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JILA INFORMATION CENTER REPORT

No. 10

BIBLIOGRAPHY OF LOW ENERGY ELECTRON COLLISION CROSS SECTION DATA (1967-1969)

by

G. E. Chamberlain

L. J. Kleffer

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*Army Research Office
Durham, N. C. 27706
Prof. C. M. Dupe. H. E.*

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Best Available Copy

University of Colorado
Boulder, Colorado
February 16, 1970

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I. INTRODUCTION

This bibliography is a supplement to a previously issued bibliography* and includes all of the bibliographic material on electron collisions that has been added to our files since the previous publication. The literature for JILA Information Center Report No. 10 was searched from October, 1966, through October, 1969. Additional references from 1969 may not be included because of the delay time involved in adding items to our files and because we rely upon the abstracting journals to obtain references from sources which do not in general contain information of interest. The current scientific literature is searched on a continuing basis and items omitted herein will be included in future updatings of this bibliography.

The Electron Collision Cross Section Bibliography is divided into three main sections. The first section codes the data which are in the references included in the bibliography. The second section lists the title, authors and complete reference for the paper cited. These are ordered by their "file" number. The third section consists of an alphabetical author index. After each name is a list of the "file" numbers of articles authored or co-authored to be found in the bibliographic section.

Description of the Coding Format

The data are categorized by a hierarchy of descriptors in the following order:

1. Process (e.g., elastic scattering, electronic excitation, etc.)
2. Experimental or Theoretical
3. Normalized or Relative (The data are considered normalized if given in absolute units.)
4. Atomic or Molecular Species including the degree of ionization of the species.

(A negative ion is indicated by a minus sign; neutral unexcited species by a blank; neutral excited species by a star; and a positive ion by a number indicating the degree of positive ionization. All of these symbols follow the atomic species, which are listed in ascending order of nuclear charge, Z. Molecular species are listed in arbitrary order.)

*"Bibliography of Low Energy Electron Collision Cross Section Data," by L. J. Kieffer, NBS Miscellaneous Publication #289, 1967, available from the U.S. Government Printing Office, price 50 cents.

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5. The references in which the data described are found. The references are identified by a file number, the first author, and the year of publication (e.g., 63 implies 1963).

The following comments about categories (see Contents) will aid in the proper use of the bibliography. The category Elastic Scattering replaces the previous categories Total Elastic and Differential Elastic Scattering. The following categories were deleted: Radiative Attachment, Dissociative Recombination, and Radiative Recombination. The category Total Scattering covers cross sections which are the sum of elastic and inelastic cross sections. It includes any references to experimentally determined cross sections in which the experiment does not distinguish between elastically and inelastically scattered electrons even if the experiment is carried out in an energy range in which only elastic scattering is expected.

The abbreviations for journal titles are taken from Chemical Abstracts or if not abstracted there, from Science Abstracts, Series A Physics Abstracts.

Electron Collision Cross Section Bibliography

The criterion used in choosing the references for this bibliography is that the publication contain original measurements or calculations of electron cross sections. The target species covered were all the atoms plus simple molecules of atmospheric and astrophysical interest. The incident energy range covered was 0 to 10 KeV. The upper limit on the energy was not used as an absolute limit; however, one should not expect to find electron collision cross sections in the range of 50 KeV and above.

Papers containing the following quantities, which are not explicitly cross sections, have also been collected:

1. phase shifts,
2. scattering lengths,
3. ionization efficiencies,
4. excitation efficiencies.

The reason for including these quantities is that under the proper conditions, cross sections have been or can be simply derived from them.

Published manuscripts, theses, reports given at meetings, and company or agency reports which have been printed and circulated are included in the bibliography. However, reference is not made to material that is unavailable either through library facilities or government document centers. (No classified material is included.)

[†]These processes are covered in part in JILA Information Center Report No. 4, A Bibliography of Electron Swarm Data 1967, by J. Dutton.

There is a tendency for authors to publish material which is identical to that which they have reported on at a meeting (which is printed and circulated) and also issued as a company or agency report. In some cases it is possible to verify that this is so and in those cases only one reference (the formal publication if there is one) is kept in our bibliography. In most cases it is not possible to make such a precise distinction among such documents, since only some of the material may have been available before. Because of this, there may be more than one reference to the same original data. We have tried to keep this to a minimum consistent with our aim of collecting all published data.

Inclusion of a reference in this bibliography does not imply a value judgment about the accuracy of the information. We only assert that this reference claims to report a measured or calculated electron collision cross section (or the equivalent as described previously). The question of the accuracy of the data is to be covered in separate published critical reviews [see, for example, Kieffer, L. J. and G. H. Dunn, Rev. Mod. Phys. 38, 1, (1966); Moiseiwitsch, B. L. and S. J. Smith, Rev. Mod. Phys. 40, 238 (1968)].

The authors would like to gratefully acknowledge the assistance of the staff of the JILA Information Center. The computer programs used for this report were written by Patricia Ruttenberg. The manuscript was prepared by Elizabeth Hosack and Victoria Tempey.

ERRATA TO NBS MISC. PUB. 289*

The following should be deleted from the bibliography of electron processes:

	Total Elastic Scattering	Experimental
Normalized		
H	0933 Cody, 64	

	Differential Elastic Scattering	Experimental
Relative		
Hg	0486 Kessler, 65	

	Electronic Excitation	Theoretical
Normalized		
H	0585 Seaton, 62	

	Dissociation	Experimental
Relative		
H2O	0924 Mann, 40	
N H3	0924 Mann, 40	

Normalized		
O2	1460 Rapp, 65	
N O	1460 Rapp, 65	
N2	1460 Rapp, 65	
N2O	1460 Rapp, 65	
C O2	1460 Rapp, 65	
C O	1460 Rapp, 65	

The following should be added to the bibliography of electron processes:

	Differential Elastic Scattering	Experimental
Normalized		
Hg	0486 Kessler, 65	

The following should be added to the bibliography of positron processes:

	Total Elastic Scattering	Theoretical
Normalized		
H	0933 Cody, 64	

The following should be deleted from the citation and author lists:

585 Seaton, M. J. (The paper is correctly listed as 534.)

* National Bureau of Standards Miscellaneous Publication 289, 1967, U. S. Government Printing Office, price 50 cents.

PUBLISHED ERRATA TO ELECTRON COLLISION CROSS SECTION CITATIONS

<u>File</u>	<u>Citation</u>	<u>Erratum</u>
20	Hughes, A. L. and McMillen, J. H., Inelastic and elastic electron scattering in argon, Phys Rev <u>39</u> , 585-600 (1932).	Phys Rev <u>40</u> , 469-70 (1932).
256	DeVore, R. V., Absorption and Bremsstrahlung cross sections of nitrogen for slow electrons, Phys Rev <u>136</u> , A666-8 (1964).	Phys Rev <u>140</u> , AB3 (1965).
332	Stebbing, R. F. et al., Collisions of electrons with hydrogen atoms. V. Excitation of metastable 2S hydrogen atoms, Phys Rev <u>119</u> , 1939-45 (1960).	Phys Rev <u>124</u> , 2051-2 (1961).
503	Temkin, A., Electron-hydrogen phase shifts just below the inelastic threshold, Phys Rev Lett <u>10</u> , 22-5 (1963).	Phys Rev Lett <u>11</u> , 278-81 (1963).
773	Feldman, P. and Novick, R., Autoionizing states in the alkali atoms with microsecond lifetimes, Phys Rev Lett <u>11</u> , 278-81 (1963).	Phys Rev <u>168</u> , 270 (1968).
920	Doering, J. P. and Mahan, B. H., Photoionization of nitric oxide, J Chem Phys <u>36</u> , 669-74 (1962).	J Chem Phys <u>41</u> , 2724 (1963).
942	St. John, R. M. and Lin, C. C., Production of excitation and ionization in helium by single-electron impact, J Chem Phys <u>41</u> , 195-7 (1964).	J Chem Phys <u>47</u> , 347 (1967).
1082	Mjolsness, R. C. and Sampson, D. H., Distorted-wave calculation of rotational excitation of N ₂ by slow electrons, Phys Rev Lett <u>13</u> , 812-15 (1964).	Phys Rev Lett <u>14</u> , 39 (1965).
1512	McGowan, J. W., et al., Electron-H-atom elastic-scattering resonances, Phys Rev Lett <u>15</u> , 917-20 (1965).	Phys Rev Lett <u>17</u> , 66 (1966).
1673	Mittleman, M. H., Single and double ionization of He by electrons, Phys Rev Lett <u>16</u> , 498-9 (1966).	Phys Rev Lett <u>16</u> , 779 (1966).
1695	Fox, M. A., Electron excitation from the ground state of helium to the 3 ¹ D state, Proc Phys Soc London <u>88</u> , 65-9 (1966).	Proc Phys Soc London <u>90</u> , 585 (1967).
2626	Anderson, R. J. et al., Electron excitation functions of mercury, Phys Rev <u>157</u> , 31 (1967).	Phys Rev <u>185</u> , 404 (1969).

<u>File</u>	<u>Citation</u>	<u>Erratum</u>
2647	Kieffer, L. J. and Dunn, G. H., Dissociative ionization of H ₂ and D ₂ , Phys Rev <u>158</u> , 61-5 (1967).	Phys Rev <u>164</u> , 270 (1967).
2696	Lassettre, E. N. et al., Electron-impact spectrum of ethane, J Chem Phys <u>46</u> , 4536-7 (1967).	J Chem Phys <u>48</u> , 539 (1968).
2759	Feldman, P. and Novick, R., Auto-ionizing states on the alkali atoms with microsecond lifetimes, Phys Rev <u>160</u> , 143-58 (1967).	Phys Rev <u>168</u> , 270 (1968).
3729	Moustafa Moussa, H. R. et al., Excitation of helium by 0.05-6 KeV electrons and polarization of the resulting radiation, Physica <u>40</u> , 517-49 (1969).	Physica <u>42</u> , 490 (1969).
3774	Tai, H. et al., Angular distributions of elastically scattered electrons from hydrogen, Phys Rev Lett <u>22</u> , 1415 (1969).	Phys Rev Lett <u>23</u> , 453 (1969).

III. BIBLIOGRAPHY

ELASTIC SCATTERING		EXPERIMENTAL	ELASTIC SCATTERING		THEORETICAL
NORMALIZED			NORMALIZED		
HE	1209 VRIENS,68 1817 BROMBERG,69	3565 SCHEARER,68	C	2060 ROBINSON,67 3268 HENRY,68 3704 SMITH,69	2616 SMITH,67 3700 HENRY,69
NA	1944 BALLING,66		N	2211 MJOLSNES,67 2714 MALINOWSKA-ADAMSKA,6 3700 HENRY,69	2616 SMITH,67 3268 HENRY,68 3704 SMITH,69
K	2022 RUMIN,59		O -	1744 PEIXOTO,69	
CS	3202 NIGHAN,67		O	0588 HENRY,67 2016 BREIG,66 2071 GARRETT,67 2616 SMITH,67 3700 HENRY,69	0878 GINGO,66 2060 ROBINSON,67 2211 MJOLSNES,67 2714 MALINOWSKA-ADAMSKA,67 3704 SMITH,69
HG	3011 EITEL,68		F	2060 ROBINSON,67	
N2	1817 BROMBERG,69		F 1	3825 MANSON,69	
C O	3817 BROMBERG,69		NE	1139 THOMPSON,66	3844 SHEORFY,69
RELATIVE			NE *	1926 ROBINSON,69	
H	3774 TAI,69		NE 1	3744 PEIXOTO,69	3825 MANSON,69
HE	2290 MEHR,67 3513 SCHACKERT,68	2912 CHAMBERLAIN,67 3450 CIBSON,69	NA	2093 GARRETT,65	
NE	2290 MEHR,67	3513 SCHACKERT,68	NA 1	3744 PEIXOTO,69	3825 MANSON,69
AR	2290 MEHR,67	3513 SCHACKERT,68	SI	2060 ROBINSON,67	
K	2947 COLLINS,67		SI 1	3825 MANSON,69	
KR	2290 MEHR,67	3513 SCHACKERT,68	S	2060 ROBINSON,67	
XE	2290 MEHR,67	3513 SCHACKERT,68	CL	2060 ROBINSON,67	
HG	2023 YEATES,67		AR	1139 THOMPSON,66 3882 MEISTER,68	3248 YATES,68 3844 SHEORFY,69
BI	1570 HAUG,68		AR *	3426 ROBINSON,69	
H2	3252 EHRHARDT,68	3377 EHRHARDT,68	AR 1	3825 MANSON,69	
N2	2179 EHRHARDT,67		K 1	3825 MANSON,69	
C O	3377 EHRHARDT,68		CA 1	3825 MANSON,69	
ELASTIC SCATTERING		THEORETICAL	SC 1	3825 MANSON,69	
NORMALIZED			NI 1	3825 MANSON,69	
H -	3522 MCDOWELL,68		2M 1	3825 MANSON,69	
H	1169 KRAIDY,66 1976 ORMONDE,63 2126 JHA,66 2159 MOLT,68 2754 MICHELS,67 2959 CALLAWAY,68 3058 RARIK,67 3258 ARMSTEAD,68 3371 MADAN,68 3404 KELLY,68 3701 GARRETT,69 3738 MOHR,69 3774 TAI,69 3822 FRANCO,68	1904 GUPTA,67 2059 HOUSTON,68 2129 JHA,66 2749 JHA,67 2758 KELLY,67 2968 BANERJEE,67 3215 SLOAN,68 3370 MALL,68 3394 JHA,67 3511 SCHLESSINGER,68 3728 TRUHLAR,68 3742 ORMONDE,69 3881 McDONALD,69	GA 1	3825 MANSON,69	
HE	1102 BANERJEE,66 2059 HOUSTON,68 2075 LAMSON,68 2127 BANERJEE,66 2751 BANERJEE,67 3340 HERZENBERG,68 3452 JHA,67 3586 HOUSTON,68 3686 MICHELS,69 3749 KWARE,69 3844 SHEOREY,69	2005 PU,66 2070 MASHIMO,66 2114 GUPTA,66 2714 MALINOWSKA-ADAMSKA,67 2959 CALLAWAY,68 3341 KENNEDY,68 3567 DOUGHTY,68 3683 PETROKOP,68 3705 POY,68 3772 LABAMN,69	GE 1	3825 MANSON,69	
HE *	1364 MUSAIN,67 3826 ROBINSON,69	3516 SKLAREW,68	QR	2060 ROBINSON,67	3248 YATES,68
HE 1	3825 MANSON,69		KR	3248 YATES,68	
LI	2093 GARRETT,65 3348 FEAUTRIER,68	3857 HARRIOTT,67 3838 BURKE,69	KR *	3826 ROBINSON,69	3882 MEISTER,68
LI 1	3522 MCDOWELL,68	3825 MANSON,69	QB	3771 BALLING,69	
HE 1	3348 FEAUTRIER,68		Y 1	3825 MANSON,69	
BE 3	3844 SHEOREY,69		QM 1	3825 MANSON,69	
BE 4	3844 SHEOREY,69		I	2060 ROBINSON,67	
B	2177 SMOODGRASS,66		XE	3342 KARIVANOV,68	
			XE *	3826 ROBINSON,69	
			XE 1	3825 MANSON,69	
			CS	1178 BASU,66	
			FU 1	3825 MANSON,69	
			TA 1	3825 MANSON,69	
			AU 1	3825 MANSON,69	
			HG	3731 WALKER,69 3882 MEISTER,68	3773 YATES,69
			HG 1	3825 MANSON,69	
			H2	0893 SHEPPARD,66 2464 HARA,67 3843 HENRY,69	1993 LANE,67 2777 WILKINS,67
			H2 1	2027 TENKIN,67	3411 WEINBERG,68

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ELASTIC SCATTERING		THEORETICAL		ELECTRONIC EXCITATION		EXPERIMENTAL	
NORMALIZED				NORMALIZED			
N2	8893 SHEPPARD,66			C O4	3432 VROOM,69		
H20	2857 SHIMIZU,63			RELATIVE			
N H3	2857 SHIMIZU,63			HE	1148 SIMPSON,66	2872 SOLTYSIK,67	
CL2	8893 SHEPPARD,66				2474 ZAPESOCCHNYI,66	2175 DUGAN,67	
N CL	3787 IYIKAWA,69				2176 DOWELL,66	2941 MCFARLAND,67	
C N	3787 IYIKAWA,69				2642 MEDOLE,67	2648 MEDOLF,67	
					2658 EHRHARDT,67	2911 GAVALLAS,67	
					2912 CHAMBERLAIN,67	2915 ODERING,67	
					2962 PICMANICK,68	3391 ANDRICK,68	
					3418 EHRHARDT,68	3748 WHITTAKER,67	
					3487 IONIKH,69	3813 KUPPERMANN,68	
ELECTRONIC EXCITATION		EXPERIMENTAL		HE	1 2422 DALY,67	3323 REDHEAD,68	
NORMALIZED				LI	1998 ALEKSAMIN,66		
M	2821 MILS,66	2962 KLEINPOPPEN,68		N	2874 ZAPESOCCHNYI,66		
	3827 LONG,68	3373 WILLIAMS,68		HE	2176 DOWELL,66	2911 GAVALLAS,67	
	3836 MCCOWAN,69				2962 PICMANICK,68		
HE	2698 HEAVER,67	2757 SHPENIK,67		HC	2967 ZAPESOCCHNYI,66		
	2838 JOSE,67	2841 VRIENS,68		AR	2176 DOWELL,66	2911 GAVALLAS,67	
	2983 JOSE,67	2916 LUCAS,63			2962 PICMANICK,68		
	2929 HOUSTAFI MOUSSA,67	2983 JOSE,68		K	2874 ZAPESOCCHNYI,66	2757 SHPENIK,67	
	3598 ZAPESOCCHNYI,67	3687 BARTS,68			3849 RUBIN,69		
	3729 HOUSTAFI MOUSSA,69	3814 LASSETTRE,69		CA	3512 KARSTENSEN,68		
	3838 BRONGERSMA,68	3846 ANDERSON,69		ZN	2874 ZAPESOCCHNYI,66	2757 SHPENIK,67	
LI	2726 ALEKSAMIN,67	2759 FELDMAN,67			2967 ZAPESOCCHNYI,66		
	3863 ALEKSAMIN,67			HR	2176 DOWELL,66	2962 PICMANICK,68	
HE	2725 FELTSAN,66	2989 ZAPESOCCHNYI,67		RR	2366 SHIRON,64		
	3322 GUN,57			CO	2874 ZAPESOCCHNYI,66	2987 ZAPESOCCHNYI,66	
HE	3457 KHAIRIN,68				3419 ZAPESOCCHNYI,68		
HA	2838 ZAPESOCCHNYI,67	2971 FRISH,67		XE	2176 DOWELL,66	2962 PICMANICK,68	
AR	2833 FELTSAN,67	3767 HERCFR,67		CS	3516 MERTEL,68		
K	2869 ZAPESOCCHNYI,66	2715 KORCHEVOI,67		HC	1988 BOGDANOVA,66	2874 ZAPESOCCHNYI,66	
	2759 FELDMAN,67	2838 ZAPESOCCHNYI,67			2628 BOGDANOVA,67	2823 YEATES,67	
	3519 MERTEL,68	3776 MERTEL,69			3418 ZAPESOCCHNYI,65	3528 ZAPESOCCHNYI,64	
	3776 MERTEL,69				1889 SKERBELE,69		
KR	2799 FELTSAN,67			H2	1889 CAYILL,67	2939 DOWELL,67	
RO	1969 ZAPESOCCHNYI,66	2869 ZAPESOCCHNYI,66			3445 TRAJNAR,68		
	2715 KORCHEVOI,67	2759 FELDMAN,67		O2	2176 KOVAL,66	3743 MASTER,69	
	2838 ZAPESOCCHNYI,67	3776 MERTEL,69		H2	2176 KOVAL,66	2179 EHRHARDT,67	
	3777 MERTEL,69				2659 SKERBELE,67	2827 LASSETTRE,62	
CO	2967 PENKIN,67				2915 ODERING,67	3762 BURNS,69	
XE	3888 FELTSAN,68				3813 KUPPERMANN,64	3824 RIDGE,69	
CS	2869 ZAPESOCCHNYI,66	2715 KORCHEVOI,67		H20	3823 MILLER,69		
	2838 ZAPESOCCHNYI,67	3777 MERTEL,69		N O	3743 MASTER,69		
SA	1 2938 BACON,64			CM2	2172 ODERING,67	2915 ODERING,67	
HC	8877 ANDERSON,66	2674 ANDERSON,67			3813 KUPPERMANN,68		
	2643 FRISH,67	2757 SHPENIK,67		C O	2684 SKERBELE,67	3289 FREUND,67	
	2923 FOWLER,67	3848 BOST,69			3743 MASTER,69	3813 KUPPERMANN,68	
H2	3813 KUPPERMANN,68	3871 VROOM,69		C H4	2518 EHRHARDT,67	3818 BRONGERSMA,69	
O2	3768 MCCOWAN,69			O2	2838 DOWELL,67		
H2	1989 ZAPESOCCHNYI,66	2128 JOSE,67		CM4	2686 LASSETTRE,67	3818 BRONGERSMA,69	
	2978 MOLLAND,64	3844 SKUDNICH,67					
	3687 BARTS,68	3718 STANTON,69					
	3743 MASTER,69	3769 SHIVASTAVA,69					
	3838 BRONGERSMA,68	3833 SOKOL,69					
	3851 MCCOWAN,69						
H2	1 3338 LEE,68			ELECTRONIC EXCITATION		THEORETICAL	
H20	3812 VROOM,69			NORMALIZED			
C O2	3838 BRONGERSMA,68	3374 SKUDNICH,67		N	1113 COLTMAN,66	1171 CROTHERS,69	
C O	3864 SKUDNICH,67				1999 BURKE,66	2813 STAMPER,66	
	3838 BRONGERSMA,68				2822 MORRISON,66	2867 SMIDVAN,64	
C H4	3832 VROOM,69				2877 ONTOVAR,67	2124 JMA,66	
O2	3871 VROOM,69				2159 MOLT,68	2737 BEISHAM,67	
CM4	3838 BRONGERSMA,68	3832 VROOM,69			2734 CROTHERS,67	2749 JMA,67	
CM6	3832 VROOM,69				2791 BURKE,67	2762 TAYLOR,67	
					3884 MCCOWAN,67	3888 BURKE,67	
					3888 RADIK,67	3865 VAINSHTEIN,67	

ELECTRONIC EXCITATION		THEORETICAL	ELECTRONIC EXCITATION		THEORETICAL
NORMALIZED			NORMALIZED		
H	3388 HARRIOTT,68 3580 GAUDIN,68 3728 TRUHLAR,68 3775 KYLE,68 3839 KYLE,69	3572 PERESSE,65 3642 KOLODZIEJSKI,68 3742 ORMONDE,69 3805 OCHKUR,68	MG	6 2020 SARAPH,66	
H *	1946 PLUTA,66 2786 MOMMIN,67	2863 PURCELL,52 3216 VAN DERKON,68	AL	5 3294 CZYZAK,67	
HE	1941 JOACHAIN,66 2655 INOKUTI,67 2733 REIGHAN,67 2837 INOKUTI,67 3010 BELL,68 3059 LYASH,67 3200 RFL,68 3255 KANG,68 3344 CATHRIGHT,68 3579 LYASH,67 3698 VAINSTEIN,69 3733 BELL,69	2817 VRIENS,67 2605 MORRISON,67 2750 HAMERJEF,67 3802 KENNEDY,68 3819 BELL,68 3206 MILLER,68 3211 LIN,68 3341 KENNEDY,68 3521 KIM,68 3587 BELL,68 3770 VAN DEN BOS,69	P	1 1992 DELY,67	3294 CZYZAK,67
HE *	2813 STAUFFER,66 3847 KIM,69	3856 HURKE,67	S	1 2335 CZYZAK,67	
HE 1	2427 ORMONDE,67 3734 HURKE,69	3861 KYLE,57	S	2 1992 DELY,67	3294 CZYZAK,67
LI	3857 HARRIOTT,67 3838 BURKE,69	3789 MATHUR,69	S 10	2020 SARAPH,66	
LI 1	2733 REIGHAN,67	3579 LYASH,67	CL	1 3294 CZYZAK,67	
DE	1 2118 DELY,66		CL	2 2335 CZYZAK,67	
DE 2	1579 LYASH,67		CL	3 1992 DELY,67	3294 CZYZAK,67
DE 3	1579 LYASH,67		AR	1970 VELORE,65	
C	2616 SMITH,67 3784 SMITH,69	3788 HENRY,69	AR	2 3294 CZYZAK,67	
C 2	2733 REIGHAN,67		AR	3 2335 CZYZAK,67	
C 4	2733 REIGHAN,67	3579 LYASH,67	AR	4 1992 DELY,67	3294 CZYZAK,67
H	1970 VELORE,65 3788 HENRY,69	2616 SMITH,67 3784 SMITH,69	AR 10	3294 CZYZAK,67	
H 1	1992 DELY,67 3788 HENRY,69	2870 SARAPH,66	AR 11	3294 CZYZAK,67	
H 4	2118 DELY,66		AR 12	1992 DELY,67	
H 5	3579 LYASH,67		K	3789 MATHUR,69	
O	1970 VELORE,65 2616 SMITH,67 3788 HENRY,69	2813 STAUFFER,66 2824 REIG,66 3784 SMITH,69	K	3 3294 CZYZAK,67	
O 1	3294 CZYZAK,67 3739 MARTINS,69	3788 HENRY,69	K	4 2335 CZYZAK,67	
O 2	1992 DELY,67 3788 HENRY,69	3869 MIYAMOTO,41 3732 EISSNER,69	K	5 3294 CZYZAK,67	
O 4	3868 REIGHAN,67		K 13	1992 DELY,67	
O 6	3579 LYASH,67		CA	3868 REIGHAN,67	
F	1 3294 CZYZAK,67		CA	1 1138 DELY,66	3818 BURKE,68
F 2	3294 CZYZAK,67	3739 MARTINS,69	CA	4 3294 CZYZAK,67	
ME	1970 VELORE,65		CA	5 2335 CZYZAK,67	
ME 2	3294 CZYZAK,67		CA	6 1992 DELY,67	3294 CZYZAK,67
ME 3	3294 CZYZAK,67	3739 MARTINS,69	CA 14	1992 DELY,67	
ME 4	2020 SARAPH,66		V	7 3294 CZYZAK,67	
ME 7	2118 DELY,66		V	8 2335 CZYZAK,67	
MA	1159 POKHLYAKOV,66 3864 VAINSTEIN,67	2864 POKHLYAKOV,66 3788 MATHUR,68	V	9 1992 DELY,67	3294 CZYZAK,67
MA 3	3294 CZYZAK,67		CR	8 3294 CZYZAK,67	
MA 4	3294 CZYZAK,67	3739 MARTINS,69	CR 10	1992 DELY,67	3294 CZYZAK,67
MA 5	1992 DELY,67		MM	9 3294 CZYZAK,67	
MA 1	3818 BURKE,68		MM 11	1992 DELY,67	3294 CZYZAK,67
MA 4	3294 CZYZAK,67		FE	10 3294 CZYZAK,67	
MA 5	3294 CZYZAK,67		FE 11	2335 CZYZAK,67	
			FE 12	1992 DELY,67 3294 CZYZAK,67	2115 DELY,66
			FE 13	2832 POKHLYAKOV,42	
			FE 14	3813 DELY,67	
			NI	12 3294 CZYZAK,67	
			NI 14	1992 DELY,67	3294 CZYZAK,67
			ZN	3837 TRIPATHI,68	
			ZN 24	2020 SARAPH,66	
			ED	1970 VELORE,65	
			OD	3788 MATHUR,68	
			CO	3837 TRIPATHI,68	
			SE	1970 VELORE,65	
			CS	3788 MATHUR,68	
			ME	2760 LIN,64	3818 MCCOMMELL,68

ELECTRONIC EXCITATION		THEORETICAL		IONIZATION		EXPERIMENTAL	
NORMALIZED				NORMALIZED			
HG	3616 YAVORSKY,52	3637 TRIPATHI,69		NE	8589 GLUPE,67 3559 PERESSE,65	2744 GAUDIN,67 3819 VAN DER NIEL,69	
H2	2024 KHARE,66 2627 KHARE,67 2913 MILLER,67 3344 CARTWRIGHT,68 3883 PROK,69	2886 KHARE,66 2773 CARTWRIGHT,67 2914 ROZSNYAI,67 3545 TRAJMAR,68		NA	3619 ZAPESCHNYI,69		
H2	1 2914 ROZSNYAI,67	3842 PEEK,69		NA	1 2977 PEART,68		
O2	3574 TAKAYANAGI,67			HG	1 3408 MARTIN,68		
O2	1 2828 SARAPH,66			AR	8613 BENNETT,66 2123 HANMER,67 2899 MELTON,67 3843 DOLGOV-SAVELEV,68 3819 VAN DER NIEL,69	2128 SRINIVASAN,67 2744 GAUDIN,67 3569 PERESSE,65 3767 MERCER,67	
H2	2914 ROZSNYAI,67			K	2715 KORCHEVOI,67	3699 ZAPESCHNYI,69	
H2O	3823 MILLER,69			K	1 2977 PEART,68		
ELECTRON DETACHMENT		EXPERIMENTAL		CA	2713 MCFARLAND,67		
NORMALIZED				CU	2729 PAVLOV,67	2917 CRAWFORD,67	
H -	2788 DANCE,67	2984 TISONE,68		KR	1851 SRINIVASAN,67	3569 PERESSE,65	
O -	2984 TISONE,68			RB	1919 ZAPESCHNYI,66 3619 ZAPESCHNYI,69	2715 KORCHEVOI,67	
ELECTRON DETACHMENT		THEORETICAL		SR	2713 MCFARLAND,67		
NORMALIZED				AG	2729 PAVLOV,67 2917 CRAWFORD,67	2825 CRAWFORD,66 2918 CRAWFORD,67	
H -	2116 MOSALSKI,68	3419 INOKUTI,68		XE	3549 PERESSE,65		
DE-EXCITATION		EXPERIMENTAL		CS	2715 KORCHEVOI,67 3619 ZAPESCHNYI,69	3455 NYGAARD,68	
NORMALIZED				BA	2713 MCFARLAND,67		
HE *	2698 KHAJIN,66			HA	1 1216 PEART,68		
RELATIVE				TL	2713 MCFARLAND,67		
H2 *	2646 BURTON,67	3871 BURTON,66		PB	2729 PAVLOV,67	3643 HANG,69	
H2 *	3543 BURTON,68			H2	2954 MCCONAN,68		
DE-EXCITATION		THEORETICAL		O2	3824 NISHIMURA,68 3347 KOROL,68 3578 SKUBENICH,68	3864 SKUBENICH,67 3527 PERESSE,67 3768 MCCONKEY,69	
NORMALIZED				H2	1214 MCCONKEY,67 1963 HAYAKAWA,65 2923 FOWLER,67 3824 NISHIMURA,68 1864 SKUBENICH,67 3527 PERESSE,67 3769 SRIVASTAVA,69	1881 DALY,66 2785 HOLLAND,67 2964 SRIVASTAVA,68 3851 SRINIVASAN,67 3524 SRIVASTAVA,68 3718 STANTON,69	
DE-EXCITATION		THEORETICAL		H2O	3212 COMET,67		
NORMALIZED				C2H2	2744 GAUDIN,67		
H *	2863 PURCELL,82			C O2	3824 NISHIMURA,68 3527 PERESSE,67	3246 MCCONKEY,68	
IONIZATION		EXPERIMENTAL		C O	2128 SRINIVASAN,67 3176 SKUBENICH,67	3864 SKUBENICH,67	
NORMALIZED				C HA	2399 MELTON,67	3527 PERESSE,67	
H	2784 MCCONAN,68	2959 MCCONAN,68		RELATIVE			
HE	1942 AMBETHYON,67 2746 GAUDIN,67 3569 PERESSE,65	2698 HEAVY,67 3841 HOUTAFA NOUSSA,67 3819 VAN DER NIEL,69		HE	3531 KRIST,68 3839 MARCHAND,69	3747 EMMERD,69	
HE *	3580 LONG,67			H	1 1881 DALY,66		
L2	3863 ALEXANDER,67	3699 ZAPESCHNYI,68		HE	2960 FIOUET-FAYARD,68		
LI	1 2771 HARTING,67	3296 PEART,68		AR	8598 MAGSTRUM,66 3839 MARCHAND,69	2349 SCHWAN,66	
C	8549 GLUPE,67			CA	2648 KUMPIYANOV,68		
H	8549 GLUPE,67			ZN	2768 ZIESEL,67	2960 FIOUET-FAYARD,68	
O	8549 GLUPE,67			GE	2964 LIN,67		
				HR	8598 MAGSTRUM,66 2762 ZIESEL,67	2349 SCHWAN,66 2767 MEHLHORN,68	
				HR	1 3768 LATYPOV,68		
				QB	2368 SHIMON,64 2960 FIOUET-FAYARD,68	2762 ZIESEL,67	

IONIZATION		EXPERIMENTAL		IONIZATION		THEORETICAL	
RELATIVE				NORMALIZED			
SR	2668 KUPRIYANOV,66	2762 ZIESEL,67		NE	2974 KOOZEKANANI,67 3456 KOOZEKANANI,68 3585 PEACH,68	3249 KOOZEKANANI,68 3581 GAUDIN,68	
SN	2944 LIN,67			NE	1 3758 THOMAS,69		
XE	8558 MAGSTRUM,56			NA	1163 BATES,65 3782 GAUDIN,68 3884 TRIPATHI,69	2985 GARCIA,67 3735 TRIPATHI,69	
CS	1 3050 EMELIANOV,67			NA	1 3758 THOMAS,69		
BA	2761 ZIESEL,67			MG	2713 MCFARLAND,67 3837 TRIPATHI,69	3582 GAUDIN,68	
MG	3528 ZAPESOGHNYI,64			MG	1 3883 DELY,68		
PB	2944 LIN,67			AL	3582 GAUDIN,68	3585 PEACH,68	
RI	2988 KOML,67			AL	2 3883 DELY,68		
OZ	1888 PERESSE,65 2388 TURNER,67	2174 KOVAL,66 2878 PERESSE,67		SI	3582 GAUDIN,68	3585 PEACH,68	
MZ	1888 PERESSE,65 2614 KIEFFER,67	2174 KOVAL,66 2969 FIQUET-FAYARD,68		P	3582 GAUDIN,68	3585 PEACH,68	
MZ	1 1881 DALY,68			P	4 3883 DELY,68		
N M3	2969 FIQUET-FAYARD,68			S	3582 GAUDIN,68	3585 PEACH,68	
N O	2969 FIQUET-FAYARD,68			CL	3582 GAUDIN,68	3585 PEACH,68	
C2M2	3888 RRION,69			AR	2876 KOOZEKANANI,66 2799 VAINSHTEIN,67 3582 GAUDIN,68	2648 VAINSHTEIN,67 3456 KOOZEKANANI,68 3585 PEACH,68	
C O2	1888 PERESSE,65	2119 SJOGREN,66		K	2713 MCFARLAND,67 3735 TRIPATHI,69	2985 GARCIA,67 3884 TRIPATHI,69	
C O	2969 FIQUET-FAYARD,68			K	1 3758 THOMAS,69		
C M4	2518 EMERHARDT,67	2658 BRENN,67		CA	2713 MCFARLAND,67	3837 TRIPATHI,69	
MZS	2969 FIQUET-FAYARD,68			CA	9 3883 DELY,68		
C S2	2969 FIQUET-FAYARD,68			FE	15 3883 DELY,68		
C O S	2969 FIQUET-FAYARD,68			NI	2695 PERLMAN,68	2981 KOLBENSTVEDT,67	
812	2988 KOML,67			ZH	3837 TRIPATHI,69		
IONIZATION		THEORETICAL					
NORMALIZED							
M -	3736 DELY,69			KR	2974 KOOZEKANANI,67 3456 KOOZEKANANI,68	3249 KOOZEKANANI,68	
M	1168 ABRINES,66 2877 ONIDVAR,67 2756 BRATSEV,67 3588 GAUDIN,68 3737 LUFFMAN,69 3746 ONIDVAR,69	1951 MCDOWELL,66 2716 CROTHERS,67 2981 KOLBENSTVEDT,67 3584 VRIENS,68 4745 GARCIA,69		RB	2713 MCFARLAND,67 3735 TRIPATHI,69	2985 GARCIA,67	
M *	2823 KINGSTON,66 3526 KYLE,68	3587 KINGSTON,68 3584 VRIENS,68		SR	2713 MCFARLAND,67		
ME	1942 ANDERSON,67 2837 INOKUTI,67 3882 ONIDVAR,67 3747 EMERHARDT,69	2836 CATLOW,67 2965 PECUL,67 3581 GAUDIN,68		AS	2981 KOLBENSTVEDT,67		
ME	1 3881 KYLE,67	3758 THOMAS,69		CD	3837 TRIPATHI,69		
LI	1951 MCDOWELL,66 2985 GARCIA,67 3581 GAUDIN,68	2836 CATLOW,67 3882 ONIDVAR,67 3884 TRIPATHI,69		SN	2981 KOLBENSTVEDT,67		
LI	1 3758 THOMAS,69			CS	2713 MCFARLAND,67 3735 TRIPATHI,69	2985 GARCIA,67	
DE	2713 MCFARLAND,67 3837 TRIPATHI,69	3581 GAUDIN,68		NA	2713 MCFARLAND,67		
B	3581 GAUDIN,68	3585 PEACH,68		AU	2981 KOLBENSTVEDT,67		
C	3581 GAUDIN,68	3585 PEACH,68		ME	2695 PERLMAN,68 3837 TRIPATHI,69	3882 ONIDVAR,67	
C	4 2946 BEIGHAN,68			VL	2713 MCFARLAND,67		
C	9 2946 BEIGHAN,68			MZ	3883 PROX,69		
M	2836 CATLOW,67 3585 PEACH,68	3581 GAUDIN,68		OZ	3574 TAKAYAMAGI,67		
M	1 3758 THOMAS,69			MZ	3883 PROX,69		
O	2836 CATLOW,67 3581 GAUDIN,68	3882 ONIDVAR,67 3585 PEACH,68		RELATIVE			
F	3581 GAUDIN,68	3585 PEACH,68		ME *	3525 KOOZEKANANI,68		
				AR *	3525 KOOZEKANANI,68		
				KR *	3525 KOOZEKANANI,68		

DISSOCIATION		EXPERIMENTAL	DISSOCIATIVE IONIZATION		EXPERIMENTAL
NORMALIZED			RELATIVE		
N2	2945 DE MEER, 67	3831 VROOM, 69	C H4	2658 BRENN, 67	
N2	1 2171 DUNN, 67	2798 DANCE, 67	O2	2647 KIEFFER, 67	3023 FIGUET-FAYARD, 68
O2	2782 SPOKA, 67		S F6	2215 DIEBELER, 48	
O2	1 2772 VAN ZYL, 67		C H3CL	2731 GUTBIER, 54	
N2	3833 SPOKA, 69		C H3RR	2731 GUTBIER, 54	
N2	1 2772 VAN ZYL, 67		C F4	2215 DIEBELER, 48	
H2O	3812 VROOM, 69		SI F4	2215 DIEBELER, 48	
C O2	3759 CORVIN, 69		H2OR2	2731 GUTBIER, 54	
C H4	2849 MFLTON, 67	3832 VROOM, 69	H2CL2	2731 GUTBIER, 54	
O2	3831 VROOM, 69		PI2	2988 KOHL, 67	
O2	1 2171 DUNN, 67				
C2H4	3832 VROOM, 69		DISSOCIATIVE IONIZATION		THEORETICAL
C2H6	3832 VROOM, 69		RELATIVE		
C O4	3832 VROOM, 69		H2	1984 MCCULLOH, 68	
RELATIVE					
N2	3881 LEVENTHAL, 67	3756 CLAMPITT, 69	RADIATIVE CAPTURE		EXPERIMENTAL
N2	2737 NIEHAUS, 67		NORMALIZED		
N2	2 1881 DALY, 66		CS	1 2888 AGNEW, 66	
H2O	3285 FREUND, 67	3756 CLAMPITT, 69			
C O2	3285 FREUND, 67				
DISSOCIATION		THEORETICAL	ROTATIONAL EXCITATION		EXPERIMENTAL
NORMALIZED			NORMALIZED		
N2	3344 CARTWRIGHT, 68		H2	3252 EMHARDT, 68	
N2	1 2218 PETH, 67	2491 LANE, 67			
	2486 OKSTUN, 67	1842 PETH, 69			
FREE-FREE EMISSION		THEORETICAL	ROTATIONAL EXCITATION		THEORETICAL
NORMALIZED			NORMALIZED		
N	2211 MJOLNESS, 67		H2	1993 LANE, 67	2824 SAMPSON, 63
O	2211 MJOLNESS, 67			3025 ARDILL, 68	3349 LANE, 68
				3886 ABRAH, 69	3828 CHANG, 69
				1843 MERRY, 69	
DISSOCIATIVE IONIZATION		EXPERIMENTAL	H2	2824 SAMPSON, 63	
NORMALIZED			H CL	3787 IYINAWA, 69	
			C H	1786 TAKAYANAGI, 68	3787 IYINAWA, 69
DISSOCIATION		EXPERIMENTAL	VIBRATIONAL EXCITATION		EXPERIMENTAL
NORMALIZED			NORMALIZED		
O2	2782 SPOKA, 67	3527 PERESSI, 67	H2	3327 EMHARDT, 68	
N2	1881 DALY, 66	3527 PERESSI, 67	C O2	3740 BOWEST, 68	
	3831 SPOKA, 69		C O	3327 EMHARDT, 68	
C2H2	2744 SAUDER, 67		RELATIVE		
C O2	3527 PERESSI, 67		H2	1927 PERESSI, 66	
C H4	2849 MFLTON, 67	3527 PERESSI, 67	O2	3846 SEIBERLE, 68	
RELATIVE			H2	3343 MALL, 68	3846 SEIBERLE, 68
H2	2647 KIEFFER, 67		H2O	3847 SEIBERLE, 68	
O2	2388 TURNER, 67				
N2	2614 KIEFFER, 67				
C O2	2119 SJOBERG, 68				

VIBRATIONAL EXCITATION			EXPERIMENTAL	DISSOCIATIVE ATTACHMENT			EXPERIMENTAL
RELATIVE				RELATIVE			
N O	3546 SKERBELE,68			LI CL	2918 ERINGHAUS,64		
C O2	3547 SKERBELE,68	3778 ANDRICK,69		SI CL4	2786 VOUGHT,47	3641 JAGER,68	
C O	3546 SKERBELE,68			H2SE	2738 MEUERT,53		
				TL CL	3416 KHVOSTENKO,64		
				TL BR	3416 KHVOSTENKO,65		
				IN BR	3417 KHVOSTENKO,64		
VIBRATIONAL EXCITATION			THEORETICAL	DISSOCIATIVE ATTACHMENT			THEORETICAL
NORMALIZED				NORMALIZED			
H2	2884 BARDLEY,66 2824 BREIG,66	2798 TAKAYANAGI,65 3886 ARAM,69		H2	2884 BARDLEY,66		
H2 1	3684 BOIKOVA,68						
H2	2824 BREIG,66						
N O	2769 LIN,64						
C O	2769 LIN,64	2824 BREIG,66					
HE H 1	3684 BOIKOVA,68						
DISSOCIATIVE ATTACHMENT			EXPERIMENTAL	TOTAL SCATTERING			EXPERIMENTAL
NORMALIZED				NORMALIZED			
H2	2763 SCHULZ,67			HE	2327 RAMSAUER,31 2433 CROMPTON,67 2986 POLUSHKIN,66 2957 CAVALLAS,67 3568 VOLKOV,68	2326 NY,37 2448 BALDWIN,67 2956 POLUSHKIN,66 3284 TICE,67 3782 HOFFMANN,69	
O2	3841 HENDERSON,69			N	2753 HIRMAN,67		
H2O	2884 BAILEY,38			O	1945 DAIDER,66 2178 SUNSHINE,65	2178 SUNSHINE,67	
N H3	2884 BAILEY,38 3763 COMPTON,68	3287 SHARP,68		HE	2326 RAMSAUER,31 2957 CAVALLAS,67 3782 HOFFMANN,69	2326 NY,37 3568 VOLKOV,68	
H2O	3845 CHANEY,69			AR	1945 DAIDER,66 2328 NY,37 2986 POLUSHKIN,66 2957 CAVALLAS,67 3568 VOLKOV,68	2327 RAMSAUER,31 2448 BALDWIN,67 2956 POLUSHKIN,66 3284 TICE,67	
H CL	2884 BAILEY,38	3887 CHRISTOPHORO,68		K	2956 POLUSHKIN,66		
C H4	2285 SHARP,67	2899 WELTON,67		HR	2326 RAMSAUER,31 3782 HOFFMANN,69	3568 VOLKOV,68	
C CL4	3886 CHRISTOPHORO,68			HE	2326 RAMSAUER,31 3782 HOFFMANN,69	3568 VOLKOV,68	
H O	2763 SCHULZ,67			CS	2986 POLUSHKIN,66		
O2	2763 SCHULZ,67			H2	2127 RAMSAUER,31	3284 TICE,67	
H I	3887 CHRISTOPHORO,68			O2	2878 CHANEY,66 2178 SUNSHINE,65	2178 SUNSHINE,67	
H BR	3887 CHRISTOPHORO,68			K2	1997 GOLDEN,66 3284 TICE,67	2326 RAMSAUER,31	
C O4	2285 SHARP,67			H2O	2884 BAILEY,38	3283 TICE,67	
N O3	3287 SHARP,68	3763 COMPTON,68		N H3	2884 BAILEY,38	3283 TICE,67	
C CL3F	3886 CHRISTOPHORO,68			H2O	3283 TICE,67		
CL2F2	3886 CHRISTOPHORO,68			C O2	2326 RAMSAUER,31	3283 TICE,67	
D CL	3887 CHRISTOPHORO,68			C O	2326 RAMSAUER,31	3283 TICE,67	
D BR	3887 CHRISTOPHORO,68			H CL	2884 BAILEY,38		
D I	3887 CHRISTOPHORO,68			C H4	2326 RAMSAUER,31	3284 TICE,67	
RELATIVE				O2	3284 TICE,67		
H2	2977 DOWELL,68			S O2	3283 TICE,67		
N H3	2975 KRAUS,61			H C H	3283 TICE,67		
N O	3282 CHANEY,68			C F4	3284 TICE,67		
C O2	2975 KRAUS,61			C O4	3284 TICE,67		
C O	3282 CHANEY,68	3834 DEMPY,69					
HA CL	2918 ERINGHAUS,64						
H2S	2738 MEUERT,53	2975 KRAUS,61					
C S2	2975 KRAUS,61						
S F4	8746 DUCHENKOV,68						
S O2	2975 KRAUS,61						

POSITRON PAPERS

ELASTIC SCATTERING

THEORETICAL

NORMALIZED

H	2812 BRANSDEN, 66	2859 HOUSTON, 68
	2774 FELS, 67	2959 CALLAWAY, 68
	3892 DRACHMAN, 67	3358 DRACHMAN, 68
	1781 GARRETT, 69	3848 RANMAN, 69
HE	2859 HOUSTON, 68	2959 CALLAWAY, 68
	3892 DRACHMAN, 67	3853 KRATOV, 67

ELECTRONIC EXCITATION

THEORETICAL

NORMALIZED

H	2937 DARBURG, 66
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IONIZATION

THEORETICAL

NORMALIZED

HE	3827 FERRANTE, 69
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ROTATIONAL EXCITATION

THEORETICAL

NORMALIZED

N2	2783 YAKAYAMAGI, 67
N2	2783 YAKAYAMAGI, 67

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