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Bibliography of Electron and Photon Cross Sections with
Atoms and Molecules Published in the 20th Century
- Ammonia and Phosphine -

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Bibliography of Electron and Photon Cross Sections

with Atoms and Molecules

Published in the 20th Century

—— Ammonia and Phosphine ——*

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Bibliographies of original and review reports of experiments or theories of electron and photon cross sections and also electron swarm data are presented for atomic or molecular species with specified targets. These works covered 17 atoms and 51 molecules. The present bibliography is only for ammonia (NH₃) and phosphine (PH₃). About 820 (NH₃) and 190 (PH₃) papers were compiled respectively. Comprehensive author indexes for each molecule are included. The bibliography covers the period 1922 through 2000 for NH₃ and 1928 through 2000 for PH₃. Finally, author's comments for NH₃ electron collision cross sections are given.

Keywords : NH₃ and PH₃ molecules, collision cross sections, electron, elastic scattering, rotational, vibrational and electronic excitations, dissociation, ionization, photon, photoabsorption, photodissociation, photoexcitation, photoionization, electron swarm, drift velocity, diffusion coefficient, ionization coefficient, excitation and ionization energies, transition probabilities, lifetimes of excited states

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Introduction

History

This bibliography is the result of a continuing literature survey which was begun around 1970 and originally encompassed only electron collision cross section and electron swarm data. The organization responsible for continuing this survey is Nagoya Institute of Technology, Nagoya. From 1994, the work continued to Gaseous Electronics Institute, Nagoya. In 1997, the collection of photon cross section references was begun. The search for references in both cases was retrospective and included all papers reporting measurements, theoretical calculations or reviews and data compilations of such cross sections and electron swarm data.

Scope

This bibliography contains references to original research papers which report experiments or theoretical calculations of cross sections for electron and photon collisions with ammonia and phosphine molecules NH_3 and PH_3 . The review papers on this subject are also included. Some ammonia and phosphine molecule cluster papers are included. Some conference reports, company or agency reports and PhD thesis are included. Ammonia and phosphine molecules ion papers and positron collision papers are not included in principle.

Papers reporting the following data are included.

For electron collision cross section :

- 1) elastic scattering
- 2) rotational excitation
- 3) vibrational excitation
- 4) electronic excitation
- 5) dissociation
- 6) ionization
- 7) attachment
- 8) grand total scattering (sum of elastic and inelastic cross sections)
- 9) electron swarm parameters (drift velocity, diffusion coefficient)
- 10) excitation and ionization coefficients

For photon collision cross section :

- 1) photoabsorption
- 2) photoexcitation and fluorescence
- 3) photodissociation
- 4) photoionization

For some related data :

- 1) excitation and ionization energies
- 2) transition probabilities
- 3) lifetimes of excited states
- 4) others

The energy range for electron cross section data is usually 0 - 10 keV, but some higher electron energy papers are included. The wavelength range for photon cross section data is from microwave to X-ray. Most papers are concerned with infrared, visible and ultraviolet ray region.

The bibliography includes the papers published in the 20th century, from 1901 to 2000. Oldest paper for NH_3 in this list is given by H. B. Wahlin (1922). Oldest paper for PH_3 molecules is given by R. Robertson (1928). So for this bibliography, published papers from 1922 to 1999 are compiled by alphabetical order of the first author's surname of the paper. And the references published in 2000 and plus some old papers found very recently after compilation are added as "Addenda of References for NH_3 and PH_3 ". In total, about 800 for NH_3 and 190 for PH_3 papers are compiled in the ammonia and phosphine molecule bibliography.

Organization

This report consists of four parts : introduction, the bibliography and its addenda, author index, and some comments on electron collision cross sections.

Bibliography

In this section the complete citation for all references are given. At first following classifications are shown :

E : <u>E</u> lastic collision	QT : grand <u>T</u> otal cross section
R : <u>R</u> otational excitation	(sum of elastic and inelastic
V : <u>V</u> ibrational excitation	electron cross sections).
EX : electronic <u>E</u> Xcitation	<u>Q</u> came from Querschnitt
D : <u>D</u> issociation	
I : <u>I</u> onization	
A : <u>A</u> ttachment	
ME : <u>M</u> Etastable molecules	
S : electron <u>S</u> warm	
O : <u>O</u> thers (photon cross sections and the others)	

All authors' initials and surname, journal name, volume, inclusive pages and year of publication are given as well as the title, and some additional information in the square bracket []. E and T in the square bracket mean experiment and theory.

Bibliographies for NH_3 and PH_3 are divided into two parts :

NH_3

Part 1. 1922 - 1999 p. 1 - 49

Part 2. Addenda of References published in 2000, plus some
old papers p. 50 - 71

PH_3

Part 1. 1928 - 1999 p. 1 - 15

Part 2. Addenda of References published in 2000, plus some
old papers p. 16 - 19

Author Index

In this section all authors are listed alphabetically by surname. After each author's name is a list of page numbers indicating which references he or she authored or coauthored.

NH_3 p. 1 - 11

PH_3 p. 1 - 5

Each author index of ammonia and phosphine molecules follows each bibliography.

Some Comments on Electron Collision Cross Sections for NH_3

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Ammonia NH_3

References for NH₃, ND₃ and
radicals NH₂ and NH (1900 - 1999)

(Ammonia, Ammonia-D₃)

[Amine]

E : Elastic collision,	R : Rotatioal excitation,
V : Vibrational excitation,	EX : Electronic excitation,
D : Dissociation,	I : Ionization,
A : Attachment,	QT : Grand total cross section,
S : Swarm,	α : Ionization coefficient,
O : The others,	[] : Additional information,
	E : Exp., T : Theory.

The oldest paper in this list is given by H. B. Wahlin (1922).

- EX T. Abuain, I. C. Walker and D. F. Dance : J. Chem. Soc. Faraday Trans. II, 80, 641-645 (1984)
The lowest triplet state in ammonia and methylamine detected by electron-impact excitation. [E, NH₃, CH₃NH₂]
- O Y. Achiba, K. Sato, K. Shobatake and K. Kimura : J. Chem. Phys. 78, 5474-5479 (1983)
A photoelectron spectroscopic study of (3+1) resonant multiphoton ionization of NO and NH₃. [E, h ν , NH₃, NO]
- I B. Adamczyk : Ann. Univ. Marie Curie-Sklodowska, Sect. AA20, 141- (1969/70)
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[E, NH₃; see K. Bederski (1980)]
- O H. Agren, I. Reineck, H. Veenhuizen, R. Maripuu, R. Arneberg and L. Karlsson : Mol. Phys. 45, 477-492 (1982)
A theoretical investigation of the U. V. excited ¹A₁ \rightarrow ²A₁ photoelectron spectra of NH₃ and ND₃. [T, h ν , NH₃, ND₃]
- O V. N. Akimov, A. S. Vinogradov and A. V. Zhadenov : Opt. Spectrosc. 65, 210-213 (1988).
Resonance characteristic properties of the oscillator-strength distribution in K absorption spectra of N₂ and NH₃ molecules. [E, h ν , NH₃, N₂]

- O F. Alberti and A. E. Douglas : Chem. Phys. 34, 399-402 (1978)
Anomalous populations in the λ doublets of the $c^1\Pi$ state of NH.
[E, $h\nu$, NH_3 ; $\text{NH}_3 + h\nu \rightarrow \text{H}_2 + \text{NH}(c^1\Pi)$]
- A N. L. Aleksandrov and A. P. Napartovich : Phys. Usp. 36, 107-128 (1993)
Phenomena in gases and plasmas with negative ions.
[review, NH_3 , N_2 , CO, O_2 , SF_6 , N_2O , CCl_4]
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Elastic scattering of low-energy electrons from ammonia.
[E, NH_3 ; DCS, 2 - 30 eV, 10/20 - 120/125°]
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Molecular photoelectron spectroscopy. Part II. A summary of ionization potentials. [E, $h\nu$, NH_3 , O_2 , NO_2 , CH_4 , C_6H_6 , C_2H_4 , etc. 48 compounds]
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Theory of low-energy electron scattering by polar molecules.
[T, NH_3 , H_2O ; 0.36 - 1 eV]
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Geometrics, harmonic frequencies and infrared and Raman intensities for H_2O , NH_3 , and CH_4 . [T, $h\nu$, NH_3 , H_2O , CH_4]
- O R. Angstl, H. Finsterholzl, H. Frunder, D. Illig, D. Papousek, P. Pracna, K. Narahari Rao, H. W. Schrotter and S. Urban : J. Mol. Spectrosc. 114, 454-472 (1985)
Fourier transforms and CARS spectroscopy of the ν_1 and ν_3 fundamental bands of $^{14}\text{NH}_3$. [E, $h\nu$, NH_3]
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The fluorescence excitation spectrum of deuterated ammonia in the region 105 - 200 nm : the E, F and G states of ND_3 . [E, $h\nu$, ND_3]
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Molecular predissociation dynamics revealed through multiphoton ionisation spectroscopy. II. The C^1A_1' state of NH_3 and ND_3 . [E, $h\nu$, NH_3 , ND_3]

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Predissociation dynamics of A-state ammonia probed by two-photon excitation spectroscopy. [E, $h\nu$, NH_3]
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Dissociation dynamics of $\text{NH}_3(A^1A_2')$. [E, $h\nu$, NH_3]
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Rydberg states of ammonia. [review, $h\nu$, NH_3 , ND_3]
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The electron energy loss rates by polar molecules. [T, NH_3 ,]
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Photoelectron spectra and partial photoionization cross sections for NO , N_2O , CO , CO_2 and NH_3 . [E, $h\nu$, NH_3 , NO , N_2O , CO , CO_2 ; 584 - 890 Å]
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Isotope effect in resonant vibrational excitation of H_2O (D_2O), NH_3 (ND_3), CH_4 (CD_4). [E, NH_3 , ND_3 , H_2O , D_2O , CH_4 , CD_4]

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An investigation of the lower lying excited states of ammonia.
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Phosphine PH_3

References for PH₃ and
radicals PH₂, PH (1900 - 1999)

(Phosphine)

[Tetratomic hydride]

E : Elastic collision,	R : Rotational excitation,
V : Vibrational excitation,	EX : Electronic excitation,
D : Dissociation,	I : Ionization,
A : Attachment,	QT : Grand total cross section,
S : Swarm,	α : Ionization coefficient,
O : The others,	[] : Additional information,
	E : Exp., T : Theory.

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Central atom ls photoabsorption spectra of nitrogen and phosphorus
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I A critical review of integral cross-sections. II. - Polyatomic
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Some Comments on Electron Collision Cross Sections for NH₃

We have determined the electron collision cross section set for NH₃ (Hayashi (1990)), assuming that all NH₃ molecules are in the ground state. This assumption is not true, so we do not like our cross section set for NH₃. We cannot determine the exact values of cross section set for molecules. The reason is very simple. NH₃ molecules are always mixture of NH₃(r) and NH₃(v) initially at given experimental conditions. And cross section sets for NH₃(r) and NH₃(v) are different.

Experimental and theoretical studies on electron collision cross sections of NH₃ are summarized as follows :

On the study of electron scattering cross sections for NH₃

<u>grand total cross section,</u>	<u>experiment</u>	
E. Bruche	1928	
E. Bruche	1929	
O. Sueoka	B 1987○	1 - 400 eV
Cz. Szmytkowski	B 1989○	1 - 250 eV
A. Zecca	P 1992○	75 - 4000 eV
G. Garcia	B 1996○	300 - 5000 eV, 3 %
H. Nishimura	1997	
A. Zecca	B 2000	comment
G. P. Karwasz	2001	compilation

<u>grand total cross section,</u>	<u>theory</u>	
A. Jain	B 1988	10 - 3000 eV
N. H. March	Z 1994	
K. N. Joshipura	B 1996a	50 -
G. Garcia	1997	500 - 5000 eV
Y. Jiang	1997	30 - 1000 eV
Y. Lin	1997	10 - 1000 eV

elastic. experiment

K. D. Bayes	C 1962	
J. L. Pack	P 1962	0.001 - 0.1 eV
R. Tice	C 1967	
J. P. Bromberg	1975	
L. G. Christophorou	D 1981	
S. Trajmar	1983	compilation
G. Csanak	1984	review
T. W. Shyn	1989	DCS, 8.5 and 15 eV
M. Furlan	C 1990	DCS (rel.), 12, 25, 50 eV
D. T. Alle	B 1992○	DCS, 2 - 30 eV
S. J. Buckman	1994	
S. J. Buckman	1997	
G. P. Karwasz	2001	compilation

elastic. theory

S. Altshuler	P 1957	0.36 - 1 eV
M. Shimizu	1963	< 1 eV
M. E. Mittleman	P 1965	
A. Szabo	C 1974	
I. I. Fabrikant	B 1977	
A. Jain	1983	0.01 - 10 eV
B. S. Sharma	B 1983	
F. A. Gianturco	1986	
H. P. Pritchard	P 1989	DCS, 2.5 - 20 eV
F. A. Gianturco	1991	
T. N. Rescigno	P 1992a	DCS, 1 - 20 eV
J. Yuan	P 1992	0.5 - 20 eV
C. Winstead	1996	review
E. M. S. Ribeiro	1999	DCS, 5 - 100 eV
E. M. S. Ribeiro	2001	

rotational excitation, experiment

no data

rotational excitation, theory

K. Takayanagi	1970	
Y. Itikawa	1971a	
Y. Itikawa	1971b	
M. T. do N. Varella	C 1999	7.5 - 30 eV
M. T. do N. Varella	2001	

vibrational excitation, experiment

M. Ben Arfa	1985	
M. Ben Arfa	1987	
S. Cvejjanovic	1987b	2 - 9.5 eV
M. Ben Arfa	1990	
M. Furlan	C 1990	DCS (rel.), 25, 50 eV
M. -J. Hubin-Franskin	1990	DCS, 12 - 50 eV
R. J. Gulley	B 1992○	DCS, 5 - 15 eV
G. P. Karwasz	2001	compilation

vibrational excitation, theory

no theoretical value

electronic excitation, experiment

A. M. Skerbele	C	1965	
E. L. Lassetre	C	1968	33 - 100 eV
R. Clampitt		1969	
J. W. McGowan		1969	
R. N. Compton	P	1969	
W. R. Harshbarger	C	1970	
N. Bose		1971	emission, th. - 480 eV
W. R. Harshbarger	C	1971 a	
W. R. Harshbarger	C	1971 b	
J. F. Rendina		1971	
L. J. Kieffer		1972	
J. W. Rablais	C	1973	
H. D. Morgan		1974	
G. R. Mohlman		1976	
K. Fukui		1977	
K. E. Johson	C	1977	
S. M. Kishko		1977	
S. Tsurubuchi		1977	
G. R. Wight	B	1977	5 - 60 eV
G. R. Mohlmann		1978	
G. R. Mohlmann		1979	20 - 2000 eV
H. A. van Sprang		1979	
B. L. Carnahan	C	1981	
M. D. Tasic		1981	
I. P. Bogdanova		1982	100 eV
N. Kouchi		1982	
T. Abuain		1984	
J. Kurawaki		1984	
M. Furlan	C	1985	
D. Roy		1985	
I. Fujita		1986	
J. Jovanovic-Kurepa		1986 a	
J. Jovanovic-Kurepa		1986 b	
T. Sato		1986	th. - 100 eV
M. Furlan	B	1987	
M. J. Hubin-Franskin		1987	
U. Muller		1987	emission, 9 - 160 eV
A. P. Hitchcock		1990	
U. Muller		1990	emission, th. - 100 eV
H. M. Boechat Roberty	B	1992	1 KeV
U. Muller	C	1992	emission
S. Cvejanovic	B	1992	
G. P. Karwasz		2001	compilation

electronic excitation, theory

no theoretical value

ionization. experiment

H. M. Mann	1940		
H. Neuert	1952		
W. F. Lampe	1957		75 eV
F. H. Dorman	1961		
G. De Maria	1963		75 eV
h. E. Stanton	1964		
L. E. Melton	C 1966		100 eV
F. Fiquet-Fayarad	1968		250 - 2200 eV
B. Adamczyk	1969		
C. B. Opal	1971 a		
C. B. Opal	1971 b		
C. B. Opal	1972		
M. J. van der Wiel	1972		
B. Adamczyk	1973		
J. D. Morrison	1973		
B. Adamczyk	1974		
L. Wojcik	1974		
J. -C. Gomet	1975		
N. Djuric	(1976)		
A. Crowe	1977	○	th. - 300 eV
T. D. Mark	C 1977		th. - 180 eV
G. R. Wight	1977		
J. -C. Gomet	1978		th. - 300 eV
K. Bederski	1980	○	25 - 1000 eV
N. Djuric	1981	○	th. - 200 eV
T. D. Mark	1982		review
O. J. Orient	1985		th. - 500 eV
R. Loch	1988 a		15 - 50 eV
R. Loch	1988 b		18 - 50 eV
R. Loch	1988 c		20 - 50 eV
J. A. Syage	1988		th. - 180 eV
R. Loch	1989		30 - 100 eV
M. V. V. S. Rao	B 1992	○	th. - 1000 eV
J. A. Syage	C 1992	○	10 - 270 eV
V. Tarnovsky	1997	○	th. - 200 eV
G. P. Karwasz	2001		compilation
R. Rejoub	C 2001	○	th. - 1000 eV

ionization, theory

D. K. Jain	B	1976	th. - 10^4 eV
T. D. Mark	C	1977	
S. P. Khare		1987	
S. K. Srivastava		1987	
S. P. Khare		1989	
D. Margreiter		1990	
M. Bobeldijk		1994	
W. Hwang	C	1996	○
C. Vallance		1996	
P. W. Harland		1997	
Y. -K. Kim		1997	
H. Deutsch		2000	

attachment, experiment

H. B. Wahlin		1922	
N. E. Bradbury		1935	
K. Kraus		1961	
F. H. Dorman		1966	
R. N. Compton		1969	
T. E. Sharp	C	1969	
J. E. Parr	D	1972	
A. V. Risbud		1979	
P. D. Burrow		1984	
K. L. Stricklett	B	1986	4.5 - 7 eV
M. Tronc		1987	review
M. Tronc	B	1988	4 - 13 eV
T. Yalcin		1992	0 - 10 eV
X. Ling		1993	
F. B. Dunning		1995	review
G. P. Karwasz		2001	compilation

attachment, theory

no theoretical value

Numbers of References

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published in the 20th Century

Atoms (17)		Molecules (51)			
A + e,	A + hν		M + e,	M + hν,	
He 2	2170 *	2 H ₂ , D ₂	2200 ○	5 CH ₄	950
Ne 10	1140 *	N ₂	2240 ○		
Ar 18	1960 ○	O ₂	1700	CF ₄	400
Kr 36	1000	CO	1190	CCl ₄	210
Xe 54	1180 ○	NO	880	CCl ₂ F ₂	250
				CH ₃ Cl	90
Li 3	450	F ₂	190 ○		
Na 11	800	Cl ₂	360 ○	SiH ₄	230
		Br ₂	140 ○	SiF ₄	140
K 19	370	I ₂	240 ○	GeH ₄	50
Rb 37	220				
Cs 55	370	HF	330 ○	6 C ₂ H ₄	370
		HCl	420 ○	CH ₃ OH	350
O 8	390	HBr	220 ○		
		HI	150 ○	7 SF ₆	920 ○
F 9	90				
Cl 17	130	3 CO ₂	1240 ○	8 C ₂ H ₆	260
		H ₂ O	1200 ○	C ₂ F ₆	150
Cu 29	180			Si ₂ H ₆	70
Cd 48	210	O ₃	480		
Ba 56	340	N ₂ O	450	9 C ₃ H ₆	120
		NO ₂	350	C ₂ H ₅ OH	60
Hg 80	600	H ₂ S	270		
		SO ₂	290		
		CS ₂	260		
		OCS	280	11 C ₃ H ₈	190
not final, but finished mostly		4 NH ₃	820 ○	C ₃ F ₈	100
		PH ₃	190 ○	12 C ₄ F ₈	100
include electron swarm papers		C ₂ H ₂	390	C ₆ H ₆	240
		NF ₃	110	C ₆ F ₆	100
include review papers		BF ₃	110	60 C ₆ O	300
		BCl ₃	90		
		H ₂ CO	180	M _r + M _v	850

* He(Ne) + e only. Not include He(Ne) + hν papers.

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