01	0.400E-02
0.700	0.524E+00	0.122E-01	0.468E-02
0.800	0.526E+00	0.144E-01	0.537E-02
0.900	0.529E+00	0.166E-01	0.605E-02
1.000	0.531E+00	0.189E-01	0.675E-02
1.100	0.533E+00	0.213E-01	0.744E-02
1.200	0.535E+00	0.238E-01	0.815E-02
1.300	0.537E+00	0.262E-01	0.885E-02
1.400	0.540E+00	0.288E-01	0.956E-02
1.500	0.542E+00	0.313E-01	0.103E-01
1.600	0.544E+00	0.340E-01	0.110E-01
1.700	0.547E+00	0.366E-01	0.117E-01
1.800	0.549E+00	0.393E-01	0.124E-01
1.900	0.551E+00	0.420E-01	0.132E-01
2.000	0.554E+00	0.447E-01	0.139E-01
3.000	0.578E+00	0.736E-01	0.215E-01
4.000	0.603E+00	0.104E+00	0.295E-01
5.000	0.629E+00	0.136E+00	0.377E-01
6.000	0.655E+00	0.169E+00	0.460E-01
7.000	0.681E+00	0.202E+00	0.544E-01
8.000	0.706E+00	0.235E+00	0.627E-01
9.000	0.731E+00	0.267E+00	0.708E-01
10.000	0.755E+00	0.299E+00	0.785E-01
12.000	0.799E+00	0.361E+00	0.925E-01
14.000	0.837E+00	0.418E+00	0.104E+00
16.000	0.868E+00	0.471E+00	0.112E+00
18.000	0.892E+00	0.518E+00	0.117E+00
20.000	0.909E+00	0.559E+00	0.118E+00
22.000	0.918E+00	0.596E+00	0.116E+00
24.000	0.921E+00	0.627E+00	0.111E+00
26.000	0.919E+00	0.654E+00	0.102E+00
28.000	0.911E+00	0.677E+00	0.901E-01
30.000	0.899E+00	0.697E+00	0.760E-01
32.000	0.884E+00	0.713E+00	0.595E-01
34.000	0.866E+00	0.728E+00	0.411E-01
36.000	0.845E+00	0.740E+00	0.209E-01
38.000	0.823E+00	0.750E+00	-0.819E-03
40.000	0.799E+00	0.760E+00	-0.238E-01
42.000	0.773E+00	0.768E+00	-0.480E-01
44.000	0.747E+00	0.775E+00	-0.732E-01
46.000	0.720E+00	0.782E+00	-0.993E-01
48.000	0.693E+00	0.799E+00	-0.126E+00
50.000	0.665E+00	0.795E+00	-0.154E+00

TABLE 15b.

E, (EV)	J = 3			J = 4		
	T11	T12	T22	T11	T12	T22
10.000	-0.162E+00	0.103E-01	0.209E-01	0.906E-01	0.507E-02	0.101E-01
12.000	-0.167E+00	0.146E-01	0.244E-01	0.979E-01	0.774E-02	0.122E-01
14.000	-0.173E+00	0.195E-01	0.275E-01	0.106E+00	0.111E-01	0.144E-01
16.000	-0.178E+00	0.249E-01	0.301E-01	0.115E+00	0.152E-01	0.166E-01
18.000	-0.183E+00	0.309E-01	0.323E-01	0.125E+00	0.200E-01	0.190E-01
20.000	-0.188E+00	0.373E-01	0.340E-01	0.135E+00	0.257E-01	0.214E-01
22.000	-0.193E+00	0.441E-01	0.352E-01	0.147E+00	0.322E-01	0.240E-01
24.000	-0.199E+00	0.513E-01	0.359E-01	0.160E+00	0.397E-01	0.268E-01
26.000	-0.204E+00	0.588E-01	0.361E-01	0.174E+00	0.482E-01	0.298E-01
28.000	-0.209E+00	0.665E-01	0.358E-01	0.190E+00	0.577E-01	0.330E-01
30.000	-0.214E+00	0.744E-01	0.351E-01	0.208E+00	0.684E-01	0.366E-01
32.000	-0.219E+00	0.825E-01	0.338E-01	0.228E+00	0.803E-01	0.405E-01
34.000	-0.224E+00	0.908E-01	0.321E-01	0.249E+00	0.936E-01	0.449E-01
36.000	-0.229E+00	0.991E-01	0.299E-01	0.274E+00	0.108E+00	0.498E-01
38.000	-0.234E+00	0.108E+00	0.273E-01	0.301E+00	0.125E+00	0.552E-01
40.000	-0.240E+00	0.116E+00	0.242E-01	0.331E+00	0.143E+00	0.613E-01
42.000	-0.245E+00	0.124E+00	0.207E-01	0.365E+00	0.163E+00	0.683E-01
44.000	-0.250E+00	0.133E+00	0.160E-01	0.404E+00	0.186E+00	0.761E-01
46.000	-0.263E+00	0.140E+00	0.127E-01	0.447E+00	0.211E+00	0.851E-01
48.000	-0.261E+00	0.150E+00	0.792E-02	0.496E+00	0.239E+00	0.954E-01
50.000	-0.266E+00	0.158E+00	0.292E-02	0.552E+00	0.271E+00	0.107E+00

TABLE 16. TM + P --> TM + P

E _r (EV)	T(J=0)	T(J=1)	T(J=2)	T(J=3)
0.001	0.351E-02	0.125E-03	0.121E-03	0.121E-03
0.002	0.486E-02	0.967E-04	0.855E-04	0.854E-04
0.003	0.590E-02	0.901E-04	0.699E-04	0.697E-04
0.004	0.677E-02	0.913E-04	0.608E-04	0.604E-04
0.005	0.752E-02	0.965E-04	0.547E-04	0.540E-04
0.006	0.820E-02	0.104E-03	0.503E-04	0.493E-04
0.007	0.882E-02	0.114E-03	0.471E-04	0.457E-04
0.008	0.939E-02	0.125E-03	0.447E-04	0.427E-04
0.009	0.992E-02	0.137E-03	0.430E-04	0.403E-04
0.010	0.104E-01	0.150E-03	0.416E-04	0.383E-04
0.020	0.143E-01	0.300E-03	0.431E-04	0.279E-04
0.030	0.170E-01	0.463E-03	0.587E-04	0.253E-04
0.040	0.191E-01	0.623E-03	0.816E-04	0.264E-04
0.050	0.209E-01	0.778E-03	0.108E-03	0.304E-04
0.060	0.225E-01	0.927E-03	0.136E-03	0.366E-04
0.070	0.238E-01	0.107E-02	0.165E-03	0.445E-04
0.080	0.250E-01	0.121E-02	0.192E-03	0.536E-04
0.090	0.261E-01	0.135E-02	0.219E-03	0.634E-04
0.100	0.271E-01	0.149E-02	0.244E-03	0.736E-04
0.200	0.334E-01	0.282E-02	0.482E-03	0.162E-03
0.300	0.365E-01	0.404E-02	0.728E-03	0.240E-03
0.400	0.381E-01	0.517E-02	0.971E-03	0.323E-03
0.500	0.386E-01	0.622E-02	0.122E-02	0.402E-03
0.600	0.385E-01	0.721E-02	0.146E-02	0.482E-03
0.700	0.379E-01	0.813E-02	0.171E-02	0.564E-03
0.800	0.370E-01	0.900E-02	0.196E-02	0.644E-03
0.900	0.358E-01	0.982E-02	0.221E-02	0.724E-03
1.000	0.344E-01	0.106E-01	0.247E-02	0.805E-03
1.100	0.328E-01	0.113E-01	0.272E-02	0.886E-03
1.200	0.311E-01	0.120E-01	0.298E-02	0.967E-03
1.300	0.293E-01	0.126E-01	0.324E-02	0.105E-02
1.400	0.273E-01	0.132E-01	0.350E-02	0.113E-02
1.500	0.253E-01	0.138E-01	0.376E-02	0.121E-02
1.600	0.233E-01	0.143E-01	0.403E-02	0.129E-02
1.700	0.212E-01	0.148E-01	0.430E-02	0.137E-02
1.800	0.190E-01	0.152E-01	0.457E-02	0.145E-02
1.900	0.168E-01	0.156E-01	0.484E-02	0.153E-02
2.000	0.145E-01	0.160E-01	0.511E-02	0.161E-02
3.000	-0.891E-02	0.184E-01	0.801E-02	0.242E-02
4.000	-0.328E-01	0.185E-01	0.112E-01	0.324E-02

TABLE 16. TM + P --> TM + P

E _r (EV)	T(J=0)	T(J=1)	T(J=2)	T(J=3)
5.000	-0.562E-01	0.169E-01	0.148E-01	0.405E-02
6.000	-0.790E-01	0.139E-01	0.188E-01	0.488E-02
7.000	-0.101E+00	0.990E-02	0.233E-01	0.570E-02
8.000	-0.123E+00	0.497E-02	0.283E-01	0.654E-02
9.000	-0.143E+00	-0.679E-03	0.340E-01	0.737E-02
10.000	-0.164E+00	-0.692E-02	0.404E-01	0.822E-02
12.000	-0.203E+00	-0.208E-01	0.557E-01	0.993E-02
14.000	-0.240E+00	-0.360E-01	0.750E-01	0.117E-01
16.000	-0.275E+00	-0.521E-01	0.995E-01	0.135E-01
18.000	-0.309E+00	-0.689E-01	0.131E+00	0.153E-01
20.000	-0.342E+00	-0.861E-01	0.171E+00	0.172E-01
22.000	-0.374E+00	-0.103E+00	0.223E+00	0.191E-01
24.000	-0.406E+00	-0.121E+00	0.292E+00	0.211E-01
26.000	-0.437E+00	-0.139E+00	0.385E+00	0.232E-01
28.000	-0.467E+00	-0.156E+00	0.516E+00	0.253E-01
30.000	-0.496E+00	-0.174E+00	0.707E+00	0.275E-01
32.000	-0.525E+00	-0.191E+00	0.101E+01	0.299E-01
34.000	-0.554E+00	-0.209E+00	0.155E+01	0.323E-01
36.000	-0.583E+00	-0.226E+00	0.275E+01	0.348E-01
38.000	-0.611E+00	-0.243E+00	0.755E+01	0.374E-01
40.000	-0.639E+00	-0.261E+00	-0.171E+02	0.401E-01
42.000	-0.667E+00	-0.277E+00	-0.461E+01	0.429E-01
44.000	-0.695E+00	-0.294E+00	-0.287E+01	0.459E-01
46.000	-0.722E+00	-0.311E+00	-0.218E+01	0.490E-01
48.000	-0.750E+00	-0.328E+00	-0.182E+01	0.522E-01
50.000	-0.778E+00	-0.344E+00	-0.160E+01	0.556E-01

TABLE 17.

TM + D --> TM + D

E _r (EV)	T(J=0)	T(J=1)	T(J=2)	T(J=3)
0.001	-0.729E-02	0.142E-03	0.153E-03	0.153E-03
0.002	-0.105E-01	0.772E-04	0.109E-03	0.108E-03
0.003	-0.129E-01	0.299E-04	0.894E-04	0.884E-04
0.004	-0.150E-01	-0.155E-04	0.785E-04	0.766E-04
0.005	-0.168E-01	-0.629E-04	0.718E-04	0.686E-04
0.006	-0.185E-01	-0.114E-03	0.676E-04	0.627E-04
0.007	-0.201E-01	-0.168E-03	0.652E-04	0.581E-04
0.008	-0.216E-01	-0.226E-03	0.640E-04	0.545E-04
0.009	-0.230E-01	-0.289E-03	0.639E-04	0.516E-04
0.010	-0.243E-01	-0.356E-03	0.646E-04	0.492E-04
0.020	-0.353E-01	-0.124E-02	0.102E-03	0.406E-04
0.030	-0.441E-01	-0.245E-02	0.166E-03	0.474E-04
0.040	-0.518E-01	-0.392E-02	0.239E-03	0.640E-04
0.050	-0.587E-01	-0.557E-02	0.311E-03	0.867E-04
0.060	-0.650E-01	-0.736E-02	0.378E-03	0.113E-03
0.070	-0.709E-01	-0.927E-02	0.442E-03	0.139E-03
0.080	-0.765E-01	-0.113E-01	0.503E-03	0.165E-03
0.090	-0.818E-01	-0.133E-01	0.563E-03	0.189E-03
0.100	-0.869E-01	-0.155E-01	0.623E-03	0.211E-03
0.200	-0.130E+00	-0.383E-01	0.125E-02	0.415E-03
0.300	-0.165E+00	-0.614E-01	0.188E-02	0.624E-03
0.400	-0.195E+00	-0.835E-01	0.251E-02	0.833E-03
0.500	-0.223E+00	-0.104E+00	0.314E-02	0.104E-02
0.600	-0.249E+00	-0.124E+00	0.378E-02	0.125E-02
0.700	-0.273E+00	-0.143E+00	0.441E-02	0.146E-02
0.800	-0.297E+00	-0.160E+00	0.505E-02	0.167E-02
0.900	-0.319E+00	-0.177E+00	0.569E-02	0.188E-02
1.000	-0.340E+00	-0.193E+00	0.633E-02	0.209E-02
1.100	-0.361E+00	-0.208E+00	0.698E-02	0.230E-02
1.200	-0.381E+00	-0.223E+00	0.762E-02	0.251E-02
1.300	-0.401E+00	-0.237E+00	0.827E-02	0.272E-02
1.400	-0.420E+00	-0.250E+00	0.892E-02	0.293E-02
1.500	-0.439E+00	-0.264E+00	0.957E-02	0.314E-02
1.600	-0.457E+00	-0.276E+00	0.102E-01	0.335E-02
1.700	-0.476E+00	-0.289E+00	0.109E-01	0.356E-02
1.800	-0.494E+00	-0.301E+00	0.115E-01	0.377E-02
1.900	-0.511E+00	-0.313E+00	0.122E-01	0.398E-02

TABLE 17.

TM + D --> TM + D

E _r (EV)	T(J=0)	T(J=1)	T(J=2)	T(J=3)
2.000	-0.529E+00	-0.324E+00	0.128E-01	0.420E-02
3.000	-0.698E+00	-0.428E+00	0.195E-01	0.635E-02
4.000	-0.865E+00	-0.518E+00	0.264E-01	0.857E-02
5.000	-0.104E+01	-0.602E+00	0.333E-01	0.109E-01
6.000	-0.122E+01	-0.682E+00	0.405E-01	0.134E-01
7.000	-0.143E+01	-0.759E+00	0.477E-01	0.161E-01
8.000	-0.166E+01	-0.836E+00	0.551E-01	0.191E-01
9.000	-0.193E+01	-0.913E+00	0.626E-01	0.224E-01
10.000	-0.224E+01	-0.990E+00	0.703E-01	0.264E-01
12.000	-0.312E+01	-0.115E+01	0.860E-01	0.368E-01
14.000	0.464E+01	-0.132E+01	0.102E+00	0.533E-01
16.000	-0.814E+01	-0.151E+01	0.119E+00	0.835E-01
18.000	-0.254E+02	-0.172E+01	0.136E+00	0.154E+00
20.000	0.265E+02	-0.195E+01	0.154E+00	0.457E+00
22.000	0.907E+01	-0.222E+01	0.173E+00	-0.868E+00
24.000	0.557E+01	-0.254E+01	0.192E+00	-0.274E+00
26.000	0.406E+01	-0.292E+01	0.212E+00	-0.184E+00
28.000	0.321E+01	-0.340E+01	0.233E+00	-0.150E+00
30.000	0.266E+01	-0.401E+01	0.255E+00	-0.133E+00
32.000	0.227E+01	-0.482E+01	0.277E+00	-0.125E+00
34.000	0.198E+01	-0.596E+01	0.301E+00	-0.122E+00
36.000	0.175E+01	-0.768E+01	0.325E+00	-0.121E+00
38.000	0.157E+01	-0.106E+02	0.351E+00	-0.121E+00
40.000	0.142E+01	-0.166E+02	0.379E+00	-0.123E+00
42.000	0.129E+01	-0.368E+02	0.408E+00	-0.126E+00
44.000	0.118E+01	0.230E+03	0.438E+00	-0.129E+00
46.000	0.109E+01	0.290E+02	0.472E+00	-0.133E+00

TABLE 1B. $TM(F=0) + T \rightarrow TM(F=0) + T, S = 1/2$

E_r (EV)	T (J=0)	T (J=1)	T (J=2)	E_r (EV)	T (J=0)	T (J=1)	T (J=2)
0.001	-0.257E-03	0.640E-04	0.832E-05	0.080	-0.213E-01	0.460E-02	0.787E-03
0.002	-0.555E-03	0.134E-03	0.170E-04	0.090	-0.236E-01	0.511E-02	0.887E-03
0.003	-0.857E-03	0.200E-03	0.284E-04	0.100	-0.259E-01	0.562E-02	0.986E-03
0.004	-0.116E-02	0.265E-03	0.394E-04	0.110	-0.281E-01	0.611E-02	0.109E-02
0.005	-0.146E-02	0.329E-03	0.495E-04	0.120	-0.302E-01	0.660E-02	0.118E-02
0.006	-0.176E-02	0.393E-03	0.591E-04	0.130	-0.323E-01	0.707E-02	0.128E-02
0.007	-0.205E-02	0.457E-03	0.685E-04	0.140	-0.343E-01	0.754E-02	0.138E-02
0.008	-0.235E-02	0.521E-03	0.780E-04	0.150	-0.362E-01	0.800E-02	0.149E-02
0.009	-0.265E-02	0.585E-03	0.878E-04	0.160	-0.381E-01	0.845E-02	0.159E-02
0.010	-0.294E-02	0.648E-03	0.977E-04	0.170	-0.398E-01	0.889E-02	0.169E-02
0.020	-0.583E-02	0.126E-02	0.196E-03	0.180	-0.415E-01	0.933E-02	0.179E-02
0.030	-0.861E-02	0.136E-02	0.294E-03	0.190	-0.431E-01	0.975E-02	0.189E-02
0.040	-0.113E-01	0.243E-02	0.393E-03	0.200	-0.445E-01	0.102E-01	0.199E-02
0.050	-0.139E-01	0.299E-02	0.491E-03	0.210	-0.457E-01	0.106E-01	0.209E-02
0.060	-0.164E-01	0.354E-02	0.590E-03	0.220	-0.466E-01	0.110E-01	0.219E-02
0.070	-0.189E-01	0.408E-02	0.688E-03	0.230	-0.469E-01	0.114E-01	0.230E-02

TABLE 19a. $TM(F=0) + T, TM(F=1) + T, S = 1/2$

E_r (EV)	J = 0			J = 1		
	T11	T12	T22	T11	T12	T22
0.001	-0.448E-01	0.389E-01	0.127E-01	0.117E-01	-0.161E-04	0.637E-04
0.002	-0.451E-01	0.463E-01	0.177E-01	0.118E-01	-0.272E-04	0.133E-03
0.003	-0.453E-01	0.512E-01	0.214E-01	0.118E-01	-0.369E-04	0.199E-03
0.004	-0.455E-01	0.551E-01	0.245E-01	0.118E-01	-0.459E-04	0.262E-03
0.005	-0.457E-01	0.582E-01	0.272E-01	0.119E-01	-0.545E-04	0.325E-03
0.006	-0.460E-01	0.609E-01	0.296E-01	0.119E-01	-0.627E-04	0.389E-03
0.007	-0.462E-01	0.633E-01	0.318E-01	0.120E-01	-0.706E-04	0.452E-03
0.008	-0.464E-01	0.655E-01	0.338E-01	0.120E-01	-0.782E-04	0.514E-03
0.009	-0.466E-01	0.675E-01	0.356E-01	0.120E-01	-0.857E-04	0.576E-03
0.010	-0.469E-01	0.693E-01	0.373E-01	0.121E-01	-0.930E-04	0.638E-03
0.020	-0.491E-01	0.825E-01	0.503E-01	0.125E-01	-0.161E-03	0.124E-02
0.030	-0.514E-01	0.914E-01	0.593E-01	0.128E-01	-0.224E-03	0.181E-02
0.040	-0.536E-01	0.984E-01	0.661E-01	0.132E-01	-0.286E-03	0.236E-02
0.050	-0.559E-01	0.104E+00	0.717E-01	0.136E-01	-0.347E-03	0.289E-02
0.060	-0.581E-01	0.109E+00	0.763E-01	0.139E-01	-0.407E-03	0.340E-02
0.070	-0.603E-01	0.114E+00	0.801E-01	0.143E-01	-0.468E-03	0.390E-02
0.080	-0.625E-01	0.118E+00	0.835E-01	0.146E-01	-0.529E-03	0.438E-02
0.090	-0.647E-01	0.122E+00	0.863E-01	0.150E-01	-0.591E-03	0.486E-02
0.100	-0.669E-01	0.125E+00	0.888E-01	0.153E-01	-0.654E-03	0.531E-02
0.200	-0.885E-01	0.151E+00	0.101E+00	0.184E-01	-0.132E-02	0.933E-02
0.300	-0.109E+00	0.168E+00	0.103E+00	0.211E-01	-0.205E-02	0.125E-01
0.400	-0.130E+00	0.181E+00	0.993E-01	0.233E-01	-0.285E-02	0.150E-01
0.500	-0.150E+00	0.193E+00	0.929E-01	0.252E-01	-0.369E-02	0.170E-01

TABLE 19a. $TM(F=0) + T$, $TM(F=1) + T$, $S = 1/2$

E_{ν} (EV)	$J = 0$			$J = 1$		
	T11	T12	T22	T11	T12	T22
0.600	-0.169E+00	0.202E+00	0.849E-01	0.268E-01	-0.458E-02	0.184E-01
0.700	-0.188E+00	0.211E+00	0.758E-01	0.280E-01	-0.550E-02	0.194E-01
0.800	-0.206E+00	0.219E+00	0.660E-01	0.290E-01	-0.645E-02	0.201E-01
0.900	-0.225E+00	0.225E+00	0.557E-01	0.298E-01	-0.742E-02	0.204E-01
1.000	-0.242E+00	0.231E+00	0.450E-01	0.303E-01	-0.841E-02	0.204E-01
1.100	-0.260E+00	0.237E+00	0.342E-01	0.305E-01	-0.941E-02	0.201E-01
1.200	-0.277E+00	0.243E+00	0.232E-01	0.306E-01	-0.104E-01	0.195E-01
1.300	-0.295E+00	0.249E+00	0.121E-01	0.305E-01	-0.114E-01	0.187E-01
1.400	-0.311E+00	0.254E+00	0.937E-03	0.302E-01	-0.125E-01	0.177E-01
1.500	-0.328E+00	0.259E+00	-0.102E-01	0.297E-01	-0.135E-01	0.165E-01
1.600	-0.345E+00	0.264E+00	-0.214E-01	0.291E-01	-0.145E-01	0.151E-01
1.700	-0.361E+00	0.268E+00	-0.326E-01	0.283E-01	-0.155E-01	0.135E-01
1.800	-0.378E+00	0.273E+00	-0.437E-01	0.274E-01	-0.166E-01	0.118E-01
1.900	-0.394E+00	0.278E+00	-0.548E-01	0.264E-01	-0.176E-01	0.990E-02
2.000	-0.410E+00	0.282E+00	-0.659E-01	0.252E-01	-0.186E-01	0.788E-02
2.200	-0.442E+00	0.291E+00	-0.880E-01	0.226E-01	-0.206E-01	0.345E-02
2.400	-0.474E+00	0.300E+00	-0.110E+00	0.195E-01	-0.226E-01	-0.143E-02
2.600	-0.506E+00	0.309E+00	-0.132E+00	0.160E-01	-0.246E-01	-0.671E-02
2.800	-0.538E+00	0.318E+00	-0.153E+00	0.123E-01	-0.265E-01	-0.123E-01
3.000	-0.570E+00	0.327E+00	-0.175E+00	0.819E-02	-0.284E-01	-0.183E-01
3.200	-0.602E+00	0.336E+00	-0.196E+00	0.384E-02	-0.303E-01	-0.245E-01

TABLE 19a. $TM(F=0) + T$, $TM(F=1) + T$, $S = 1/2$

E_{ν} (EV)	$J = 0$			$J = 1$		
	T11	T12	T22	T11	T12	T22
3.400	-0.634E+00	0.346E+00	-0.217E+00	-0.741E-03	-0.322E-01	-0.309E-01
3.600	-0.666E+00	0.355E+00	-0.239E+00	-0.554E-02	-0.340E-01	-0.375E-01
3.800	-0.699E+00	0.365E+00	-0.260E+00	-0.105E-01	-0.350E-01	-0.443E-01
4.000	-0.732E+00	0.376E+00	-0.281E+00	-0.157E-01	-0.375E-01	-0.513E-01
4.200	-0.765E+00	0.386E+00	-0.302E+00	-0.211E-01	-0.392E-01	-0.585E-01
4.400	-0.799E+00	0.397E+00	-0.323E+00	-0.266E-01	-0.409E-01	-0.657E-01
4.600	-0.833E+00	0.408E+00	-0.345E+00	-0.322E-01	-0.425E-01	-0.731E-01
4.800	-0.868E+00	0.420E+00	-0.366E+00	-0.379E-01	-0.442E-01	-0.806E-01
5.000	-0.903E+00	0.432E+00	-0.387E+00	-0.438E-01	-0.458E-01	-0.882E-01
6.000	-0.109E+01	0.499E+00	-0.497E+00	-0.744E-01	-0.534E-01	-0.127E+00
7.000	-0.131E+01	0.583E+00	-0.614E+00	-0.107E+00	-0.606E-01	-0.167E+00
8.000	-0.156E+01	0.689E+00	-0.743E+00	-0.140E+00	-0.674E-01	-0.208E+00
9.000	-0.187E+01	0.827E+00	-0.889E+00	-0.174E+00	-0.741E-01	-0.250E+00
10.000	-0.226E+01	0.101E+01	-0.106E+01	-0.209E+00	-0.806E-01	-0.292E+00
12.000	-0.355E+01	0.167E+01	-0.158E+01	-0.279E+00	-0.937E-01	-0.377E+00
14.000	-0.703E+01	0.359E+01	-0.282E+01	-0.351E+00	-0.107E+00	-0.465E+00
16.000	-0.768E+02	0.437E+02	-0.259E+02	-0.424E+00	-0.122E+00	-0.555E+00
18.000	0.082E+01	-0.567E+01	0.216E+01	-0.499E+00	-0.138E+00	-0.648E+00
20.000	0.410E+01	-0.308E+01	0.409E+01	-0.575E+00	-0.157E+00	-0.746E+00
22.000	0.258E+01	-0.234E+01	-0.156E+01	-0.653E+00	-0.178E+00	-0.851E+00
24.000	0.179E+01	-0.203E+01	-0.589E+00	-0.742E+00	-0.202E+00	-0.963E+00
26.000	0.128E+01	-0.192E+01	-0.969E+00	-0.832E+00	-0.230E+00	-0.108E+01

TABLE 19a. $TM(F=0) + T$, $TM(F=1) + T$, $S = 1/2$

E_r (EV)	$J = 0$			$J = 1$		
	T11	T12	T22	T11	T12	T22
28.000	0.081E+00	-0.192E+01	-0.136E+01	-0.928E+00	-0.264E+00	-0.122E+01
30.000	0.536E+00	-0.202E+01	-0.183E+01	-0.103E+01	-0.305E+00	-0.137E+01
32.000	0.192E+00	-0.224E+01	-0.242E+01	-0.114E+01	-0.354E+00	-0.153E+01
34.000	-0.207E+00	-0.263E+01	-0.328E+01	-0.127E+01	-0.415E+00	-0.173E+01
36.000	-0.762E+00	-0.334E+01	-0.466E+01	-0.141E+01	-0.491E+00	-0.195E+01
38.000	-0.176E+01	-0.486E+01	-0.742E+01	-0.156E+01	-0.589E+00	-0.222E+01
40.000	-0.467E+01	-0.975E+01	-0.160E+02	0.143E+01	-0.250E+01	-0.154E+01
42.000	0.734E+02	0.123E+03	0.231E+03	-0.197E+01	-0.888E+00	-0.295E+01
44.000	0.538E+01	0.804E+01	0.147E+02	-0.224E+01	-0.113E+01	-0.349E+01
46.000	0.304E+01	0.409E+01	0.779E+01	-0.258E+01	-0.148E+01	-0.424E+01
48.000	0.219E+01	0.272E+01	0.535E+01	-0.307E+01	-0.203E+01	-0.534E+01
50.000	0.173E+01	0.204E+01	0.410E+01	-0.381E+01	-0.300E+01	-0.717E+01

TABLE 19b. $TM(F=0) + T$, $TM(F=1) + T$, $S = 1/2$, $J = 2$

E_r (EV)	T11	T12	T22
1.000	0.158E-01	0.603E-02	0.174E-01
1.100	0.178E-01	0.782E-02	0.209E-01
1.200	0.200E-01	0.100E-01	0.249E-01
1.300	0.225E-01	0.126E-01	0.297E-01
1.400	0.253E-01	0.158E-01	0.353E-01
1.500	0.286E-01	0.197E-01	0.419E-01
1.600	0.323E-01	0.244E-01	0.498E-01
1.700	0.366E-01	0.301E-01	0.593E-01
1.800	0.417E-01	0.371E-01	0.709E-01
1.900	0.479E-01	0.458E-01	0.850E-01
2.000	0.555E-01	0.567E-01	0.103E+00
2.200	0.771E-01	0.889E-01	0.154E+00
2.400	0.116E+00	0.148E+00	0.249E+00
2.600	0.202E+00	0.284E+00	0.464E+00
2.800	0.566E+00	0.858E+00	0.137E+01
3.000	-0.106E+01	-0.171E+01	-0.270E+01
3.200	-0.308E+00	-0.528E+00	-0.821E+00
3.400	-0.193E+00	-0.346E+00	-0.533E+00
3.600	-0.147E+00	-0.275E+00	-0.420E+00
3.800	-0.123E+00	-0.237E+00	-0.360E+00
4.000	-0.100E+00	-0.215E+00	-0.325E+00
4.200	-0.990E-01	-0.200E+00	-0.303E+00
4.400	-0.927E-01	-0.190E+00	-0.287E+00
4.600	-0.885E-01	-0.183E+00	-0.277E+00
4.800	-0.856E-01	-0.179E+00	-0.270E+00
5.000	-0.838E-01	-0.175E+00	-0.266E+00
6.000	-0.832E-01	-0.170E+00	-0.263E+00
7.000	-0.900E-01	-0.173E+00	-0.275E+00
8.000	-0.101E+00	-0.179E+00	-0.294E+00
9.000	-0.114E+00	-0.186E+00	-0.316E+00
10.000	-0.129E+00	-0.194E+00	-0.340E+00
12.000	-0.163E+00	-0.209E+00	-0.393E+00
14.000	-0.200E+00	-0.225E+00	-0.448E+00
16.000	-0.241E+00	-0.240E+00	-0.507E+00
18.000	-0.283E+00	-0.255E+00	-0.567E+00
20.000	-0.328E+00	-0.271E+00	-0.630E+00
22.000	-0.373E+00	-0.288E+00	-0.694E+00
24.000	-0.421E+00	-0.305E+00	-0.762E+00
26.000	-0.470E+00	-0.323E+00	-0.831E+00
28.000	-0.520E+00	-0.343E+00	-0.904E+00
30.000	-0.572E+00	-0.364E+00	-0.980E+00
32.000	-0.626E+00	-0.388E+00	-0.106E+01
34.000	-0.681E+00	-0.413E+00	-0.115E+01
36.000	-0.740E+00	-0.441E+00	-0.124E+01
38.000	-0.800E+00	-0.473E+00	-0.133E+01
40.000	-0.864E+00	-0.508E+00	-0.144E+01
42.000	-0.931E+00	-0.547E+00	-0.155E+01
44.000	-0.100E+01	-0.591E+00	-0.167E+01
46.000	-0.108E+01	-0.641E+00	-0.180E+01
48.000	-0.116E+01	-0.698E+00	-0.195E+01
50.000	-0.125E+01	-0.763E+00	-0.211E+01

TABLE 19c. $TM(F=0) + T$, $TM(F=1) + T$, $S = 1/2$

E_p (EV)	$J = 3$			$J = 4$		
	T11	T12	T22	T11	T12	T22
10.000	0.421E-01	-0.103E-01	0.293E-01	0.152E-01	0.768E-03	0.157E-01
12.000	0.545E-01	-0.175E-01	0.334E-01	0.180E-01	0.157E-02	0.194E-01
14.000	0.689E-01	-0.270E-01	0.367E-01	0.207E-01	0.284E-02	0.236E-01
16.000	0.855E-01	-0.391E-01	0.394E-01	0.234E-01	0.471E-02	0.283E-01
18.000	0.105E+00	-0.536E-01	0.417E-01	0.259E-01	0.734E-02	0.339E-01
20.000	0.126E+00	-0.705E-01	0.435E-01	0.284E-01	0.109E-01	0.405E-01
22.000	0.150E+00	-0.898E-01	0.451E-01	0.310E-01	0.156E-01	0.484E-01
24.000	0.176E+00	-0.111E+00	0.466E-01	0.338E-01	0.216E-01	0.580E-01
26.000	0.205E+00	-0.135E+00	0.479E-01	0.368E-01	0.293E-01	0.699E-01
28.000	0.236E+00	-0.160E+00	0.491E-01	0.404E-01	0.391E-01	0.846E-01
30.000	0.268E+00	-0.187E+00	0.503E-01	0.450E-01	0.515E-01	0.103E+00
32.000	0.302E+00	-0.216E+00	0.513E-01	0.510E-01	0.676E-01	0.128E+00
34.000	0.337E+00	-0.245E+00	0.522E-01	0.592E-01	0.886E-01	0.160E+00
36.000	0.372E+00	-0.275E+00	0.529E-01	0.711E-01	0.117E+00	0.204E+00
38.000	0.408E+00	-0.306E+00	0.532E-01	0.892E-01	0.157E+00	0.267E+00
40.000	0.443E+00	-0.336E+00	0.531E-01	0.118E+00	0.217E+00	0.365E+00
42.000	0.478E+00	-0.367E+00	0.524E-01	0.171E+00	0.317E+00	0.532E+00
44.000	0.512E+00	-0.397E+00	0.511E-01	0.284E+00	0.523E+00	0.879E+00
46.000	0.544E+00	-0.426E+00	0.491E-01	0.666E+00	0.119E+01	0.202E+01
48.000	0.574E+00	-0.455E+00	0.462E-01	-0.544E+01	-0.929E+01	-0.160E+02
50.000	0.602E+00	-0.482E+00	0.424E-01	-0.648E+00	-0.104E+01	-0.183E+01

TABLE 20.

 $TM(F=1) + T \rightarrow TM(F=1) + T$, $S = 3/2$

E_p (EV)	T(J=0)	T(J=1)	T(J=2)	T(J=3)
0.001	-0.518E-02	0.664E-04	0.798E-05	0.318E-05
0.002	-0.750E-02	0.135E-03	0.188E-04	0.503E-05
0.003	-0.936E-02	0.200E-03	0.297E-04	0.885E-05
0.004	-0.110E-01	0.265E-03	0.394E-04	0.129E-04
0.005	-0.124E-01	0.331E-03	0.488E-04	0.165E-04
0.006	-0.138E-01	0.396E-03	0.585E-04	0.197E-04
0.007	-0.150E-01	0.461E-03	0.684E-04	0.228E-04
0.008	-0.162E-01	0.525E-03	0.784E-04	0.259E-04
0.009	-0.173E-01	0.588E-03	0.883E-04	0.292E-04
0.010	-0.184E-01	0.652E-03	0.981E-04	0.326E-04
0.020	-0.276E-01	0.128E-02	0.196E-03	0.653E-04
0.030	-0.352E-01	0.188E-02	0.294E-03	0.980E-04
0.040	-0.420E-01	0.247E-02	0.392E-03	0.131E-03
0.050	-0.481E-01	0.305E-02	0.490E-03	0.163E-03
0.060	-0.539E-01	0.361E-02	0.588E-03	0.196E-03
0.070	-0.594E-01	0.417E-02	0.686E-03	0.229E-03
0.080	-0.646E-01	0.471E-02	0.784E-03	0.261E-03
0.090	-0.695E-01	0.525E-02	0.882E-03	0.294E-03
0.100	-0.743E-01	0.577E-02	0.980E-03	0.327E-03
0.200	-0.116E+00	0.106E-01	0.196E-02	0.654E-03
0.300	-0.151E+00	0.148E-01	0.292E-02	0.981E-03
0.400	-0.182E+00	0.185E-01	0.388E-02	0.131E-02
0.500	-0.210E+00	0.218E-01	0.483E-02	0.164E-02
0.600	-0.237E+00	0.247E-01	0.576E-02	0.197E-02
0.700	-0.263E+00	0.272E-01	0.668E-02	0.230E-02
0.800	-0.287E+00	0.294E-01	0.758E-02	0.262E-02
0.900	-0.310E+00	0.313E-01	0.846E-02	0.296E-02
1.000	-0.333E+00	0.330E-01	0.932E-02	0.329E-02
1.100	-0.355E+00	0.343E-01	0.102E-01	0.362E-02
1.200	-0.376E+00	0.355E-01	0.110E-01	0.395E-02
1.300	-0.397E+00	0.364E-01	0.118E-01	0.429E-02
1.400	-0.418E+00	0.372E-01	0.126E-01	0.462E-02
1.500	-0.439E+00	0.377E-01	0.133E-01	0.496E-02
1.600	-0.458E+00	0.381E-01	0.140E-01	0.529E-02
1.700	-0.478E+00	0.383E-01	0.147E-01	0.563E-02
1.800	-0.497E+00	0.383E-01	0.154E-01	0.597E-02
1.900	-0.516E+00	0.382E-01	0.161E-01	0.631E-02
2.000	-0.535E+00	0.379E-01	0.167E-01	0.666E-02
2.200	-0.573E+00	0.370E-01	0.179E-01	0.735E-02

TABLE 20.

TM(F=1) + T \rightarrow TM(F=1) + T, S = 3/2

E, (eV)	T(J=0)	T(J=1)	T(J=2)	T(J=3)
2.400	-0.610E+00	0.356E-01	0.190E-01	0.804E-02
2.600	-0.648E+00	0.337E-01	0.179E-01	0.875E-02
2.800	-0.685E+00	0.315E-01	0.208E-01	0.946E-02
3.000	-0.722E+00	0.289E-01	0.215E-01	0.102E-01
3.200	-0.759E+00	0.259E-01	0.222E-01	0.109E-01
3.400	-0.796E+00	0.227E-01	0.227E-01	0.117E-01
3.600	-0.833E+00	0.192E-01	0.231E-01	0.124E-01
3.800	-0.871E+00	0.155E-01	0.234E-01	0.132E-01
4.000	-0.910E+00	0.116E-01	0.236E-01	0.140E-01
4.200	-0.948E+00	0.742E-02	0.237E-01	0.148E-01
4.400	-0.988E+00	0.309E-02	0.237E-01	0.156E-01
4.600	-0.103E+01	-0.140E-02	0.236E-01	0.164E-01
4.800	-0.107E+01	-0.605E-02	0.234E-01	0.172E-01
5.000	-0.111E+01	-0.108E-01	0.231E-01	0.181E-01
6.000	-0.133E+01	-0.365E-01	0.201E-01	0.226E-01
7.000	-0.159E+01	-0.643E-01	0.148E-01	0.277E-01
8.000	-0.189E+01	-0.934E-01	0.760E-02	0.333E-01
9.000	-0.226E+01	-0.123E+00	-0.138E-02	0.395E-01
10.000	-0.274E+01	-0.154E+00	-0.119E-01	0.465E-01
12.000	-0.429E+01	-0.217E+00	-0.366E-01	0.627E-01
14.000	-0.837E+01	-0.281E+00	-0.651E-01	0.823E-01
16.000	-0.545E+02	-0.345E+00	-0.965E-01	0.106E+00
18.000	0.134E+02	-0.411E+00	-0.130E+00	0.133E+00
20.000	0.614E+01	-0.478E+00	-0.165E+00	0.164E+00
22.000	0.404E+01	-0.546E+00	-0.201E+00	0.193E+00
24.000	0.302E+01	-0.616E+00	-0.239E+00	0.237E+00
26.000	0.242E+01	-0.689E+00	-0.277E+00	0.279E+00
28.000	0.201E+01	-0.764E+00	-0.315E+00	0.324E+00
30.000	0.172E+01	-0.843E+00	-0.355E+00	0.371E+00
32.000	0.150E+01	-0.926E+00	-0.395E+00	0.421E+00
34.000	0.132E+01	-0.101E+01	-0.436E+00	0.473E+00
36.000	0.117E+01	-0.111E+01	-0.478E+00	0.526E+00
38.000	0.105E+01	-0.121E+01	-0.520E+00	0.579E+00
40.000	0.942E+00	-0.132E+01	-0.563E+00	0.632E+00
42.000	0.849E+00	-0.143E+01	-0.608E+00	0.685E+00
44.000	0.766E+00	-0.156E+01	-0.653E+00	0.736E+00
46.000	0.693E+00	-0.170E+01	-0.700E+00	0.785E+00
48.000	0.626E+00	-0.186E+01	-0.748E+00	0.832E+00
50.000	0.564E+00	-0.203E+01	-0.798E+00	0.876E+00

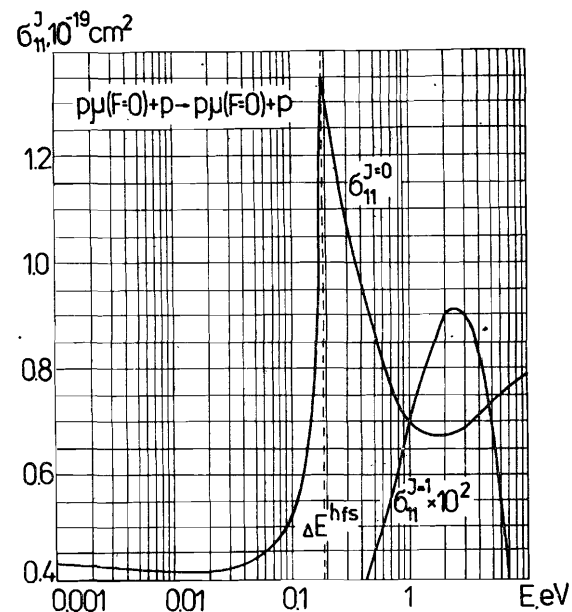


Fig. 2.

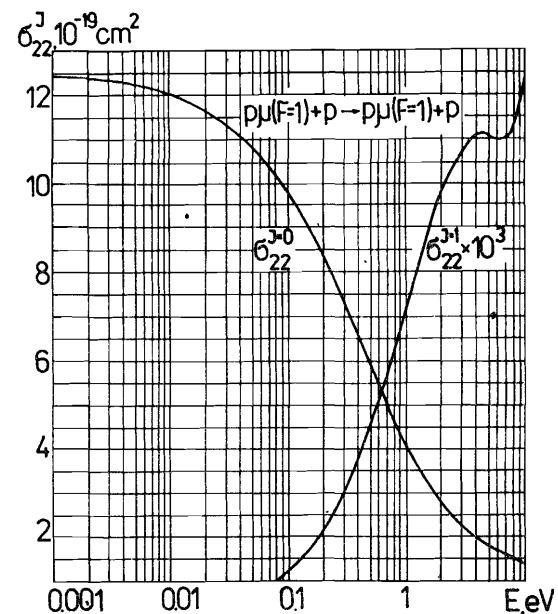


Fig. 3.

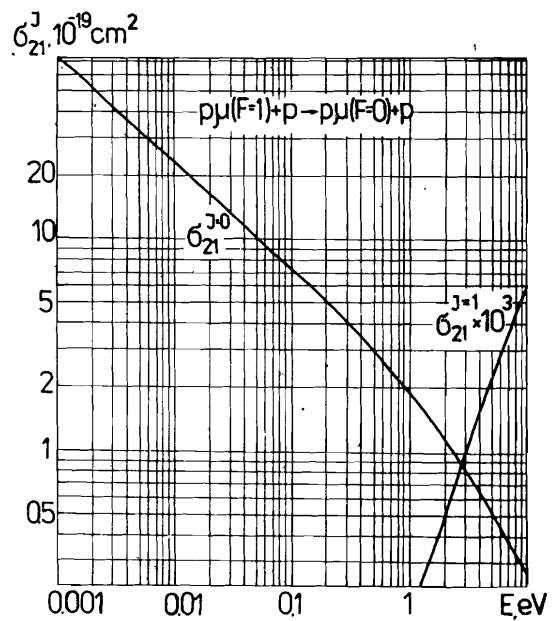


Fig.4.

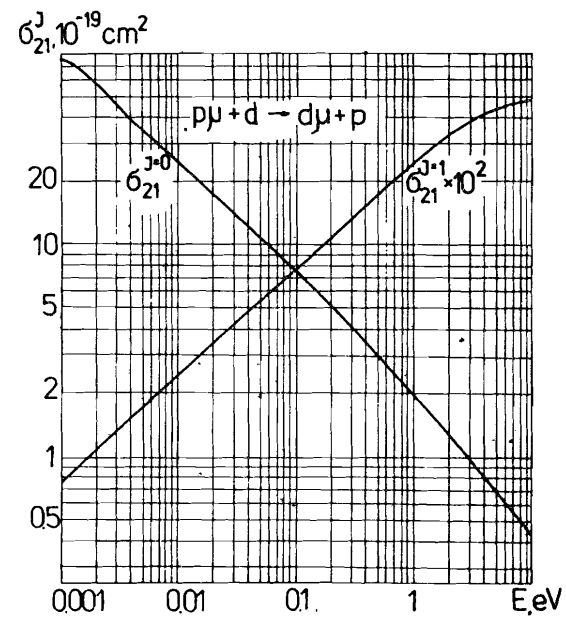


Fig.6.

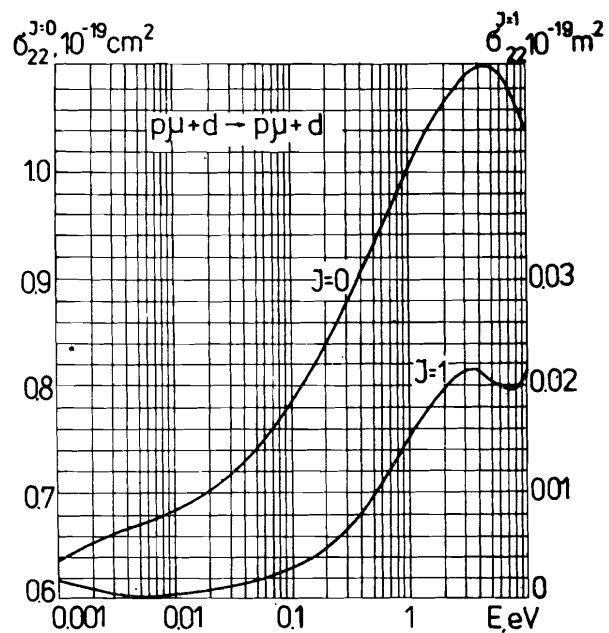


Fig.5.

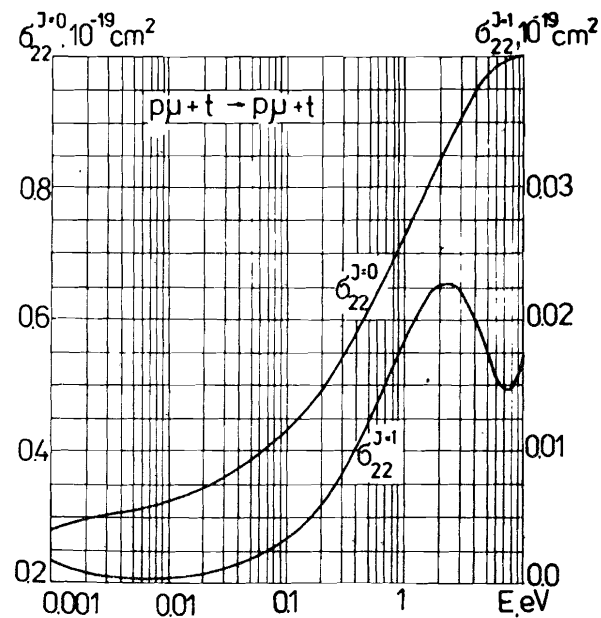


Fig.7.

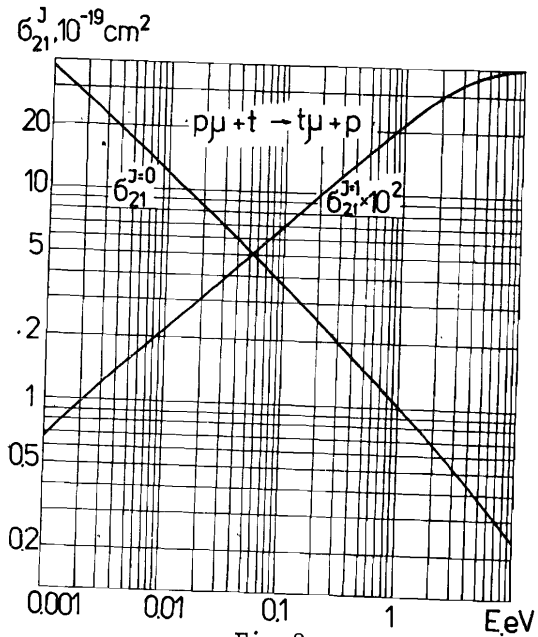


Fig. 8.

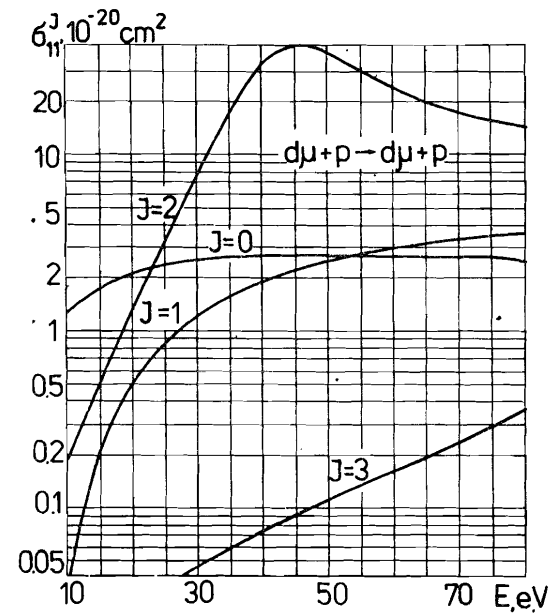


Fig. 10.

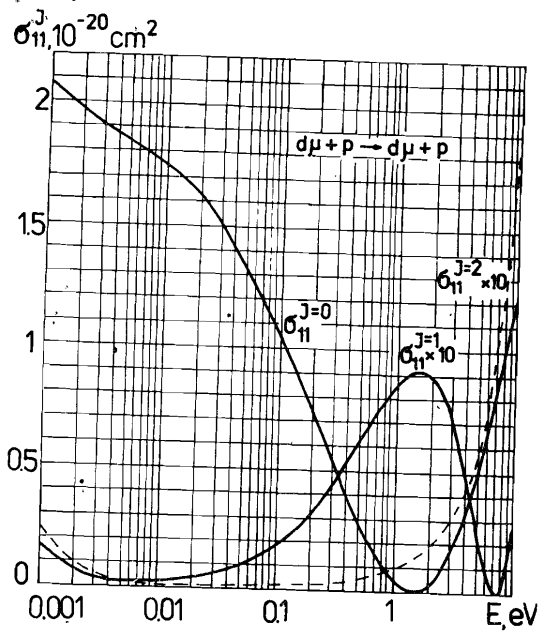


Fig. 9.

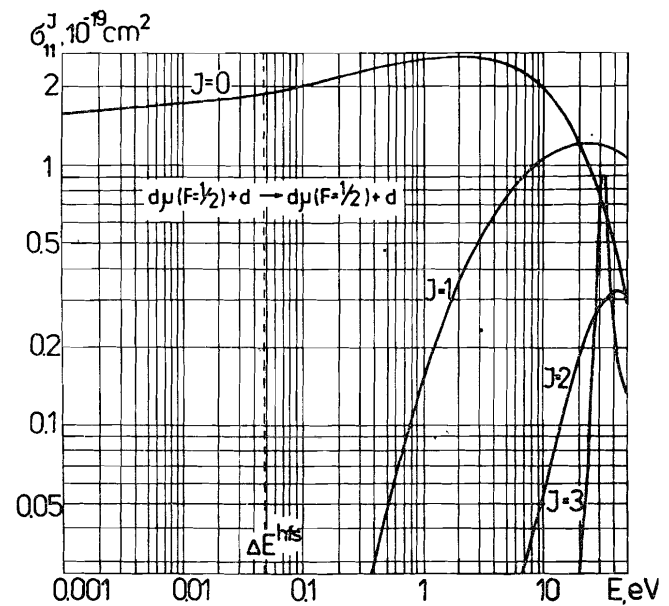


Fig. 11.

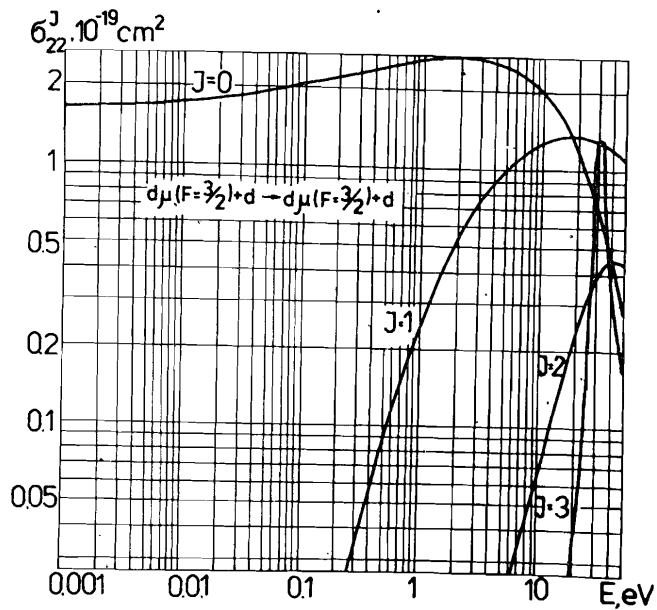


Fig. 12.

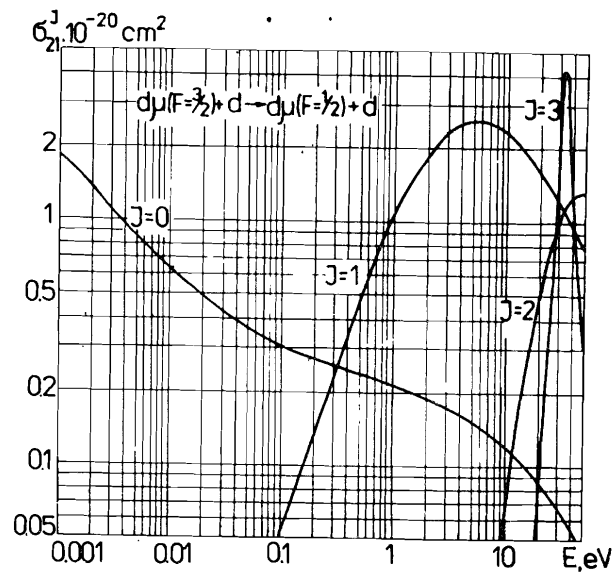


Fig. 13.

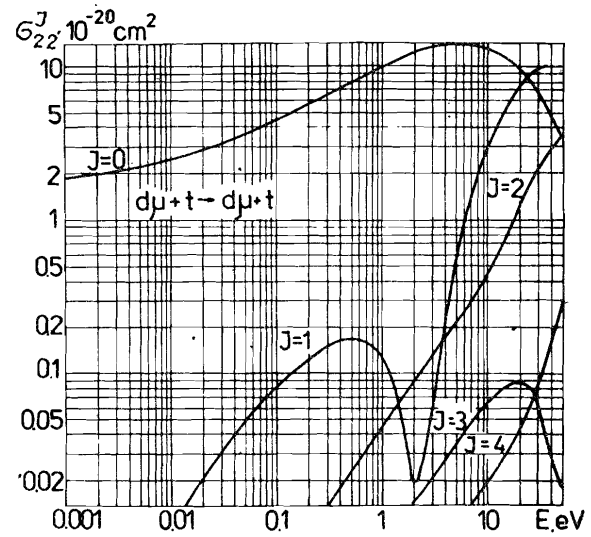


Fig. 14.

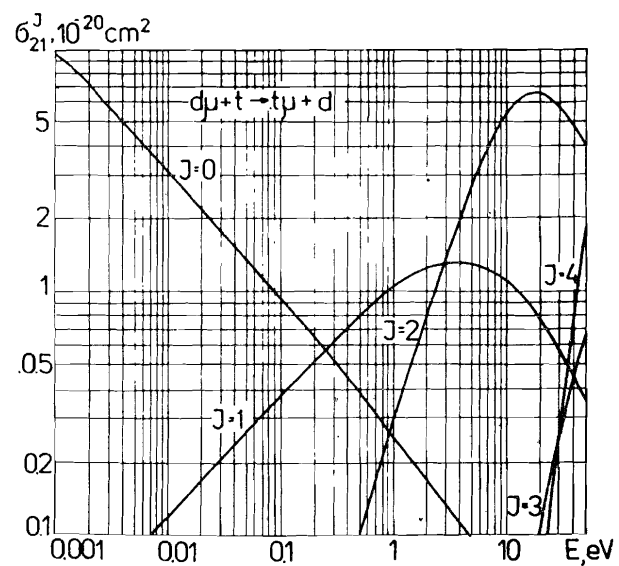


Fig. 15.

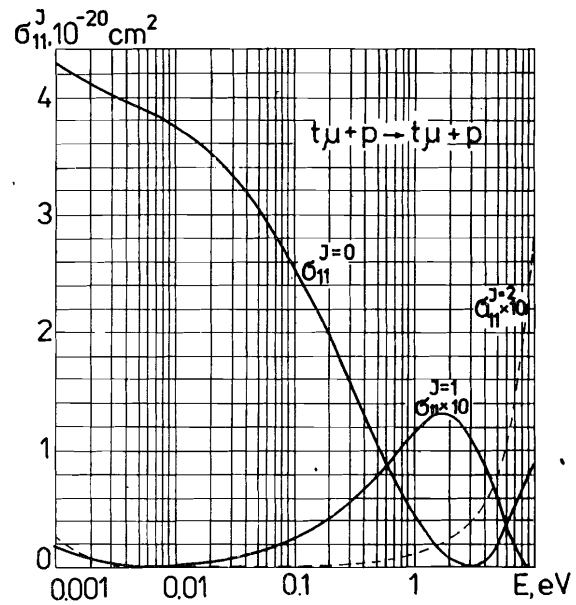


Fig. 16.

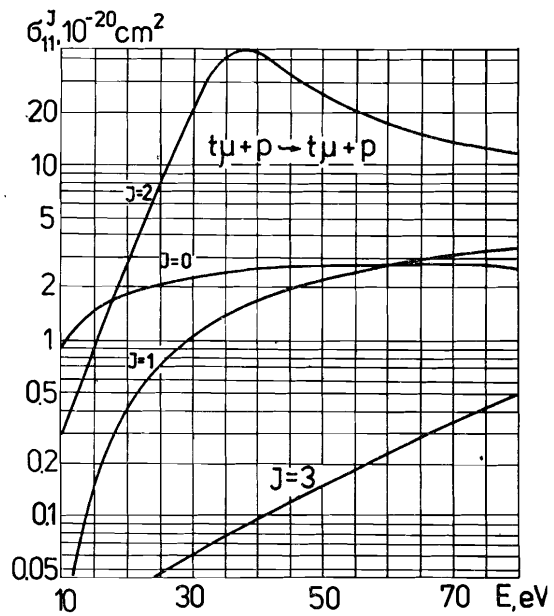


Fig. 17.

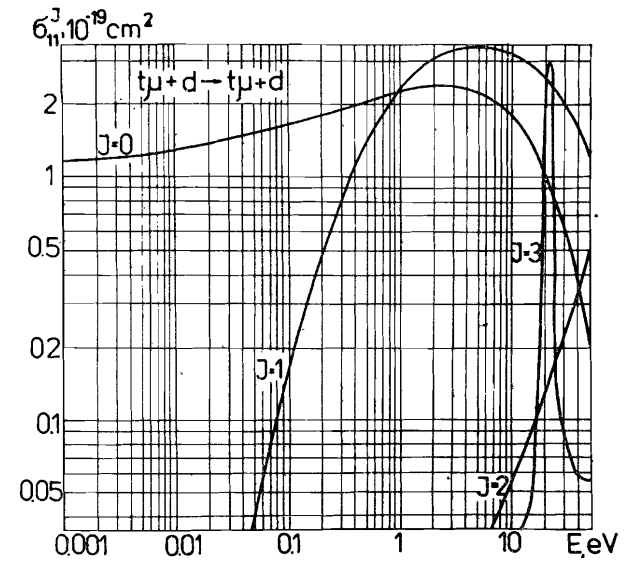


Fig. 18.

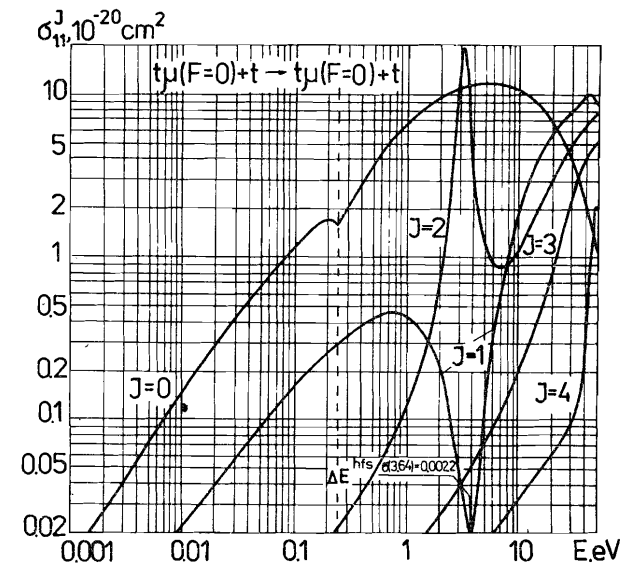


Fig. 19.

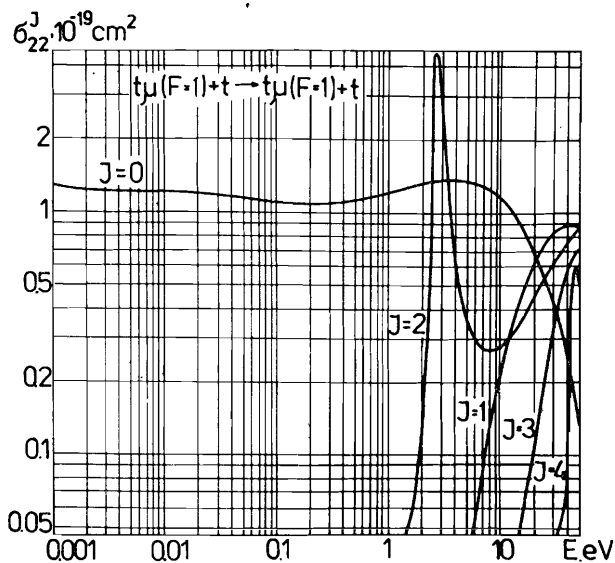


Fig. 20.

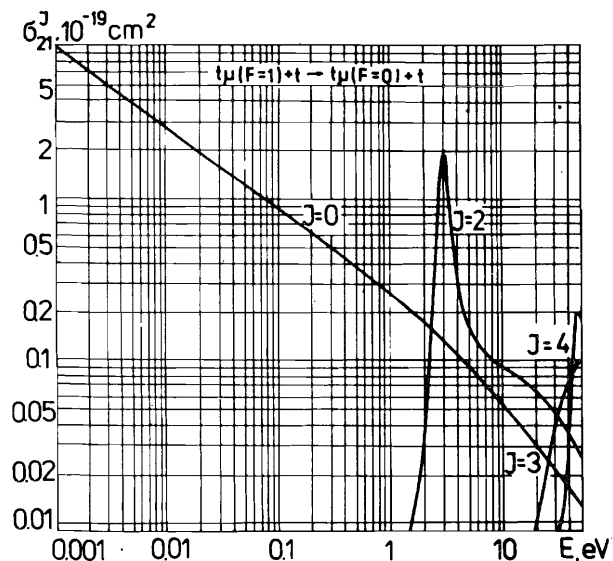


Fig. 21.

REFERENCES

1. Gerstein S.S. et al. - Zh.Eksp.Teor.Fiz., 1980,78,p.2099; Sov.Phys., JETP, 1980, 51, p.1053.
2. Bubak M., Bystritsky V.M., Gula A.- Acta Phys.Pol., 1985, B16, p.575; Gula A. - Acta Phys.Pol., 1985, B16, p.589; Gula A., Bubak M., Niwicki J.- Atomkernenergie/Kerntech-nik, 1985, 46, p.205.
3. Cohen J.A.- Phys.Rev., 1986, 34A, p.2719; Men'shikov L.I., Somov L.N., Faifman M.P. JINR P4-87-82, Dubna, 1987.
4. Vinitzky S.I., Ponomarev L.I.- Fiz.Elem.Chastits A.Yadra, 1982, 13, p.1336; Sov.J.Part.Nucl., 1982, 13, p.557.
5. Melezhik V.S.- J.Comp.Phys., 1986, 65, p.1.
6. Melezhik V.S., Ponomarev L.I., Faifman M.P. - Zh.Eksp. Teor.Fiz., 1983, 85, p.434; Sov.Phys.JETP, 1983,58,p.254.
7. Melezhik V.S., Wozniak J.- Phys.Lett., 1986, 116A,p.370.
8. Adamczak A., Melezhik V.S.- Phys.Lett., 1986, 118A,p.181.
9. Ponomarev L.I., Somov L.N., Faifman M.P.- Yad.Fiz., 1979, 29,p.133; Sov.J.Nucl.Phys., 1980, 29, p.67.
10. Galogero A.V., Ponomarev L.I.- TMF, 1972, 12, p.64.
11. Galogero F. Variable Phase Approach to Potential Scatter-ing, Acad.Press N.Y., London, 1967; Babikov V.V. Variable Phase Method in Quantum Mechanics, Nauka, Moscow, 1967.
12. Matveenko A.V., Ponomarev L.I. - Zh.Eksp.Teor.Fiz., 1970, 59, p.1593; Sov.Phys. JETP, 1971,32,p.871.
13. Matveenko A.V.- Zh.Eksp.Teor.Fiz., 1973,65,p.2167.
14. Matveenko A.V., Ponomarev L.I., Faifman M.P. - Zh.Eksp. Teor.Fiz., 1975, 68,p.437; Sov.Phys.JETP, 1975,41,p.212.
15. Faifman M.P.- Yad.Fiz., 1977, 26, p.433; Sov.J.Nucl.Phys., 1977, 26, p.227.
16. Ponomarev L.I., Puzynina T.P. Report JINR P4-5040, Dubna, 1970; Ponomarev L.I., Puzynina T.P., Truskova N.P. - Phys.B, 1978, 11, p.3861.
17. Adamczak A., Melezhik V.S., Men'shikov L.I. - Z.Phys., 1986, D4, p.153.
18. Men'shikov L.I. Preprint IAE 3811/12, Moscow, 1983.
19. Gerstein S.S.- Zh.Eksp.Teor.Fiz., 1958, 34, p.463; Sov.Phys. JETP, 1958, 7, p.318; Gerstein S.S. - Zh.Eksp. Teor.Fiz., 1961, 40, p.698; Sov.Phys. JETP, 1961, 13, p.488.
20. Particle Properties Data Booklet, April, 1984, CERN.

Received by Publishing Department
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Бубак М., Файфман М.П.
Сечения мезоатомных процессов
в двухуровневом приближении адиабатического метода

E4-87-464

В широком интервале энергий столкновений $0,001 \leq \epsilon \leq 50$ эВ вычислены сечения процессов упругого рассеяния и перезарядки мезоатомов водорода в смеси изотопов водорода. Расчеты проведены в двухуровневом приближении адиабатического метода для задачи трех тел с кулоновским взаимодействием. Представленные таблицы и графики вычисленных фаз и сечений рассеяния необходимы для исследования кинетики процессов катализа.

Работа выполнена в Лаборатории ядерных проблем ОИЯИ.

Сообщение Объединенного института ядерных исследований. Дубна 1987

Bubak M., Faifman M.P.
Cross Sections for Hydrogen Muonic Atomic Processes
in Two-Level Approximation of the Adiabatic Framework

E4-87-464

The phase-shifts and cross sections have been calculated in a broad collision energy range ($0,001 \leq \epsilon \leq 50$ eV) for the elastic scattering, isotopic exchange and spin-flip hydrogen muonic atomic processes. The so-called "simple approach" to the three-body problem with the Coulomb interaction in the adiabatic two-level approximation has been applied. The comparison of the obtained values with available results of the multichannel approximation shows that the accuracy of our calculations is about 10%. The presented set of the phases and cross sections together with corrections for the electron screening and molecular structure enables one to investigate kinetics of the muon-catalyzed fusion in any mixtures of hydrogen isotopes.

The investigation has been performed at the Laboratory of Nuclear Problems, JINR.

Communication of the Joint Institute for Nuclear Research. Dubna 1987