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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. Kieffer

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Army Research Office
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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.)

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649 862

*"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.

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 Abstr-cts, 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.)

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†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 manscript 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.)

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

PUBLISHED ERRATA TO ELECTRON COLLISION CROSS SECTION CITATIONS

File	Citation	Erratum
20	Hughes, A. L. and McMillen, J. H., Inelastic and elastic electron scattering in argon, Phys Rev 39, 585-600 (1932).	Phys Rev 40, 469-70 (1932).
256	DeVore, R. V., Absorption and Bremsstrahlung cross sections of nitrogen for slow electrons, Phys Rev 136, A666-8 (1964).	Phys Rev 140, AB3 (1965).
332	Stebbings, R. F. et al., Collisions of electrons with hydrogen atoms. V. Excitation of metastable 2S hydrogen atoms, Phys Rev 119, 1939-45 (1960).	Phys Rev 124, 2051-2 (1961).
503	Temkin, A., Electron-hydrogen phase shifts just below the inelastic threshold, Phys Rev Lett 10, 22-5 (1963).	Phys Rev Lett 11, 278-81 (1963).
773	Feldman, P. and Novick, R., Autoionizing states in the alkali atoms with microsecond lifetimes, Phys Rev Lett 11, 278-81 (1963).	Phys Rev 168, 270 (1968).
920	Doering, J. P. and Mahan, B. H., Photoionization of nitric oxide, J Chem Phys 36, 669-74 (1962).	J Chem Phys 41, 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 41, 195-7 (1964).	J Chem Phys 47, 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 13, 812-15 (1964).	Phys Rev Lett 14, 89 (1965).
1512	McGowan, J. W., et al., Electron-H-atom elastic-scattering resonances, Phys Rev Lett 15, 917-20 (1965).	Phys Rev Lett 17, 66 (1966).
1673	Mittleman, M. H., Single and double ionization of He by electrons, Phys Rev Lett 16, 498-9 (1966).	Phys Rev Lett 16, 779 (1966).
1695	Fox, M. A., Electron excitation from the ground state of helium to the 3^1D state, Proc Phys Soc London 88, 65-9 (1966).	Proc Phys Soc London 90, 585 (1967).
2626	Anderson, R. J. et al., Electron excitation functions of mercury, Phys Rev 157, 31 (1967).	Phys Rev 185, 404 (1969).

File	Citation	Erratum
2647	Kieffer, L. J. and Dunn, G. H., Dissociative ionization of H_2 and D_2, Phys Rev 158, 61-5 (1967).	Phys Rev 164, 270 (1967).
2696	Lassettre, E. N. et al., Electron-impact spectrum of ethane, J Chem Phys 46, 4536-7 (1967).	J Chem Phys 48, 539 (1968).
2759	Feldman, P. and Novick, R., Auto-ionizing states on the alkali atoms with microsecond lifetimes, Phys Rev 160, 143-58 (1967).	Phys Rev 168, 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 40, 517-49 (1969).	Physica 42, 490 (1969).
3774	Tai, H. et al., Angular distributions of elastically scattered electrons from hydrogen, Phys Rev Lett 22, 1415 (1969).	Phys Rev Lett 23, 453 (1969).

III. BIBLIOGRAPHY

	ELASTIC SCATTERING	EXPERIMENTAL
NORMALIZED		
HE	3209 VRIENS,68	3565 SCHEARER,68
	3817 BROMBERG,69	
NA	1944 BALLING,66	
K	2822 RUBIN,59	
CS	3202 NIGHAN,67	
HG	3811 EITEL,68	
N2	3817 BROMBERG,69	
C O	3817 BROMBERG,69	
RELATIVE		
H	3774 TAI,69	
HE	2290 MEHR,67	2912 CHAMBERLAIN,67
	3513 SCHACKERT,68	3850 GIBSON,69
NE	2290 MEHR,67	3513 SCHACKERT,68
AR	2290 MEHR,67	3513 SCHACKERT,68
K	2947 COLLINS,67	
KR	2290 MEHR,67	3513 SCHACKERT,68
XE	2290 MEHR,67	3513 SCHACKERT,68
HG	2823 YEATES,67	
BI	3570 HAUG,68	
H2	3252 EHRHARDT,68	3377 EHRHARDT,68
N2	2179 EHRHARDT,67	
C O	3377 EHRHARDT,68	

	ELASTIC SCATTERING	THEORETICAL
NORMALIZED		
H -	3522 MCDONELL,68	
H	1169 KRAIDY,66	1904 GUPTA,67
	1976 ORMONDE,63	2059 HOUSTON,68
	2126 JHA,66	2129 JHA,66
	2159 HOLT,68	2749 JHA,67
	2754 MICHELS,67	2758 KELLY,67
	2959 CALLAWAY,68	2968 BANERJEE,67
	3058 RABIK,67	3215 SLOAN,68
	3258 ARMSTEAD,68	3370 BALL,68
	3371 MADAN,68	3394 JHA,67
	3404 KELLY,68	3511 SCHLESSINGER,68
	3701 GARRETT,69	3728 TRUHLAR,68
	3738 MOHR,69	3742 ORMONDE,69
	3774 TAI,69	3881 MCDONALD,69
	3822 FRANCO,68	
HE	1182 BANERJEE,66	2005 PU,66
	2059 HOUSTON,68	2078 HASHINO,66
	2075 LAWSON,66	2114 GUPTA,66
	2127 BANERJEE,66	2714 MALINOWSKA-ADAMSKA,67
	2751 BANERJEE,67	2959 CALLAWAY,68
	3340 HERZENBERG,68	3341 KENNEDY,68
	3452 JHA,67	3587 DOUGHTY,68
	3586 HOUSTON,68	3603 PETERKOP,68
	3686 MICHELS,69	3705 POY,68
	3749 KWARE,69	3772 LABAHN,69
	3844 SHEOREY,69	
HE *	1364 HUSAIN,67	3516 SKLAREW,68
	3826 ROBINSON,69	
HE 1	3825 HANSON,69	
LI	2893 GARRETT,65	3857 HARRIOTT,67
	3348 FEAUTRIER,68	3838 BURKE,69
LI 1	3522 MCDONELL,68	3825 HANSON,69
BE 1	3348 FEAUTRIER,68	
BE 3	3844 SHEOREY,69	
BE 4	3844 SHEOREY,69	
B	2177 SNODGRASS,66	

	ELASTIC SCATTERING	THEORETICAL
NORMALIZED		
C	2060 ROBINSON,67	2616 SMITH,67
	3260 HENRY,68	3700 HENRY,69
	3704 SMITH,69	
N	2211 MJOLSNESS,67	2616 SMITH,67
	2714 MALINOWSKA-ADAMSKA,6	3260 HENRY,68
	3700 HENRY,69	3704 SMITH,69
O -	3744 PEIXOTO,69	
O	0588 HENRY,67	0878 GINGO,66
	2016 BREIG,66	2060 ROBINSON,67
	2071 GARRETT,67	2211 MJOLSNESS,67
	2616 SMITH,67	2714 MALINOWSKA-ADAMSKA,67
	3700 HENRY,69	3704 SMITH,69
F	2060 ROBINSON,67	
F 1	3825 HANSON,69	
NE	1139 THOMPSON,66	3844 SHEOREY,69
NE *	3826 ROBINSON,69	
NE 1	3744 PEIXOTO,69	3825 HANSON,69
NA	2893 GARRETT,65	
NA 1	3744 PEIXOTO,69	3825 HANSON,69
SI	2060 ROBINSON,67	
SI 1	3825 HANSON,69	
S	2060 ROBINSON,67	
CL	2060 ROBINSON,67	
AR	1139 THOMPSON,66	3248 YATES,68
	3882 MEISTER,68	3844 SHEOREY,69
AR *	3826 ROBINSON,69	
AR 1	3825 HANSON,69	
K 1	3825 HANSON,69	
CA 1	3825 HANSON,69	
SC 1	3825 HANSON,69	
NI 1	3825 HANSON,69	
ZN 1	3825 HANSON,69	
GA 1	3825 HANSON,69	
GE 1	3825 HANSON,69	
BR	2060 ROBINSON,67	
KR	3248 YATES,68	
KR *	3826 ROBINSON,69	
RB	3771 BALLING,69	
Y 1	3825 HANSON,69	
RH 1	3825 HANSON,69	
I	2060 ROBINSON,67	3248 YATES,68
XE	3342 KARAIVANOV,68	3882 MEISTER,68
XE *	3826 ROBINSON,69	
XE 1	3825 HANSON,69	
CS	1178 BASU,66	
EU 1	3825 HANSON,69	
TA 1	3825 HANSON,69	
AU 1	3825 HANSON,69	
HG	3731 WALKER,69	3773 YATES,69
	3882 MEISTER,68	
HG 1	3825 HANSON,69	
H2	0893 SHEPPARD,66	1993 LANE,67
	2464 HARA,67	2777 WILKINS,67
	3943 HENRY,69	
H2 1	2027 YENKIN,67	3411 WEINBERG,68

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ELASTIC SCATTERING — THEORETICAL

NORMALIZED

N2	0893	SHEPPARD,66
H2O	2057	SHIMIZU,63
N H3	2057	SHIMIZU,63
CL2	0893	SHEPPARD,66
H CL	3787	ITIKAWA,69
C N	3787	ITIKAWA,69

ELECTRONIC EXCITATION — EXPERIMENTAL

NORMALIZED

H	2821	MILS,66	2962	KLEINPOPPEN,68
	3027	LONG,68	3373	WILLIAMS,68
	3036	MCGOWAN,69		
HE	2698	WEAVER,67	2757	SHPENIK,67
	2838	JODE,67	2841	VRIENS,68
	2903	JODE,67	2916	LUCAS,63
	2929	MOUSTAFA MOUSSA,67	3583	JODE,68
	3598	ZAPESOCHNYI,67	3687	AARTS,68
	3729	MOUSTAFA MOUSSA,69	3814	LASSETTRE,69
	3838	BRONGERSMA,68	3846	ANDERSON,69
LI	2726	ALEKSAKHIN,67	2759	FELDMAN,67
	3863	ALEKSAKHIN,67		
NE	2725	FELTSAN,66	2989	ZAPESOCHNYI,67
	3322	GUK,97		
NE *	3457	KHAIKIN,68		
NA	2838	ZAPESOCHNYI,67	2971	FRISH,67
AR	2833	FELTSAN,67	3767	MERCER,67
K	2869	ZAPESOCHNYI,66	2715	KORCHEVOI,67
	2759	FELDMAN,67	2838	ZAPESOCHNYI,67
	3519	MERTEL,68	3776	MERTEL,69
	3778	MERTEL,69		
KR	2795	FELTSAN,67		
RB	1969	ZAPESOCHNYI,66	2869	ZAPESOCHNYI,66
	2715	KORCHEVOI,67	2759	FELDMAN,67
	2838	ZAPESOCHNYI,67	3776	MERTEL,69
	3777	MERTEL,69	3778	MERTEL,69
CD	2967	PENKIN,67		
XE	3899	FELTSAN,68		
CS	2869	ZAPESOCHNYI,66	2715	KORCHEVOI,67
	2838	ZAPESOCHNYI,67	3777	MERTEL,69
BA 1	2938	BACON,68		
MG	0877	ANDERSON,66	2696	ANDERSON,67
	2643	FRISH,67	2757	SHPENIK,67
	2923	FOWLER,67	3848	DOPST,69
N2	3813	KUPPERMANN,68	3871	VROOM,69
O2	3768	MCCONNEY,69		
N2	1969	ZAPESOCHNYI,66	2128	JODE,67
	2976	HOLLAND,68	3884	SKUDRNICH,67
	3687	AARTS,68	3718	STANTON,69
	3763	MASTED,69	3769	SRIVASTAVA,69
	3838	BRONGERSMA,68	3833	SROKA,69
	3851	MCCONNEY,69		
N2 1	3336	LEE,68		
H2O	3812	VROOM,69		
C O2	3838	BRONGERSMA,68		
C O	3864	SKUDRNICH,67	3374	SKUDRNICH,67
	3838	BRONGERSMA,68		
C H4	3832	VROOM,69		
O2	3871	VROOM,69		
C2H4	3838	BRONGERSMA,68	3832	VROOM,69
C2H6	3832	VROOM,69		

ELECTRONIC EXCITATION — EXPERIMENTAL

NORMALIZED

C O4	3832	VROOM,69		

RELATIVE

HE	1148	SIMPSON,66	2872	SOLTYSIK,67
	2674	ZAPESOCHNYI,66	2175	DUGAN,67
	2176	DOWELL,66	2941	MCFARLAND,67
	2642	HEDDLE,67	2648	HEDDLE,67
	2658	EHRHARDT,67	2911	GAVALLAS,67
	2912	CHAMBERLAIN,67	2915	DOERING,67
	2962	PICHANICK,68	3391	ANDRICK,68
	3418	EHRHARDT,68	3748	WHITTEKER,67
	3487	IONIKH,69	3813	KUPPERMANN,68
HE 1	2422	DALY,67	3323	REDHEAD,68
LI	1998	ALEKSAKHIN,66		
N	2874	ZAPESOCHNYI,66		
NE	2176	DOWELL,66	2911	GAVALLAS,67
	2962	PICHANICK,68		
AG	2987	ZAPESOCHNYI,66		
AR	2176	DOWELL,66	2911	GAVALLAS,67
	2962	PICHANICK,68		
K	2874	ZAPESOCHNYI,66	2757	SHPENIK,67
	3849	RUBIN,69		
CA	3512	KARSTENSEN,68		
ZN	2874	ZAPESOCHNYI,66	2757	SHPENIK,67
	2987	ZAPESOCHNYI,66		
KR	2176	DOWELL,66	2962	PICHANICK,68
RB	2366	SWIMON,64		
CD	2874	ZAPESOCHNYI,66	2987	ZAPESOCHNYI,66
	3419	ZAPESOCHNYI,68		
XE	2176	DOWELL,66	2962	PICHANICK,68
CS	3514	MERTEL,68		
HG	1988	BOGDANOVA,66	2874	ZAPESOCHNYI,66
	2628	BOGDANOVA,67	2823	YEATES,67
	3418	ZAPESOCHNYI,65	3528	ZAPESOCHNYI,64
	1884	SKERBELE,69		
N2	1889	CAMILL,67	2939	BOWELL,67
	3645	TRAJMAR,68		
O2	2174	KOVAL,66	3743	MASTED,69
N2	2174	KOVAL,66	2179	EHRHARDT,67
	2659	SKERBELE,67	2827	LASSETTRE,62
	2915	DOERING,67	3762	BURNS,69
	3813	KUPPERMANN,68	3824	RIDGE,69
H2O	3823	MILLER,69		
N O	3743	MASTED,69		
C2H2	2172	DOERING,67	2915	DOERING,67
	3813	KUPPERMANN,68		
C O	2694	SKERBELE,67	3285	FREUND,67
	3743	MASTED,69	3813	KUPPERMANN,68
	3834	DEWDT,69		
C H4	2518	EHRHARDT,67	3818	BRONGERSMA,69
O2	2939	DOWELL,67		
C2H4	2696	LASSETTRE,67	3818	BRONGERSMA,69

ELECTRONIC EXCITATION — THEORETICAL

NORMALIZED

N	1113	COLTMAN,66	1171	CROTHERS,65
	1909	BURKE,66	2813	STAUFFER,66
	2822	MORRISON,66	2867	SMIDVAR,66
	2877	SMIDVAR,67	2126	JMA,66
	2199	HOLT,68	2733	BRIGMAN,67
	2736	CROTHERS,67	2749	JMA,67
	2791	BURKE,67	2792	TAYLOR,67
	3894	MCDOWELL,67	3859	BURKE,67
	3854	BABIK,67	3865	VAINSHTEIN,67

NORMALIZED	ELECTRONIC EXCITATION	THEORETICAL
H	3388 MARRIOTT,68	3572 PERESSE,65
	3580 GAUDIN,68	3642 KOLODZIEJSKI,68
	3728 TRUHLAR,68	3742 ORMONDE,69
	3775 KYLE,68	3805 OCHKUR,68
	3839 KYLE,69	
H *	1946 PLUTA,66	2063 PURCELL,52
	2786 MONNIN,67	3214 VAN BLERKOM,68
HE	1941 JOACHAIN,66	2017 VRIENS,67
	2655 INOKUTI,67	2685 MORRISON,67
	2733 BEIGMAN,67	2758 BANERJEE,67
	2837 INOKUTI,67	3002 KENNEDY,68
	3018 BELL,68	3019 BELL,68
	3059 LYASH,67	3206 MILLER,68
	3208 BELL,68	3211 LIN,68
	3255 KANG,68	3341 KENNEDY,68
	3344 CARTWRIGHT,68	3521 KIM,68
	3579 LYASH,67	3587 BELL,68
	3698 VAINSHTEIN,69	3770 VAN DEN BOS,69
	3733 BELL,69	
HE *	2013 STAUFFER,66	3056 BURKE,67
	3847 KIM,69	
HE 1	2427 ORMONDE,67	3061 KYLE,67
	3734 BURKE,69	
LI	3057 MARRIOTT,67	3709 MATHUR,69
	3038 BURKE,69	
LI 1	2733 BEIGMAN,67	3579 LYASH,67
BE 1	2118 BELY,66	
BE 2	3579 LYASH,67	
BE 3	3579 LYASH,67	
C	2616 SMITH,67	3708 HENRY,69
	3784 SMITH,69	
C 2	2733 BEIGMAN,67	
C 4	2733 BEIGMAN,67	3579 LYASH,67
N	1970 VELDRE,65	2616 SMITH,67
	3708 HENRY,69	3784 SMITH,69
N 1	1992 BELY,67	2028 SARAPH,66
	3708 HENRY,69	
N 4	2118 BELY,66	
N 5	3579 LYASH,67	
O	1970 VELDRE,65	2013 STAUFFER,66
	2616 SMITH,67	2824 BREIG,66
	3708 HENRY,69	3784 SMITH,69
O 1	3294 CZYZAK,67	3708 HENRY,69
	3739 MARTINS,69	
O 2	1992 BELY,67	3869 MIYAMOTO,41
	3708 HENRY,69	3732 WISSNER,69
O 4	3068 BEIGMAN,67	
O 6	3579 LYASH,67	
F 1	3294 CZYZAK,67	
F 2	3294 CZYZAK,67	3739 MARTINS,69
NE	1970 VELDRE,65	
NE 2	3294 CZYZAK,67	
NE 3	3294 CZYZAK,67	3739 MARTINS,69
NE 4	2028 SARAPH,66	
NE 7	2118 BELY,66	
NA	1199 PREMYAKOV,66	2869 PREMYAKOV,66
	3869 VAINSHTEIN,67	3709 MATHUR,69
NA 3	3294 CZYZAK,67	
NA 4	3294 CZYZAK,67	3739 MARTINS,69
NA 5	1992 BELY,67	
MG 1	3018 BURKE,68	
MG 4	3294 CZYZAK,67	
MG 5	3294 CZYZAK,67	

NORMALIZED	ELECTRONIC EXCITATION	THEORETICAL
MG 6	2028 SARAPH,66	
AL 5	3294 CZYZAK,67	
P 1	1992 BELY,67	3294 CZYZAK,67
S 1	2335 CZYZAK,67	
S 2	1992 BELY,67	3294 CZYZAK,67
S 10	2028 SARAPH,66	
CL 1	3294 CZYZAK,67	
CL 2	2335 CZYZAK,67	
CL 3	1992 BELY,67	3294 CZYZAK,67
AR	1970 VELDRE,65	
AR 2	3294 CZYZAK,67	
AR 3	2335 CZYZAK,67	
AR 4	1992 BELY,67	3294 CZYZAK,67
AR 10	3294 CZYZAK,67	
AR 11	3294 CZYZAK,67	
AR 12	1992 BELY,67	
K	3709 MATHUR,69	
K 3	3294 CZYZAK,67	
K 4	2335 CZYZAK,67	
K 9	3294 CZYZAK,67	
K 13	1992 BELY,67	
CA	3068 BEIGMAN,67	
CA 1	1138 BELY,66	3818 BURKE,68
CA 4	3294 CZYZAK,67	
CA 5	2335 CZYZAK,67	
CA 6	1992 BELY,67	3294 CZYZAK,67
CA 14	1992 BELY,67	
V 7	3294 CZYZAK,67	
V 8	2335 CZYZAK,67	
V 9	1992 BELY,67	3294 CZYZAK,67
CR 8	3294 CZYZAK,67	
CR 10	1992 BELY,67	3294 CZYZAK,67
MN 9	3294 CZYZAK,67	
MN 11	1992 BELY,67	3294 CZYZAK,67
FE 10	3294 CZYZAK,67	
FE 11	2335 CZYZAK,67	
FE 12	1992 BELY,67 3294 CZYZAK,67	2115 BELY,66
FE 13	2832 PETRINI,67	
FE 16	3013 BELY,67	
NI 12	3294 CZYZAK,67	
NI 14	1992 BELY,67	3294 CZYZAK,67
ZN	3037 TRIPATHI,69	
ZN 24	2028 SARAPH,66	
KR	1970 VELDRE,65	
RB	3709 MATHUR,69	
CD	3037 TRIPATHI,69	
XE	1970 VELDRE,65	
CS	3709 MATHUR,69	
MS	2760 LIN,64	3216 MCCONNELL,68

ELECTRONIC EXCITATION — THEORETICAL

NORMALIZED

HG	3616 YAVORSKY,52	3837 TRIPATHI,69
H2	2024 KHARE,66 2627 KHARE,67 2913 MILLER,67 3344 CARTWRIGHT,68 3803 PROK,69	2866 KHARE,66 2773 CARTWRIGHT,67 2914 ROZSNYAI,67 3545 TRAJMAR,68
H2 1	2914 ROZSNYAI,67	3842 PEEK,69
O2	3574 TAKAYANAGI,67	
O2 1	2828 SARAPH,66	
N2	2914 ROZSNYAI,67	
H2O	3823 MILLER,69	

ELECTRON DETACHMENT — EXPERIMENTAL

NORMALIZED

H -	2788 DANCE,67	2984 TISONE,68
O -	2984 TISONE,68	

ELECTRON DETACHMENT — THEORETICAL

NORMALIZED

H -	2116 ROGALSKI,66	3419 INOKUTI,68

DE-EXCITATION — EXPERIMENTAL

NORMALIZED

NE *	2698 KHAIKIN,66	

RELATIVE

NE *	2646 BURROW,67	3871 BURROW,68
N2 *	3943 BURROW,68	

DE-EXCITATION — THEORETICAL

NORMALIZED

H *	2963 PURCELL,52	

IONIZATION — EXPERIMENTAL

NORMALIZED

H	2784 MCGOWAN,68	2959 MCGOWAN,68
HE	1942 ANDERTON,67 2744 GAUDIN,67 3569 PERESSE,65	2698 HEAVER,67 3841 MOUSTAFA MOUSSA,67 3819 VAN DER WIEL,69
HE *	3569 LONG,67	
LI	3063 ALEKSAHKIN,67	3699 ZAPESOCHNYI,69
LI 1	2771 MARRING,67	3296 PEART,68
C	0569 GLUPE,67	
N	0569 GLUPE,67	
O	0569 GLUPE,67	

IONIZATION — EXPERIMENTAL

NORMALIZED

NE	0569 GLUPE,67 3569 PERESSE,65	2744 GAUDIN,67 3819 VAN DER WIEL,69
NA	3699 ZAPESOCHNYI,69	
NA 1	2977 PEART,68	
MG 1	3408 MARTIN,68	
AR	0633 BENNETT,66 2123 HANNER,67 2899 MELTON,67 3643 DOLGOV-SAVELEV,68 3819 VAN DER WIEL,69	2128 SRINIVASAN,67 2744 GAUDIN,67 3569 PERESSE,65 3767 MERCER,67
K	2715 KORCHEVOI,67	3699 ZAPESOCHNYI,69
K 1	2977 PEART,68	
CA	2713 MCFARLAND,67	
CU	2729 PAVLOV,67	2917 CRAWFORD,67
KR	3051 SRINIVASAN,67	3569 PERESSE,65
RB	1969 ZAPESOCHNYI,66 3699 ZAPESOCHNYI,69	2715 KORCHEVOI,67
SR	2713 MCFARLAND,67	
AG	2729 PAVLOV,67 2917 CRAWFORD,67	2825 CRAWFORD,66 2918 CRAWFORD,67
XE	3569 PERESSE,65	
CS	2715 KORCHEVOI,67 3699 ZAPESOCHNYI,69	3455 NYGAARD,68
BA	2713 MCFARLAND,67	
BA 1	3256 PEART,68	
TL	2713 MCFARLAND,67	
PB	2729 PAVLOV,67	3643 WANG,69
H2	2954 MCGOWAN,68	
O2	3024 NISHIMURA,68 3347 KOROL,68 3518 SKUBENICH,68	3064 SKUBENICH,67 3927 PERESSE,67 3768 MCCONKEY,69
N2	1214 MCCONKEY,67 1963 HAYAKAWA,65 2923 FOWLER,67 3024 NISHIMURA,68 3064 SKUBENICH,67 3927 PERESSE,67 3769 SRIVASTAVA,69	1881 DALY,66 2785 HOLLAND,67 2964 SRIVASTAVA,68 3051 SRINIVASAN,67 3524 SRIVASTAVA,68 3718 STANTON,69
H2O	321.2 GOMEY,67	
C2H2	2744 GAUDIN,67	
C O2	3024 NISHIMURA,68 3927 PERESSE,67	3246 MCCONKEY,68
C O	2128 SRINIVASAN,67 3174 SKUBENICH,67	3064 SKUBENICH,67
C H4	2899 MELTON,67	3927 PERESSE,67

RELATIVE

HE	3531 KRIGE,68 3835 MARCHAND,69	3747 EHRHARDT,69
N 1	1881 DALY,66	
MG	2969 FIQUET-FAYARD,68	
AR	0958 HAGSTRUM,56 3835 MARCHAND,69	2349 SCHRAN,66
CA	2660 KUPRIYANOV,66	
ZN	2760 ZIESEL,67	2969 FIQUET-FAYARD,68
GE	2964 LIN,67	
KR	0958 HAGSTRUM,56 2762 ZIESEL,67	2349 SCHRAN,66 2797 MEHLHORN,65
KR 1	3768 LATYPOV,68	
RB	2366 SHIMON,64 2969 FIQUET-FAYARD,68	2762 ZIESEL,67

RELATIVE	IONIZATION	EXPERIMENTAL
SR	2668 KUPRIYANOV,66	2762 ZIESEL,67
SN	2944 LIN,67	
XE	8558 HAGSTRUM,56	
CS 1	3050 EMELYANOV,67	
BA	2761 ZIESEL,67	
HG	3528 ZAPESOCHNYI,64	
PB	2944 LIN,67	
BI	2908 KOHL,67	
O2	1888 PERESSE,65	2174 KOVAL,66
	2308 TURNER,67	2878 PERESSE,67
N2	1888 PERESSE,65	2174 KOVAL,66
	2614 KIEFFER,67	2969 FIQUET-FAYARD,68
N2 1	1881 DALY,66	
N H3	2969 FIQUET-FAYARD,68	
N O	2969 FIQUET-FAYARD,68	
C2H2	3888 ARION,69	
C O2	1888 PERESSE,65	2119 SJOGREN,66
C O	2969 FIQUET-FAYARD,68	
C H4	2518 EHRHARDT,67	2658 BREHM,67
H2S	2969 FIQUET-FAYARD,68	
C S2	2969 FIQUET-FAYARD,68	
C O S	2969 FIQUET-FAYARD,68	
BI2	2908 KOHL,67	

NORMALIZED	IONIZATION	THEORETICAL
H -	3736 BELY,69	
H	1168 ABRINES,66	1951 MCDOWELL,66
	2877 ONIDVAR,67	2796 CROTHERS,67
	2756 BRATSEV,67	2901 KOLBENSTVEDT,67
	3588 GAUDIN,68	3584 VRIENS,68
	3737 LUFFMAN,69	3745 GARCIA,69
	3746 ONIDVAR,69	
H +	2823 KINGSTON,66	3587 KINGSTON,68
	3526 KYLE,68	3584 VRIENS,68
HE	1942 ANDERSON,67	2836 CATLOW,67
	2837 INOKUTI,67	2965 PECUL,67
	3862 ONIDVAR,67	3581 GAUDIN,68
	3747 EHRHARDT,69	
HE 1	3861 KYLE,67	3758 THOMAS,69
LI	1991 MCDOWELL,66	2836 CATLOW,67
	2985 GARCIA,67	3862 ONIDVAR,67
	3581 GAUDIN,68	3884 TRIPATHI,69
LI 1	3758 THOMAS,69	
BE	2713 MCFARLAND,67	3581 GAUDIN,68
	3837 TRIPATHI,69	
B	3581 GAUDIN,68	3585 PEACH,68
C	3581 GAUDIN,68	3585 PEACH,68
C 4	2946 BEIGMAN,68	
C 5	2946 BEIGMAN,68	
N	2836 CATLOW,67	3581 GAUDIN,68
	3585 PEACH,68	
N 1	3758 THOMAS,69	
O	2836 CATLOW,67	3862 ONIDVAR,67
	3581 GAUDIN,68	3585 PEACH,68
F	3581 GAUDIN,68	3585 PEACH,68

NORMALIZED	IONIZATION	THEORETICAL
NE	2974 KOOZEKANANI,67	3249 KOOZEKANANI,68
	3456 KOOZEKANANI,68	3581 GAUDIN,68
	3585 PEACH,68	
NE 1	3758 THOMAS,69	
NA	1183 BATES,65	2985 GARCIA,67
	3582 GAUDIN,68	3735 TRIPATHI,69
	3884 TRIPATHI,69	
NA 1	3758 THOMAS,69	
MG	2713 MCFARLAND,67	3582 GAUDIN,68
	3837 TRIPATHI,69	
MG 1	3883 BELY,68	
AL	3582 GAUDIN,68	3585 PEACH,68
AL 2	3883 BELY,68	
SI	3582 GAUDIN,68	3585 PEACH,68
P	3582 GAUDIN,68	3585 PEACH,68
P 4	3883 BELY,68	
S	3582 GAUDIN,68	3585 PEACH,68
CL	3582 GAUDIN,68	3585 PEACH,68
AR	2876 KOOZEKANANI,66	2648 VAINSHTEIN,67
	2799 VAINSHTEIN,67	3456 KOOZEKANANI,68
	3582 GAUDIN,68	3585 PEACH,68
K	2713 MCFARLAND,67	2985 GARCIA,67
	3735 TRIPATHI,69	3884 TRIPATHI,69
K 1	3758 THOMAS,69	
CA	2713 MCFARLAND,67	3837 TRIPATHI,69
CA 9	3883 BELY,68	
FE 15	3883 BELY,68	
NI	2695 PERLMAN,68	2981 KOLBENSTVEDT,67
ZN	3837 TRIPATHI,69	
KR	2974 KOOZEKANANI,67	3249 KOOZEKANANI,68
	3456 KOOZEKANANI,68	
RB	2713 MCFARLAND,67	2985 GARCIA,67
	3735 TRIPATHI,69	
SR	2713 MCFARLAND,67	
AG	2981 KOLBENSTVEDT,67	
CD	3837 TRIPATHI,69	
SN	2981 KOLBENSTVEDT,67	
CS	2713 MCFARLAND,67	2985 GARCIA,67
	3735 TRIPATHI,69	
BA	2713 MCFARLAND,67	
AU	2981 KOLBENSTVEDT,67	
HG	2695 PERLMAN,68	3862 ONIDVAR,67
	3837 TRIPATHI,69	
TL	2713 MCFARLAND,67	
N2	3883 PROM,69	
O2	3574 TAKAYAMAGI,67	
N2	3883 PROM,69	

RELATIVE	
NE +	3529 KOOZEKANANI,68
AR +	3529 KOOZEKANANI,68
KR +	3529 KOOZEKANANI,68

DISSOCIATION EXPERIMENTAL

NORMALIZED

N2	2945 DE HEER,67	3831 VROOM,69	
N2 1	2171 DUNN,67	2798 DANCE,67	
O2	2782 SPOKA,67		
O2 1	2772 VAN ZYL,67		
N2	3833 SPOKA,69		
N2 1	2772 VAN ZYL,67		
N2O	3812 VROOM,69		
C O2	3759 CORVIN,69		
C H4	2899 MELTON,67	3832 VROOM,69	
O2	3831 VROOM,69		
O2 1	2171 DUNN,67		
C2H4	3832 VROOM,69		
C2H6	3832 VROOM,69		
C O4	3832 VROOM,69		

RELATIVE

N2	3881 LEVENTHAL,67	3756 CLAMPITT,69
N2	2737 NIEHAUS,67	
N2 2	1881 DALY,66	
N2O	3285 FREUND,67	3756 CLAMPITT,69
C O2	3285 FREUND,67	

DISSOCIATION THEORETICAL

NORMALIZED

N2	3344 CARTWRIGHT,68	
N2 1	2218 PEYK,67	2491 ZARE,67
	2966 OKSYUK,67	3842 PEYK,69

FREE-FREE EMISSION THEORETICAL

NORMALIZED

N	2211 MJOLSNESS,67
O	2211 MJOLSNESS,67

DISSOCIATIVE IONIZATION EXPERIMENTAL

NORMALIZED

O2	2782 SPOKA,67	3527 PERESSE,67
N2	1881 DALY,66 3831 SPOKA,69	3527 PERESSE,67
C2H2	2744 SAUDIN,67	
C O2	3527 PERESSE,67	
C H4	2899 MELTON,67	3527 PERESSE,67

RELATIVE

N2	2647 KIEFFER,67	
O2	2368 TURNER,67	
N2	2614 KIEFFER,67	
C O2	2119 SJOGREN,66	

DISSOCIATIVE IONIZATION EXPERIMENTAL

RELATIVE

C H4	2658 BREHM,67	
O2	2647 KIEFFER,67	3023 FIQUET-FAYARD,68
S F6	2215 DIBELER,48	
C H3CL	2731 GUTBIER,54	
C H3BR	2731 GUTBIER,54	
C F4	2215 DIBELER,48	
SI F4	2215 DIBELER,48	
H2BR2	2731 GUTBIER,54	
H2CL2	2731 GUTBIER,54	
PI2	2988 KOHL,67	

DISSOCIATIVE IONIZATION THEORETICAL

RELATIVE

N2	1968 MCCULLOH,68

RADIATIVE CAPTURE EXPERIMENTAL

NORMALIZED

CS 1	2868 AGNEW,66

ROTATIONAL EXCITATION EXPERIMENTAL

NORMALIZED

N2	3252 EHRHARDT,68

ROTATIONAL EXCITATION THEORETICAL

NORMALIZED

N2	1993 LANE,67 3825 ARDILL,68 3886 ADRAN,69 3843 HENRY,69	2826 SAMPSON,63 3349 LANE,68 3828 CHANG,69
N2	2826 SAMPSON,63	
N CL	3787 IYINAWA,69	
C N	3786 TAKAYANAGI,68	3787 IYINAWA,69

VIBRATIONAL EXCITATION EXPERIMENTAL

NORMALIZED

N2	3377 EHRHARDT,68	
C O2	3349 BONESS,68	
C O	3377 EHRHARDT,68	

RELATIVE

N2	1977 HENEWOEI,66	
O2	3946 SKERBELE,68	
N2	3343 HALL,68	3946 SKERBELE,68
N2O	3947 SKERBELE,68	

VIBRATIONAL EXCITATION EXPERIMENTAL

RELATIVE

N O	3546 SKERBELE,68	
C O2	3547 SKERBELE,68	3770 ANDRICK,69
C O	3546 SKERBELE,68	

VIBRATIONAL EXCITATION THEORETICAL

NORMALIZED

N2	2884 BARDSLEY,66 2824 BREIG,66	2790 TAKAYANAGI,65 3886 ARRAN,69
N2 1	3684 BOIKOVA,68	
N2	2824 BREIG,66	
N O	2769 LIN,64	
C O	2769 LIN,64	2824 BREIG,66
NE N 1	3684 BOIKOVA,68	

DISSOCIATIVE ATTACHMENT EXPERIMENTAL

NORMALIZED

N2	2763 SCHULZ,67	
O2	3841 HENDERSON,69	
N2O	2888 BAILEY,38	
N N3	2888 BAILEY,38 3763 COMPTON,69	3207 SHARP,68
N2O	3845 CHANEY,69	
N CL	2888 BAILEY,38	3887 CHRISTOPHOROU,68
C H4	2205 SHARP,67	2894 HELTON,67
C CL4	3886 CHRISTOPHOROU,68	
N O	2763 SCHULZ,67	
O2	2763 SCHULZ,67	
N I	3887 CHRISTOPHOROU,68	
N BR	3887 CHRISTOPHOROU,68	
C D4	2205 SHARP,67	
N D3	3207 SHARP,68	3763 COMPTON,69
C CL3F	3886 CHRISTOPHOROU,68	
CL2F2	3886 CHRISTOPHOROU,68	
O CL	3887 CHRISTOPHOROU,68	
O BR	3887 CHRISTOPHOROU,68	
O I	3887 CHRISTOPHOROU,68	

RELATIVE

N2	2977 DOWELL,68	
N N3	2975 KRAUS,61	
N O	3292 CHANTRY,68	
C O2	2975 KRAUS,61	
C O	3292 CHANTRY,68	3894 BERNT,69
NA CL	2910 FRINGHAUS,64	
N2S	2730 NEUERT,53	2975 KRAUS,61
C S2	2975 KRAUS,61	
S F6	0746 BUCHELNIKOVA,58	
S O2	2975 KRAUS,61	

DISSOCIATIVE ATTACHMENT EXPERIMENTAL

RELATIVE

LI CL	2910 FRINGHAUS,64	
SI CL4	2706 VOUGHT,47	3641 JAGER,68
H2SE	2730 NEUERT,53	
TL CL	3416 KHVOSTENKO,65	
TL BR	3416 KHVOSTENKO,65	
IN BR	3417 KHVOSTENKO,64	

DISSOCIATIVE ATTACHMENT THEORETICAL

NORMALIZED

N2	2884 BARDSLEY,66

TOTAL SCATTERING EXPERIMENTAL

NORMALIZED

HE	2327 RAMSAUER,31 2433 CROMPTON,67 2906 POLUSHKIN,66 2957 GAVALLAS,67 3568 VOLKOV,68	2328 NY,37 2448 BALDWIN,67 2956 POLUSHKIN,66 3204 TICE,67 3782 HOFFMANN,69
N	2753 HERMANN,67	
O	1945 DAIBER,66 2178 SUNSHINE,65	2178 SUNSHINE,67
NE	2326 RAMSAUER,31 2957 GAVALLAS,67 3782 HOFFMANN,69	2328 NY,37 3568 VOLKOV,68
AR	1945 DAIBER,66 2328 NY,37 2906 POLUSHKIN,66 2957 GAVALLAS,67 3568 VOLKOV,68	2327 RAMSAUER,31 2448 BALDWIN,67 2956 POLUSHKIN,66 3204 TICE,67
K	2956 POLUSHKIN,66	
KR	2326 RAMSAUER,31 3782 HOFFMANN,69	3568 VOLKOV,68
XE	2326 RAMSAUER,31 3782 HOFFMANN,69	3568 VOLKOV,68
CS	2906 POLUSHKIN,66	
H2	2327 RAMSAUER,31	3204 TICE,67
O2	2878 CHANTRY,66 2178 SUNSHINE,65	2178 SUNSHINE,67
N2	1997 GOLDEN,66 3204 TICE,67	2326 RAMSAUER,31
N2O	2888 BAILEY,38	3203 TICE,67
N N3	2888 BAILEY,38	3203 TICE,67
N2O	3203 TICE,67	
C O2	2326 RAMSAUER,31	3203 TICE,67
C O	2326 RAMSAUER,31	3203 TICE,67
N CL	2888 BAILEY,38	
C H4	2326 RAMSAUER,31	3204 TICE,67
O2	3204 TICE,67	
S O2	3203 TICE,67	
N C N	3203 TICE,67	
C F4	3204 TICE,67	
C D4	3204 TICE,67	

POSITRON PAPERS

ELASTIC SCATTERING		THEORETICAL
NORMALIZED		
H	2812 BRANSDEN,66	2859 HOUSTON,68
	2774 FELS,67	2959 CALLAWAY,68
	3852 DRACHMAN,67	3350 DRACHMAN,68
	3701 GARRETT,69	3848 RAHMAN,69
HE	2859 HOUSTON,68	2959 CALLAWAY,68
	3852 DRACHMAN,67	3853 KRAIDY,67

ELECTRONIC EXCITATION		THEORETICAL
NORMALIZED		
H	2937 DANBURG,66	

IONIZATION		THEORETICAL
NORMALIZED		
HE	3827 FERRANTE,69	

ROTATIONAL EXCITATION		THEORETICAL
NORMALIZED		
H2	2783 TAKAYANAGI,67	
H2	2783 TAKAYANAGI,67	

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