A UNITED STATES
DEPARTMENT OF
COMMERCE
PUBLICATION

NSRDS-NBS 3, Section 6

NATIONAL STANDARD REFERENCE DATA SYSTEM
NSRDS

Selected Tables of Atomic Spectra

Atomic Energy Levels and Multiplet Tables

H I, D, T

U.S.
EPARTMENT
OF
COMMERCE
National
u
of
s

NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards[1] was established by an act of Congress March 3, 1901. The Bureau's overall goal is to strengthen and advance the Nation's science and technology and facilitate their effective application for public benefit. To this end, the Bureau conducts research and provides: (1) a basis for the Nation's physical measurement system, (2) scientific and technological services for industry and government, (3) a technical basis for equity in trade, and (4) technical services to promote public safety. The Bureau consists of the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Center for Computer Sciences and Technology, and the Office for Information Programs.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of a Center for Radiation Research, an Office of Measurement Services and the following divisions:

Applied Mathematics—Electricity—Heat—Mechanics—Optical Physics—Linac Radiation[2]—Nuclear Radiation[2]—Applied Radiation[2]—Quantum Electronics[3]—Electromagnetics[3]—Time and Frequency[3]—Laboratory Astrophysics[3]—Cryogenics[3].

THE INSTITUTE FOR MATERIALS RESEARCH conducts materials research leading to improved methods of measurement, standards, and data on the properties of well-characterized materials needed by industry, commerce, educational institutions, and Government; provides advisory and research services to other Government agencies; and develops, produces, and distributes standard reference materials. The Institute consists of the Office of Standard Reference Materials and the following divisions:

Analytical Chemistry—Polymers—Metallurgy—Inorganic Materials—Reactor Radiation—Physical Chemistry.

THE INSTITUTE FOR APPLIED TECHNOLOGY provides technical services to promote the use of available technology and to facilitate technological innovation in industry and Government; cooperates with public and private organizations leading to the development of technological standards (including mandatory safety standards), codes and methods of test; and provides technical advice and services to Government agencies upon request. The Institute also monitors NBS engineering standards activities and provides liaison between NBS and national and international engineering standards bodies. The Institute consists of a Center for Building Technology and the following divisions and offices:

Engineering Standards Services—Weights and Measures—Invention and Innovation—Product Evaluation Technology—Electronic Technology—Technical Analysis—Measurement Engineering—Fire Technology—Housing Technology[4]—Federal Building Technology[4]—Building Standards and Codes Services[4]—Building Environment[4]—Structures, Materials and Life Safety[4]—Technical Evaluation and Application[4].

THE CENTER FOR COMPUTER SCIENCES AND TECHNOLOGY conducts research and provides technical services designed to aid Government agencies in improving cost effectiveness in the conduct of their programs through the selection, acquisition, and effective utilization of automatic data processing equipment; and serves as the principal focus within the executive branch for the development of Federal standards for automatic data processing equipment, techniques, and computer languages. The Center consists of the following offices and divisions:

Information Processing Standards—Computer Information—Computer Services—Systems Development—Information Processing Technology.

THE OFFICE FOR INFORMATION PROGRAMS promotes optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal Government; promotes the development of the National Standard Reference Data System and a system of information analysis centers dealing with the broader aspects of the National Measurement System; provides appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world, and directs the public information activities of the Bureau. The Office consists of the following organizational units:

Office of Standard Reference Data—Office of Technical Information and Publications—Library—Office of International Relations.

---

[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.
[2] Part of the Center for Radiation Research.
[3] Located at Boulder, Colorado 80302.
[4] Part of the Center for Building Technology.

Selected Tables of Atomic Spectra

A Atomic Energy Levels - Second Edition

B Multiplet Tables

H I, D, T

Data Derived from the Analyses of Optical Spectra

Charlotte E. Moore

Office of Standard Reference Data
U.S. National Bureau of Standards
Washington, D.C. 20234

E. O. Hulbert Center for Space Research
U.S. Naval Research Laboratory
Washington, D.C. 20390

U.S. DEPARTMENT OF COMMERCE, Peter G. Peterson, *Secretary*
NATIONAL BUREAU OF STANDARDS,

Issued September 1972

Library of Congress Catalog Card Number: 64-60074

NSRDS-NBS 3, Section 6

Nat. Stand. Ref. Data Ser., Nat. Bur. Stand. (U.S.), 3, Sec. 6, 36 pages (Sept. 1972)

CODEN: NSRDAP

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
(Order by SD Catalog No. C13.48:3/Sec. 6). Price 40 cents.
Stock Number 0303-0998

Abstract

The present publication is the sixth Section of a series being prepared in response to the persistent need for a current revision of two sets of tables containing data on atomic spectra as derived from analyses of optical spectra. As in the previous sections, Part A contains the atomic energy levels and Part B the multiplet tables. The spectra of hydrogen and of the isotopes deuterium and tritium are included. The form of presentation is described in detail in the text to Section 1.

Key words: Atomic energy levels, H I, D, T; hydrogen spectra, H I, D, T; multiplet tables, H I, D, T; spectra H I, D, T; wavelengths, hydrogen spectra H I, D, T.

Foreword

The National Standard Reference Data System provides effective access to the quantitative data of physical science, critically evaluated and compiled for convenience, and readily accessible through a variety of distribution channels. The System was established in 1963 by action of the President's Office of Science and Technology and the Federal Council for Science and Technology, with responsibility to administer it assigned to the National Bureau of Standards.

The System now comprises a complex of data centers and other activities, carried on in academic institutions and other laboratories both in and out of government. The independent operational status of existing critical data projects is maintained and encouraged. Data centers that are components of the NSRDS produce compilations of critically evaluated data, critical reviews of the state of quantitative knowledge in specialized areas, and computations of useful functions derived from standard reference data. In addition, the centers and projects establish criteria for evaluation and compilation of data and make recommendations on needed improvements in experimental techniques. They are normally closely associated with active research in the relevant field.

The technical scope of the NSRDS is indicated by the principal categories of data compilation projects now active or being planned: nuclear properties, atomic and molecular properties, solid state properties, thermodynamic and transport properties, chemical kinetics, and colloid and surface properties and mechanical properties.

The NSRDS receives advice and planning assistance from the National Research Council of the National Academy of Sciences-National Academy of Engineering. An overall Review Committee considers the program as a whole and makes recommendations on policy, long-term planning, and international collaboration. Advisory Panels, each concerned with a single technical area, meet regularly to examine major portions of the program, assign relative priorities, and identify specific key problems in need of further attention. For selected specific topics, the Advisory Panels sponsor subpanels which make detailed studies of users' needs, the present state of knowledge, and existing data resources, as a basis for recommending one or more data compilation activities. This assembly of advisory services contributes greatly to the guidance of NSRDS activities.

The NSRDS-NBS series of publications is intended primarily to include evaluated reference data and critical reviews of long-term interest to the scientific and technical community.

Lawrence M. Kushner, *Acting Director*

Preface

The present publication is the sixth Section of a series that is being prepared in response to the increasing demand for a current revision of two sets of tables containing data on atomic spectra as derived from analyses of optical spectra.

The first set, Atomic Energy Levels, NBS Circular 467, consists of three Volumes published, respectively, in 1949, 1952, and 1958, and a fourth one on rare-earth spectra, still in course of preparation. This Circular has been reprinted as NSRDS–NBS 35, Volumes I, II, and III.

The second set consists of two Multiplet Tables; one published in 1945 by the Princeton University Observatory containing multiplets having wavelengths longer than 3000 Å; the other, An Ultra-Violet Multiplet Table, NBS Circular 488, appearing in five Sections, the first in 1950, the second in 1952, and the others in 1962. The 1945 Princeton Multiplet Table has been reprinted as NSRDS–NBS 40.

The present series includes both sets of data, the energy levels and multiplet tables, as parts A and B, respectively, for selected spectra contained in Volume I of "Atomic Energy Levels." The Sections are being published at irregular intervals as revised analyses become available. A flexible paging system permits the arrangement of the various Sections by atomic number, regardless of the order in which the separate spectra are published. Section 1 includes three spectra of silicon, $Z=14$: Si II, Si III, Si IV. Section 2 contains similar data for Si I. Section 3 covers all the spectra of carbon, $Z=6$: C I, C II, C III, C IV, C V, C VI. Section 4 includes four spectra of nitrogen, $Z=7$: N IV, N V, N VI, N VII. Section 5 is scheduled to include the remaining spectra of nitrogen: N I, N II, N III. The form of presentation of the data is described in detail in the text of Section 1. All Sections are arranged identically and the same conversion factor, cm^{-1} to eV, 0.000123981 is used throughout.

The manuscript has been prepared by Charlotte E. Moore who has published the earlier tables. She appreciates the cordial cooperation of numerous atomic spectroscopists. She is particularly indebted to J. D. Garcia and the late J. E. Mack, who carried out the extensive calculations on hydrogen-like spectra, especially for inclusion in this Series. W. C. Martin and his colleagues in the Spectroscopy Section of the National Bureau of Standards have provided valuable suggestions regarding details in the text and tables. Special thanks are due Isabel D. Murray for her meticulous care in preparing the tabular data. The splendid work of Barbara N. Somerville in typing the press copy of this difficult tabular material is, also, gratefully acknowledged.

Washington, D.C., March 24, 1972.

Contents

Part A—Atomic Energy Levels

Part B—Multiplet Tables

NSRDS-NBS 3, SECTION 6

HYDROGEN $Z = 1$

A H I Atomic Energy Levels

B H I Multiplet Table

HYDROGEN

Part A **H I**

1 electron $Z=1$

Ground state $1s\,^2S_{0 1/2}$

$1s\,^2S_{0 1/2}$ **109678.764** cm^{-1}, 911.754 Å (Vac) I P 13.598 eV

The data quoted here refer to the light isotope of hydrogen $^1_1$H I. Deuterium and tritium are being handled separately.

The energy levels of the spectra of the hydrogen isoelectronic sequence H I to Ca XX have been calculated by Garcia and Mack and reported in a paper entitled "Energy Level and Line Tables for One-Electron Atomic Spectra." For H I the level values are derived to six decimal places to $n=50$, with $R=109677.576$ cm^{-1}.

In the present table the calculated values have been rounded off to three decimals. Intervals are quoted to four places only in cases of resolved levels. For further details users should consult the original paper.

For unresolved groups the term designations in Part B have no real significance. The center of gravity of all levels having a given value of n has been used to derive the quoted wavelength, regardless of the arbitrary designation entered with "etc." throughout.

Since the publication of "Atomic Energy Levels," Humphreys has reported the observation of the first member of the Sixth Series of H I at 12.37 μ, the second line of the Pfund Series and the third, fourth and fifth lines of the Brackett Series.

The Lamb shift and both fine and hyperfine structure of H I have been widely discussed in the literature. In 1964 Edlén and Svensson derived accurate "centre-of-gravity" wavelengths of the Lyman lines, $1s-np$, $n=2$ to 7, and discussed "the various factors pertinent to their use as standards."

Observations of H I in the radiofrequency range have been of far-reaching significance. For example, the transition between the two hyperfine structure levels F = 0 and F = 1 of the ground term $1s\,^2S_{0 1/2}$, 0.0475 cm^{-1}, is well known as the 21-cm line whose observed frequency is 1420 Mc/s. The presence of ground state hydrogen atoms in the interstellar medium was first established by the detection of this line.

A limited bibliography of work on H I was published by the writer in 1968. Many other papers could be quoted, as for example, the recent work by Shyn and his associates on the measurement of the $2s\,^2S_{0 1/2}-2p\,^2P^{\circ}_{1 1/2}$ energy separation as 9911.250 ± 0.063 MHz, as determined by an atomic-beam radiofrequency method.

A more recent paper by Hänsch and his co-workers on Laser Saturation Spectroscopy is of far-reaching importance. These authors have succeeded for the first time in resolving the single fine structure components of H α, and have observed the Lamb shift directly in the optical absorption spectrum.

An excellent general summary of the astrophysical importance of "The Spectra of Hydrogen" is contained in the Presidential Address to the Royal Society of Canada given by Herzberg in 1967.

H I—Continued

REFERENCES

C. J. Humphreys, J. Research Nat. Bur. Std. **50,** No. 1, 1–6, RP 2380 (1953). T, C L

B. Edlén and L. A. Svensson, Ark. Fys. (Stockholm) **28,** No. 36, 427–446 (1964). C L

J. D. Garcia and J. E.Mack, J. Opt. Soc. Am. **55,** No. 6, 654–685 (1965). I P, T, C L

G. Herzberg, Trans. Roy. Soc. Canada [IV] **5,** 3–36 (1967). T, C L, G D, Fine structure, hfs.

C. E. Moore, Nat. Bur. Std. Special Publ. 306, Section 1, 1–2 (1968). Bibliography

T. W. Shyn, T. Rebane, R. T. Robiscoe, and W. L. Williams, Phys. Rev. A3, No. 1, 116–122 (1971). Fine structure.

T. W. Hänsch, I. S. Shahin, A. L. Schawlow, Nature Phys. Sci. **235,** No. 56, 63–66 (1972). Fine structure.

L. Hagan and W. C. Martin, Nat. Bur. Std. Special Publ. 363, 103 pp. (1972). Bibliography.

H I

Config.	Desig.	J	Level	Interval
1s	1s ²S	0½	0.000	
2p	2p ²P°	0½	82258.913	0.0353
2s	2s ²S	0½	82258.949	0.3306
2p	2p ²P°	1½	82259.279	
3p	3p ²P°	0½	97492.205	0.0105
3s	3s ²S	0½	97492.215	0.098
3p, 3d	3d ²D 3p ²P°	1½	97492.313	0.036
3d	3d ²D	2½	97492.349	
4p	4p ²P°	0½	102823.842	0.0044
4s	4s ²S	0½	102823.846	0.041
4p, 4d	4d ²D 4p ²P°	1½	102823.887	0.015
4d, 4f	4d ²D 4f ²F°	2½	102823.902	0.008
4f	4f ²F°	3½	102823.910	
5p	5p ²P°	0½	105291.621	0.0023
5s	5s ²S	0½	105291.624	0.021
5p, 5d	5d ²D 5p ²P°	1½	105291.645	0.008
5d, 5f	5d ²D 5f ²F°	2½	105291.653	0.003
5g	5g ²G	3½	105291.656	0.0000
5f	5f ²F°	3½	105291.657	0.0023
5g	5g ²G	4½	105291.659	
6p	6p ²P°	0½	106632.141	0.0013
6s	6s ²S	0½	106632.143	0.012
6p, 6d	6d ²D 6p ²P°	1½	106632.155	0.004
6d, 6f	6d ²D 6f ²F°	2½	106632.159	0.002
6g	6g ²G	3½	106632.161	0.0000
6f	6f ²F°	3½	106632.162	0.001
6g, 6h	6g ²G 6h ²H°	4½	106632.163	0.001
6h	6h ²H°	5½	106632.164	
7p	7p ²P°	0½	107440.431	0.0008
7s	7s ²S	0½	107440.432	0.015
etc.	7i ²I	to 6½	to .446	
8s, 8p	8s ²S 8p ²P°	0½	107965.042	0.010
etc.	8k ²K°	to 7½	to .052	

H I

Config.	Desig.	J	Level	Interval
9s, 9p	9s ²S 9p ²P°	0½	108324.713	0.007
etc.	9l ²L	to 8½	to .720	
10s, 10p	10s ²S 10p ²P°	0½	108581.983	0.005
etc.	10m ²M°	to 9½	to .988	
11s, 11p	11s ²S 11p ²P°	0½	108772.334	0.004
etc.	11n ²N	to 10½	to .338	
12s, 12p	12s ²S 12p ²P°	0½	108917.111	0.003
etc.		to 11½	to .114	
13s, 13p	13s ²S 13p ²P°	0½	109029.782	0.002
etc.		to 12½	to .784	
14s, 14p	14s ²S 14p ²P°	0½	109119.183	0.002
etc.		to 13½	to .185	
15s, 15p	15s ²S 15p ²P°	0½	109191.307	0.001
etc.		to 14½	to .308	
16s, 16p	16s ²S 16p ²P°	0½	109250.335	0.001
etc.		to 15½	to .336	
17s, 17p	17s ²S 17p ²P°	0½	109299.256	0.001
etc.		to 16½	to .257	
18s, 18p	18s ²S 18p ²P°	0½	109340.252	0.001
etc.		to 17½	to .253	
19s, 19p	19s ²S 19p ²P°	0½	109374.947	0.001
etc.		to 18½	to .948	
20s, 20p	20s ²S 20p ²P°	0½	109404.570	
etc.		to 19½	.570	
21s, 21p	21s ²S 21p ²P°	0½	109430.062	
etc.		to 20½	.062	
22s, 22p	22s ²S 22p ²P°	0½	109452.157	0.001
etc.		to 21½	to .158	

H I — Continued

Config.	Desig.	J	Level	Interval
23s, etc.	23s ^{2}S, etc.	0½, etc.	109471.434	
24s, etc.	24s ^{2}S, etc.	0½, etc.	109488.351 to .352	0.001
25s, etc.	25s ^{2}S, etc.	0½, etc.	109503.280	
26s, etc.	26s ^{2}S, etc.	0½, etc.	109516.519	
27s, etc.	27s ^{2}S, etc.	0½, etc.	109528.315	
28s, etc.	28s ^{2}S, etc.	0½, etc.	109538.869	
29s, etc.	29s ^{2}S, etc.	0½, etc.	109548.351	
30s, etc.	30s ^{2}S, etc.	0½, etc.	109556.900	
31s, etc.	31s ^{2}S, etc.	0½, etc.	109564.635 to .636	0.001
32s, etc.	32s ^{2}S, etc.	0½, etc.	109571.657	
33s, etc.	33s ^{2}S, etc.	0½, etc.	109578.050	
34s, etc.	34s ^{2}S, etc.	0½, etc.	109583.887	
35s, etc.	35s ^{2}S, etc.	0½, etc.	109589.231	
36s, etc.	36s ^{2}S, etc.	0½, etc.	109594.136	
37s, etc.	37s ^{2}S, etc.	0½, etc.	109598.649	

H I — Continued

Config.	Desig.	J	Level	Interval
38s, etc.	38s ^{2}S, etc.	0½, etc.	109602.810	
39s, etc.	39s ^{2}S, etc.	0½, etc.	109606.655	
40s, etc.	40s ^{2}S, etc.	0½, etc.	109610.216	
41s, etc.	41s ^{2}S, etc.	0½, etc.	109613.519	
42s, etc.	42s ^{2}S, etc.	0½, etc.	109616.589	
43s, etc.	43s ^{2}S, etc.	0½, etc.	109619.447	
44s, etc.	44s ^{2}S, etc.	0½, etc.	109622.113	
45s, etc.	45s ^{2}S, etc.	0½, etc.	109624.602	
46s, etc.	46s ^{2}S, etc.	0½, etc.	109626.932	
47s, etc.	47s ^{2}S, etc.	0½, etc.	109629.114	
48s, etc.	48s ^{2}S, etc.	0½, etc.	109631.161	
49s, etc.	49s ^{2}S, etc.	0½, etc.	109633.084	
50s, etc.	50s ^{2}S, etc.	0½, etc.	109634.893	
	....	....	....	
	Limit	....	109678.764	

August, 1971.

HYDROGEN

Part B

H I (Z = 1)

I P 13.598 eV Limit 109678.764 cm^{-1} 911.754 Å (Vac)

Anal A List B August 1971

The data given here refer to the light isotope of hydrogen $^{1}_{1}$H I.

REFERENCES

B. Edlén and L. A. Svensson, Ark. Fys. (Stockholm) **28**, No. 36, 427–446 (1964). C L; W L 930.7483 Å to 1215.6701 Å

C. J. Humphreys, J. Research Nat. Bur. Std. **50**, No. 1, 1–6, RP2380 (1953). C L; W L 4861 Å to 123684 Å

A Wavelengths calculated from term values derived by J. D. Garcia and J. E. Mack, J. Opt. Soc. Am. **55**, No. 6, 654–685 (1965). I P, T, C L; W L 914.0386 Å to 887313.171 Å. For higher values of n where the terms are unresolved, the wavelength derived from the statistical mean of the components is quoted.

P Predicted wavelength for series members having $n > 20$, i.e., for series carried further than in reference A. In calculating these wavelengths the following mean values have been used for the lower level:

$2p$ ^{2}P° etc. 82259.102 cm^{-1}
$3d$ ^{2}D etc. 97492.296 cm^{-1}
$4f$ ^{2}F° etc. 102823.890 cm^{-1}
$5g$ ^{2}G etc. 105291.649 cm^{-1}
$6h$ ^{2}H° etc. 106632.159 cm^{-1}

New UV Multiplet Numbers start with UV 18. The Multiplet Numbers in the 1945 Multiplet Table (λ > 3000 Å) have been replaced. The newly-assigned numbers are printed in bold face type through number 14 to distinguish them from the older ones.

‡*Raie Ultime*

H I

I A	Ref	Int	E P		J	Multiplet No.
			Low	High		
Vac						
1215.6683‡	A	Lα	0.00	10.20	0½–1½	1s ^{2}S — 2p ^{2}P°
1215.6737	A		0.00	10.20	0½–0½	UV 1
1025.7219	A	Lβ	0.00	12.09	0½–1½	1s ^{2}S — 3p ^{2}P°
1025.7230	A		0.00	12.09	0½–0½	UV 2
972.5367	A	Lγ	0.00	12.75	0½–1½	1s ^{2}S — 4p ^{2}P°
972.5371	A		0.00	12.75	0½–0½	UV 3

H I

I A	Ref	Int	E P		J	Multiplet No.
			Low	High		
Vac						
949.7430	A	Lδ	0.00	13.05	0½–1½	1s ^{2}S — 5p ^{2}P°
949.7432	A		0.00	13.05	0½–0½	UV 4
937.8034	A	Lε	0.00	13.22	0½–1½	1s ^{2}S — 6p ^{2}P°
937.8035	A		0.00	13.22	0½–0½	UV 5
930.7483	A		0.00	13.32	0½–	1s ^{2}S — 7p ^{2}P°
						UV 6
926.2257	A		0.00	13.39	0½–	1s ^{2}S — 8p ^{2}P°
						UV 7

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac						
923.1504	A		0.00	13.43	0½–	1s ²S — 9p ²P° UV 8
920.9631	A		0.00	13.46	0½–	1s ²S —10p ²P° UV 9
919.3514	A		0.00	13.49	0½–	1s ²S —11p ²P° UV 10
918.1294	A		0.00	13.50	0½–	1s ²S —12p ²P° UV 11
917.1806	A		0.00	13.52	0½–	1s ²S —13p ²P° UV 12
916.4291	A		0.00	13.53	0½–	1s ²S —14p ²P° UV 13
915.8238	A		0.00	13.54	0½–	1s ²S —15p ²P° UV 14
915.3290	A		0.00	13.54	0½–	1s ²S —16p ²P° UV 15
914.9193	A		0.00	13.55	0½–	1s ²S —17p ²P° UV 16
914.5763	A		0.00	13.56	0½–	1s ²S —18p ²P° UV 17
914.2862	A		0.00	13.56	0½–	1s ²S —19p ²P° UV 18
914.0386	A		0.00	13.56	0½–	1s ²S —20p ²P° UV 19
913.826	P		0.00	13.57	0½–	1s ²S —21p ²P° UV 20
913.641	P		0.00	13.57	0½–	1s ²S —22p ²P° UV 21
913.480	P		0.00	13.57	0½–	1s ²S —23p ²P° UV 22
913.339	P		0.00	13.57	0½–	1s ²S —24p ²P° UV 23
913.215	P		0.00	13.58	0½–	1s ²S —25p ²P° UV 24
913.104	P		0.00	13.58	0½–	1s ²S —26p ²P° UV 25

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac						
913.006	P		0.00	13.58	0½–	1s ²S —27p ²P° UV 26
912.918	P		0.00	13.58	0½–	1s ²S —28p ²P° UV 27
912.839	P		0.00	13.58	0½–	1s ²S —29p ²P° UV 28
912.768	P		0.00	13.58	0½–	1s ²S —30p ²P° UV 29
912.703	P		0.00	13.58	0½–	1s ²S —31p ²P° UV 30
912.645	P		0.00	13.58	0½–	1s ²S —32p ²P° UV 31
912.592	P		0.00	13.59	0½–	1s ²S —33p ²P° UV 32
912.543	P		0.00	13.59	0½–	1s ²S —34p ²P° UV 33
912.498	P		0.00	13.59	0½–	1s ²S —35p ²P° UV 34
912.458	P		0.00	13.59	0½–	1s ²S —36p ²P° UV 35
912.420	P		0.00	13.59	0½–	1s ²S —37p ²P° UV 36
912.385	P		0.00	13.59	0½–	1s ²S —38p ²P° UV 37
912.353	P		0.00	13.59	0½–	1s ²S —39p ²P° UV 38
912.324	P		0.00	13.59	0½–	1s ²S —40p ²P° UV 39
912.296	P		0.00	13.59	0½–	1s ²S —41p ²P° UV 40
912.271	P		0.00	13.59	0½–	1s ²S —42p ²P° UV 41
912.247	P		0.00	13.59	0½–	1s ²S —43p ²P° UV 42
912.225	P		0.00	13.59	0½–	1s ²S —44p ²P° UV 43

H I—Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac						
912.204	P		0.00	13.59	0½–	$1s\ {}^2S - 45p\ {}^2P^\circ$ UV 44
912.185	P		0.00	13.59	0½–	$1s\ {}^2S - 46p\ {}^2P^\circ$ UV 45
912.166	P		0.00	13.59	0½–	$1s\ {}^2S - 47p\ {}^2P^\circ$ UV 46
912.149	P		0.00	13.59	0½–	$1s\ {}^2S - 48p\ {}^2P^\circ$ UV 47
912.133	P		0.00	13.59	0½–	$1s\ {}^2S - 49p\ {}^2P^\circ$ UV 48
912.118	P		0.00	13.59	0½–	$1s\ {}^2S - 50p\ {}^2P^\circ$ UV 49
911.754	A		0.00	13.60	0½–	$1s\ {}^2S$ —Limit UV 50
Air						
6562.9099	A		10.20	12.09	1½–0½	$2p\ {}^2P^\circ - 3s\ {}^2S$
6562.7520	A		10.20	12.09	0½–0½	1.01
6562.8520	A	Hα	10.20	12.09	1½–2½	$2p\ {}^2P^\circ - 3d\ {}^2D$
6562.7101	A		10.20	12.09	0½–1½	**1**
6562.7256	A		10.20	12.09	0½–1½	$2s\ {}^2S - 3p\ {}^2P^\circ$
6562.7720	A		10.20	12.09	0½–0½	1.02
4861.3752	A		10.20	12.75	1½–0½	$2p\ {}^2P^\circ - 4s\ {}^2S$
4861.2885	A		10.20	12.75	0½–0½	2.01
4861.3620	A	Hβ	10.20	12.75	1½–2½	$2p\ {}^2P^\circ - 4d\ {}^2D$
4861.2789	A		10.20	12.75	0½–1½	**2**
4861.2873	A		10.20	12.75	0½–1½	$2s\ {}^2S - 4p\ {}^2P^\circ$
4861.2980	A		10.20	12.75	0½–0½	2.02
4340.5001	A		10.20	13.05	1½–0½	$2p\ {}^2P^\circ - 5s\ {}^2S$
4340.4312	A		10.20	13.05	0½–0½	3.01
4340.4946	A	Hγ	10.20	13.05	1½–2½	$2p\ {}^2P^\circ - 5d\ {}^2D$
4340.4272	A		10.20	13.05	0½–1½	**3**

H I—Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
4340.4340	A		10.20	13.05	0½–1½	$2s\ {}^2S - 5p\ {}^2P^\circ$
4340.4385	A		10.20	13.05	0½–0½	3.02
4101.7662	A		10.20	13.22	1½–0½	$2p\ {}^2P^\circ - 6s\ {}^2S$
4101.7045	A		10.20	13.22	0½–0½	4.01
4101.7650	A	Hδ	10.20	13.22	1½–2½	$2p\ {}^2P^\circ - 6d\ {}^2D$
4101.7025	A		10.20	13.22	0½–1½	**4**
4101.7087	A		10.20	13.22	0½–1½	$2s\ {}^2S - 6p\ {}^2P^\circ$
4101.7110	A		10.20	13.22	0½–0½	4.02
3970.072	A	Hε	10.20	13.32		$2p\ {}^2P^\circ - 7d\ {}^2D$ etc. **5** etc.
3889.049	A		10.20	13.39		$2p\ {}^2P^\circ - 8d\ {}^2D$ etc. **6** etc.
3835.384	A		10.20	13.43		$2p\ {}^2P^\circ - 9d\ {}^2D$ etc. **7** etc.
3797.898	A		10.20	13.46		$2p\ {}^2P^\circ - 10d\ {}^2D$ etc. **8** etc.
3770.630	A		10.20	13.49		$2p\ {}^2P^\circ - 11d\ {}^2D$ etc. **9** etc.
3750.152	A		10.20	13.50		$2p\ {}^2P^\circ - 12d\ {}^2D$ etc. **10** etc.
3734.368	A		10.20	13.52		$2p\ {}^2P^\circ - 13d\ {}^2D$ etc. **11** etc.
3721.938	A		10.20	13.53		$2p\ {}^2P^\circ - 14d\ {}^2D$ etc. **12** etc.
3711.971	A		10.20	13.54		$2p\ {}^2P^\circ - 15d\ {}^2D$ etc. **13** etc.
3703.853	A		10.20	13.54		$2p\ {}^2P^\circ - 16d\ {}^2D$ etc. **14** etc.
3697.152	A		10.20	13.55		$2p\ {}^2P^\circ - 17d\ {}^2D$ etc. 15 etc.
3691.555	A		10.20	13.56		$2p\ {}^2P^\circ - 18d\ {}^2D$ etc. 16 etc.
3686.831	A		10.20	13.56		$2p\ {}^2P^\circ - 19d\ {}^2D$ etc. 17 etc.

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
3682.808	A		10.20	13.56		$2p\ ^2P^o$—$20d\ ^2D$ etc. 18 etc.
3679.352	P		10.20	13.57		$2p\ ^2P^o$—$21d\ ^2D$ etc. 19 etc.
3676.363	P		10.20	13.57		$2p\ ^2P^o$—$22d\ ^2D$ etc. 20 etc.
3673.758	P		10.20	13.57		$2p\ ^2P^o$—$23d\ ^2D$ etc. 21 etc.
3671.476	P		10.20	13.57		$2p\ ^2P^o$—$24d\ ^2D$ etc. 22 etc.
3669.464	P		10.20	13.58		$2p\ ^2P^o$—$25d\ ^2D$ etc. 23 etc.
3667.682	P		10.20	13.58		$2p\ ^2P^o$—$26d\ ^2D$ etc. 24 etc.
3666.095	P		10.20	13.58		$2p\ ^2P^o$—$27d\ ^2D$ etc. 25 etc.
3664.677	P		10.20	13.58		$2p\ ^2P^o$—$28d\ ^2D$ etc. 26 etc.
3663.403	P		10.20	13.58		$2p\ ^2P^o$—$29d\ ^2D$ etc. 27 etc.
3662.256	P		10.20	13.58		$2p\ ^2P^o$—$30d\ ^2D$ etc. 28 etc.
3661.219	P		10.20	13.58		$2p\ ^2P^o$—$31d\ ^2D$ etc. 29 etc.
3660.277	P		10.20	13.58		$2p\ ^2P^o$—$32d\ ^2D$ etc. 30 etc.
3659.420	P		10.20	13.59		$2p\ ^2P^o$—$33d\ ^2D$ etc. 31 etc.
3658.639	P		10.20	13.59		$2p\ ^2P^o$—$34d\ ^2D$ etc. 32 etc.
3657.923	P		10.20	13.59		$2p\ ^2P^o$—$35d\ ^2D$ etc. 33 etc.
3657.267	P		10.20	13.59		$2p\ ^2P^o$—$36d\ ^2D$ etc. 34 etc.
3656.663	P		10.20	13.59		$2p\ ^2P^o$—$37d\ ^2D$ etc. 35 etc.
3656.107	P		10.20	13.59		$2p\ ^2P^o$—$38d\ ^2D$ etc. 36 etc.

H I – Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
3651.822	P		10.20	13.59		$2p\ ^2P^o$—$50d\ ^2D$ etc. 37 etc.
3645.979	A		10.20	13.60		$2p\ ^2P^o$—Limit etc. 38
18751.210	A		12.09	12.75	1½–0½	$3p\ ^2P^o$— $4s\ ^2S$ 39.01
18750.830	A		12.09	12.75	0½–0½	
18750.724	A		12.09	12.75	0½–1½	$3s\ ^2S$ — $4p\ ^2P^o$ 39.02
18750.883	A		12.09	12.75	0½–0½	
18751.015	A		12.09	12.75		$3d\ ^2D$ — $4f\ ^2F^o$ etc. 39 etc.
12818.140	A		12.09	13.05	1½–0½	$3p\ ^2P^o$— $5s\ ^2S$ 40.01
12817.962	A		12.09	13.05	0½–0½	
12817.945	A		12.09	13.05	0½–1½	$3s\ ^2S$ — $5p\ ^2P^o$ 40.02
12817.983	A		12.09	13.05	0½–0½	
12818.082	A		12.09	13.05		$3d\ ^2D$ — $5f\ ^2F^o$ etc. 40 etc.
10938.126	A		12.09	13.22	1½–0½	$3p\ ^2P^o$— $6s\ ^2S$ 41.01
10937.998	A		12.09	13.22	0½–0½	
10937.995	A		12.09	13.22	0½–1½	$3s\ ^2S$ — $6p\ ^2P^o$ 41.02
10938.012	A		12.09	13.22	0½–0½	
10938.095	A		12.09	13.22		$3d\ ^2D$ — $6f\ ^2F^o$ etc. 41 etc.
10049.374	A		12.09	13.32		$3d\ ^2D$ — $7f\ ^2F^o$ etc. 42 etc.
9545.972	A		12.09	13.39		$3d\ ^2D$ — $8f\ ^2F^o$ etc. 43 etc.
9229.015	A		12.09	13.43		$3d\ ^2D$ — $9f\ ^2F^o$ etc. 44 etc.
9014.911	A		12.09	13.46		$3d\ ^2D$ —$10f\ ^2F^o$ etc. 45 etc.
8862.784	A		12.09	13.49		$3d\ ^2D$ —$11f\ ^2F^o$ etc. 46 etc.
8750.473	A		12.09	13.50		$3d\ ^2D$ —$12f\ ^2F^o$ etc. 47 etc.

H I—Continued

I A	Ref	Int	E P Low	E P High	*J*	Multiplet No.
Air						
8665.019	A		12.09	13.52		$3d\ ^2D$ — $13f\ ^2F^\circ$ etc. 48 etc.
8598.392	A		12.09	13.53		$3d\ ^2D$ — $14f\ ^2F^\circ$ etc. 49 etc.
8545.383	A		12.09	13.54		$3d\ ^2D$ — $15f\ ^2F^\circ$ etc. 50 etc.
8502.483	A		12.09	13.54		$3d\ ^2D$ — $16f\ ^2F^\circ$ etc. 51 etc.
8467.254	A		12.09	13.55		$3d\ ^2D$ — $17f\ ^2F^\circ$ etc. 52 etc.
8437.955	A		12.09	13.56		$3d\ ^2D$ — $18f\ ^2F^\circ$ etc. 53 etc.
8413.318	A		12.09	13.56		$3d\ ^2D$ — $19f\ ^2F^\circ$ etc. 54 etc.
8392.397	A		12.09	13.56		$3d\ ^2D$ — $20f\ ^2F^\circ$ etc. 55 etc.
8374.476	P		12.09	13.57		$3d\ ^2D$ — $21f\ ^2F^\circ$ etc. 56 etc.
8359.004	P		12.09	13.57		$3d\ ^2D$ — $22f\ ^2F^\circ$ etc. 57 etc.
8345.553	P		12.09	13.57		$3d\ ^2D$ — $23f\ ^2F^\circ$ etc. 58 etc.
8333.784	P		12.09	13.57		$3d\ ^2D$ — $24f\ ^2F^\circ$ etc. 59 etc.
8323.426	P		12.09	13.58		$3d\ ^2D$ — $25f\ ^2F^\circ$ etc. 60 etc.
8314.261	P		12.09	13.58		$3d\ ^2D$ — $26f\ ^2F^\circ$ etc. 61 etc.
8306.112	P		12.09	13.58		$3d\ ^2D$ — $27f\ ^2F^\circ$ etc. 62 etc.
8298.836	P		12.09	13.58		$3d\ ^2D$ — $28f\ ^2F^\circ$ etc. 63 etc.
8292.308	P		12.09	13.58		$3d\ ^2D$ — $29f\ ^2F^\circ$ etc. 64 etc.
8286.432	P		12.09	13.58		$3d\ ^2D$ — $30f\ ^2F^\circ$ etc. 65 etc.
8281.123	P		12.09	13.58		$3d\ ^2D$ — $31f\ ^2F^\circ$ etc. 66 etc.

H I—Continued

I A	Ref	Int	E P Low	E P High	*J*	Multiplet No.
Air						
8276.309	P		12.09	13.58		$3d\ ^2D$ — $32f\ ^2F^\circ$ etc. 67 etc.
8271.932	P		12.09	13.59		$3d\ ^2D$ — $33f\ ^2F^\circ$ etc. 68 etc.
8267.938	P		12.09	13.59		$3d\ ^2D$ — $34f\ ^2F^\circ$ etc. 69 etc.
8264.286	P		12.09	13.59		$3d\ ^2D$ — $35f\ ^2F^\circ$ etc. 70 etc.
8260.936	P		12.09	13.59		$3d\ ^2D$ — $36f\ ^2F^\circ$ etc. 71 etc.
8257.856	P		12.09	13.59		$3d\ ^2D$ — $37f\ ^2F^\circ$ etc. 72 etc.
8255.019	P		12.09	13.59		$3d\ ^2D$ — $38f\ ^2F^\circ$ etc. 73 etc.
.....	.....	.....	.....	.....	.....	.....
8233.208	A		12.09	13.59		$3d\ ^2D$ — $50f\ ^2F^\circ$ etc. 74 etc.
.....	.....	.....	.....	.....	.....	.....
8203.568	A		12.09	13.60		$3d\ ^2D$ —Limit 75
40511.92	A		12.75	13.05	$1\frac{1}{2}-0\frac{1}{2}$	$4p\ ^2P^\circ$ — $5s\ ^2S$
40511.17	A		12.75	13.05	$0\frac{1}{2}-0\frac{1}{2}$	76.01
40510.87	A		12.75	13.05	$0\frac{1}{2}-1\frac{1}{2}$	$4s\ ^2S$ — $5p\ ^2P^\circ$
40511.28	A		12.75	13.05	$0\frac{1}{2}-0\frac{1}{2}$	76.02
40511.579	A		12.75	13.05		$4f\ ^2F^\circ$ — $5g\ ^2G$ 76
26251.57	A		12.75	13.22	$1\frac{1}{2}-0\frac{1}{2}$	$4p\ ^2P^\circ$ — $6s\ ^2S$
26251.27	A		12.75	13.22	$0\frac{1}{2}-0\frac{1}{2}$	77.01
26251.21	A		12.75	13.22	$0\frac{1}{2}-1\frac{1}{2}$	$4s\ ^2S$ — $6p\ ^2P^\circ$
26251.31	A		12.75	13.22	$0\frac{1}{2}-0\frac{1}{2}$	77.02
26251.512	A		12.75	13.22		$4f\ ^2F^\circ$ — $6g\ ^2G$ 77
21655.287	A		12.75	13.32		$4f\ ^2F^\circ$ — $7g\ ^2G$ etc. 78 etc.

H I – Continued

I A	Ref	Int	E P Low	E P High	*J*	Multiplet No.
Air						
19445.564	A		12.75	13.39		$4f\ ^2F^{\circ}$—$8g\ ^2G$ etc. 79 etc.
18174.123	A		12.75	13.43		$4f\ ^2F^{\circ}$—$9g\ ^2G$ etc. 80 etc.
17362.110	A		12.75	13.46		$4f\ ^2F^{\circ}$—$10g\ ^2G$ etc. 81 etc.
16806.522	A		12.75	13.49		$4f\ ^2F^{\circ}$—$11g\ ^2G$ etc. 82 etc.
16407.193	A		12.75	13.50		$4f\ ^2F^{\circ}$—$12g\ ^2G$ etc. 83 etc.
16109.314	A		12.75	13.52		$4f\ ^2F^{\circ}$—$13g\ ^2G$ etc. 84 etc.
15880.543	A		12.75	13.53		$4f\ ^2F^{\circ}$—$14g\ ^2G$ etc. 85 etc.
15700.663	A		12.75	13.54		$4f\ ^2F^{\circ}$—$15g\ ^2G$ etc. 86 etc.
15556.450	A		12.75	13.54		$4f\ ^2F^{\circ}$—$16g\ ^2G$ etc. 87 etc.
15438.922	A		12.75	13.55		$4f\ ^2F^{\circ}$—$17g\ ^2G$ etc. 88 etc.
15341.791	A		12.75	13.56		$4f\ ^2F^{\circ}$—$18g\ ^2G$ etc. 89 etc.
15260.539	A		12.75	13.56		$4f\ ^2F^{\circ}$—$19g\ ^2G$ etc. 90 etc.
15191.845	A		12.75	13.56		$4f\ ^2F^{\circ}$—$20g\ ^2G$ etc. 91 etc.
15133.225	P		12.75	13.57		$4f\ ^2F^{\circ}$—$21g\ ^2G$ etc. 92 etc.
15082.777	P		12.75	13.57		$4f\ ^2F^{\circ}$—$22g\ ^2G$ etc. 93 etc.
15039.040	P		12.75	13.57		$4f\ ^2F^{\circ}$—$23g\ ^2G$ etc. 94 etc.
15000.862	P		12.75	13.57		$4f\ ^2F^{\circ}$—$24g\ ^2G$ etc. 95 etc.
14967.131	P		12.75	13.58		$4f\ ^2F^{\circ}$—$25g\ ^2G$ etc. 96 etc.
14937.730	P		12.75	13.58		$4f\ ^2F^{\circ}$—$26g\ ^2G$ etc. 97 etc.
14911.447	P		12.75	13.58		$4f\ ^2F^{\circ}$—$27g\ ^2G$ etc. 98 etc.

H I – Continued

I A	Ref	Int	E P Low	E P High	*J*	Multiplet No.
Air						
14888.010	P		12.75	13.58		$4f\ ^2F^{\circ}$—$28g\ ^2G$ etc. 99 etc.
14867.017	P		12.75	13.58		$4f\ ^2F^{\circ}$—$29g\ ^2G$ etc. 100 etc.
14848.142	P		12.75	13.58		$4f\ ^2F^{\circ}$—$30g\ ^2G$ etc. 101 etc.
.....	.....	.....	.....	.....	.....	.....
14678.114	P		12.75	13.59		$4f\ ^2F^{\circ}$—$50g\ ^2G$ etc. 102 etc.
74578.80	A		13.05	13.22	1½–0½	$5p\ ^2P^{\circ}$—$6s\ ^2S$ 103.01
74578.250	A		13.05	13.22		$5g\ ^2G$—$6h\ ^2H^{\circ}$ 103
46525.098	A		13.05	13.32		$5g\ ^2G$—$7h\ ^2H^{\circ}$ etc. 104 etc.
37395.370	A		13.05	13.39		$5g\ ^2G$—$8h\ ^2H^{\circ}$ etc. 105 etc.
32960.929	A		13.05	13.43		$5g\ ^2G$—$9h\ ^2H^{\circ}$ etc. 106 etc.
30383.737	A		13.05	13.46		$5g\ ^2G$—$10h\ ^2H^{\circ}$ etc. 107 etc.
28722.126	A		13.05	13.49		$5g\ ^2G$—$11h\ ^2H^{\circ}$ etc. 108 etc.
27575.156	A		13.05	13.50		$5g\ ^2G^{\circ}$—$12h\ ^2H^{\circ}$ etc. 109 etc.
26744.018	A		13.05	13.52		$5g\ ^2G^{\circ}$—$13h\ ^2H^{\circ}$ etc. 110 etc.
26119.352	A		13.05	13.53		$5g\ ^2G$—$14h\ ^2H^{\circ}$ etc. 111 etc.
25636.276	A		13.05	13.54		$5g\ ^2G$—$15h\ ^2H^{\circ}$ etc. 112 etc.
25254.015	A		13.05	13.54		$5g\ ^2G$—$16h\ ^2H^{\circ}$ etc. 113 etc.
24945.738	A		13.05	13.55		$5g\ ^2G$—$17h\ ^2H^{\circ}$ etc. 114 etc.
24693.137	A		13.05	13.56		$5g\ ^2G$—$18h\ ^2H^{\circ}$ etc. 115 etc.

H I—Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
24483.323	A		13.05	13.56		$5g\ ^2\mathrm{G} - 19h\ ^2\mathrm{H}^\circ$ etc. 116 etc.
24306.989	A		13.05	13.56		$5g\ ^2\mathrm{G} - 20h\ ^2\mathrm{H}^\circ$ etc. 117 etc.
23017.983	P		13.05	13.59		$5g\ ^2\mathrm{G} - 50h\ ^2\mathrm{H}^\circ$ etc. 118 etc.
123685.270	A		13.22	13.32		$6h\ ^2\mathrm{H}^\circ - 7i\ ^2\mathrm{I}$ etc. 119 etc.
75004.488	A		13.22	13.39		$6h\ ^2\mathrm{H}^\circ - 8i\ ^2\mathrm{I}$ etc. 120 etc.
59066.034	A		13.22	13.43		$6h\ ^2\mathrm{H}^\circ - 9i\ ^2\mathrm{I}$ etc. 121 etc.
51272.598	A		13.22	13.46		$6h\ ^2\mathrm{H}^\circ - 10i\ ^2\mathrm{I}$ etc. 122 etc.
46712.353	A		13.22	13.49		$6h\ ^2\mathrm{H}^\circ - 11i\ ^2\mathrm{I}$ etc. 123 etc.
43752.617	A		13.22	13.50		$6h\ ^2\mathrm{H}^\circ - 12i\ ^2\mathrm{I}$ etc. 124 etc.
41696.572	A		13.22	13.52		$6h\ ^2\mathrm{H}^\circ - 13i\ ^2\mathrm{I}$ etc. 125 etc.
40197.716	A		13.22	13.53		$6h\ ^2\mathrm{H}^\circ - 14i\ ^2\mathrm{I}$ etc. 126 etc.
39064.836	A		13.22	13.54		$6h\ ^2\mathrm{H}^\circ - 15i\ ^2\mathrm{I}$ etc. 127 etc.
38184.101	A		13.22	13.54		$6h\ ^2\mathrm{H}^\circ - 16i\ ^2\mathrm{I}$ etc. 128 etc.
37483.714	A		13.22	13.55		$6h\ ^2\mathrm{H}^\circ - 17i\ ^2\mathrm{I}$ etc. 129 etc.
36916.270	A		13.22	13.56		$6h\ ^2\mathrm{H}^\circ - 18i\ ^2\mathrm{I}$ etc. 130 etc.
36449.295	A		13.22	13.56		$6h\ ^2\mathrm{H}^\circ - 19i\ ^2\mathrm{I}$ etc. 131 etc.
36059.849	A		13.22	13.56		$6h\ ^2\mathrm{H}^\circ - 20i\ ^2\mathrm{I}$ etc. 132 etc.
33293.900	P		13.22	13.59		$6h\ ^2\mathrm{H}^\circ - 50i\ ^2\mathrm{I}$ 133
190567.045	A		13.32	13.39		$7i\ ^2\mathrm{I} - 8k\ ^2\mathrm{K}^\circ$ etc. 134 etc.

H I—Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
113056.141	A		13.32	13.43		$7i\ ^2\mathrm{I} - 9k\ ^2\mathrm{K}^\circ$ etc. 135 etc.
87576.773	A		13.32	13.46		$7i\ ^2\mathrm{I} - 10k\ ^2\mathrm{K}^\circ$ etc. 136 etc.
75060.591	A		13.32	13.49		$7i\ ^2\mathrm{I} - 11k\ ^2\mathrm{K}^\circ$ etc. 137 etc.
67701.453	A		13.32	13.50		$7i\ ^2\mathrm{I} - 12k\ ^2\mathrm{K}^\circ$ etc. 138 etc.
62902.015	A		13.32	13.52		$7i\ ^2\mathrm{I} - 13k\ ^2\mathrm{K}^\circ$ etc. 139 etc.
59552.203	A		13.32	13.53		$7i\ ^2\mathrm{I} - 14k\ ^2\mathrm{K}^\circ$ etc. 140 etc.
57099.058	A		13.32	13.54		$7i\ ^2\mathrm{I} - 15k\ ^2\mathrm{K}^\circ$ etc. 141 etc.
55236.826	A		13.32	13.54		$7i\ ^2\mathrm{I} - 16k\ ^2\mathrm{K}^\circ$ etc. 142 etc.
53783.083	A		13.32	13.55		$7i\ ^2\mathrm{I} - 17k\ ^2\mathrm{K}^\circ$ etc. 143 etc.
52622.492	A		13.32	13.56		$7i\ ^2\mathrm{I} - 18k\ ^2\mathrm{K}^\circ$ etc. 144 etc.
51678.714	A		13.32	13.56		$7i\ ^2\mathrm{I} - 19k\ ^2\mathrm{K}^\circ$ etc. 145 etc.
50899.318	A		13.32	13.56		$7i\ ^2\mathrm{I} - 20k\ ^2\mathrm{K}^\circ$ etc. 146 etc.
277958.040	A		13.39	13.43		$8k\ ^2\mathrm{K}^\circ - 9l\ ^2\mathrm{L}$ etc. 147 etc.
162046.877	A		13.39	13.46		$8k\ ^2\mathrm{K}^\circ - 10l\ ^2\mathrm{L}$ etc. 148 etc.
123837.927	A		13.39	13.49		$8k\ ^2\mathrm{K}^\circ - 11l\ ^2\mathrm{L}$ etc. 149 etc.
105006.373	A		13.39	13.50		$8k\ ^2\mathrm{K}^\circ - 12l\ ^2\mathrm{L}$ etc. 150 etc.
93894.586	A		13.39	13.52		$8k\ ^2\mathrm{K}^\circ - 13l\ ^2\mathrm{L}$ etc. 151 etc.
86621.417	A		13.39	13.53		$8k\ ^2\mathrm{K}^\circ - 14l\ ^2\mathrm{L}$ etc. 152 etc.
81526.684	A		13.39	13.54		$8k\ ^2\mathrm{K}^\circ - 15l\ ^2\mathrm{L}$ etc. 153 etc.

H I—Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
388592.763	A		13.43	13.46		$9l\ ^2L$ — $10m\ ^2M^\circ$ etc. 154 etc.
223343.698	A		13.43	13.49		$9l\ ^2L$ — $11m\ ^2M^\circ$ etc. 155 etc.
168760.287	A		13.43	13.50		$9l\ ^2L$ — $12m\ ^2M^\circ$ etc. 156 etc.

H I—Continued

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
141792.199	A		13.43	13.52		$9l\ ^2L$ — $13m\ ^2M^\circ$ etc. 157 etc.
125836.471	A		13.43	13.53		$9l\ ^2L$ — $14m\ ^2M^\circ$ etc. 158 etc.
115363.473	A		13.43	13.54		$9l\ ^2L$ — $15m\ ^2M^\circ$ etc. 159 etc.

NSRDS-NBS 3, SECTION 6

DEUTERIUM AND TRITIUM Z = 1

A	D and T	Atomic Energy Levels
B	D	Multiplet Table
B	T	Multiplet Table

DEUTERIUM AND TRITIUM

Part A — D AND T

1 electron — $Z = 1$

Ground state $1s\ ^2S_{0 1/2}$

$1s\ ^2S_{0 1/2}$ D($^2_1$H I)	**109708.608** cm^{-1}, 911.506 Å (Vac)	I P (D)13.602 eV
$1s\ ^2S_{0 1/2}$ T($^3_1$H I)	**109718.538** cm^{-1}, 911.423 Å (Vac)	I P (T)13.603 eV

The energy levels are quoted from the paper by Garcia and Mack, who calculated "Energy Levels and Line Tables for One-Electron Atomic Spectra" for the spectra of the hydrogen isoelectronic sequence H I to Ca XX. For D and T the level values are determined tc six decimal places to $n = 50$, with R = 109707.420 (D) and 109717.350 (T), respectively.

In the present table the calculated values have been rounded off to three decimals. Intervals are given to four places only in cases of resolved levels. For further details users should consult the original paper, in which the formulas and constants are fully described.

REFERENCE

J. D. Garcia and J. E. Mack, J. Opt. Soc. Am. **55**, No. 6, 654–685 (1965). I P, T, C L.

Config.	Desig.	J	Level (D)	Level (T)	Interval
1s	1s ²S	0½	0.000	0.000	
2p	2p ²P°	0½	82281.296	82288.743	0.0353
2s	2s ²S	0½	82281.331	82288.779	0.3307
2p	2p ²P°	1½	82281.662	82289.109	
3p	3p ²P°	0½	97518.732	97527.559	0.0105
3s	3s ²S	0½	97518.743	97527.569	0.0978
3d	3d ²D	1½	97518.840	97527.667	0.0002
3p	3p ²P°	1½	97518.841	97527.667	0.0360
3d	3d ²D	2½	97518.877	97527.703	
4p	4p ²P°	0½	102851.820	102861.129	0.0044
4s	4s ²S	0½	102851.824	102861.133	0.041
4p, 4d	4d ²D 4p ²P°	1½	102851.866	102861.175	0.015
4d, 4f	4d ²D 4f ²F°	2½	102851.881	102861.190	0.0076
4f	4f ²F°	3½	102851.888	102861.198	
5p	5p ²P°	0½	105320.271	105329.804	0.0023
5s	5s ²S	0½	105320.274	105329.806	0.0211
5p, 5d	5d ²D 5p ²P°	1½	105320.295	105329.827	0.0078
5d, 5f	5d ²D 5f ²F°	2½	105320.303	105329.835	0.0039
5f, 5g	5g ²G 5f ²F°	3½	105320.306	105329.839	0.0023
5g	5g ²G	4½	105320.309	105329.841	

Config.	Desig.	J	Level (D)	Level (T)	Interval
6p	6p ²P°	0½	106661.156	106670.810	0.0013
6s	6s ²S	0½	106661.157	106670.811	0.0122
6p, 6d	6d ²D 6p ²P°	1½	106661.169	106670.823	0.0045
6d, 6f	6d ²D 6f ²F°	2½	106661.174	106670.828	0.0022
6f, 6g	6g ²G 6f ²F°	3½	106661.176	106670.830	0.0014
6g, 6h	6g ²G 6h ²H°	4½	106661.178	106670.831	0.0009
6h	6h ²H°	5½	106661.178	106670.832	
7p	7p ²P°	0½	107469.666	107479.393	0.0018
7s	7s ²S	0½	107469.667	107479.394	0.0077
7p, 7d	7d ²D 7p ²P°	1½	107469.674	107479.401	0.0028
7d, 7f	7d ²D 7f ²F°	2½	107469.677	107479.404	0.0014
7f, 7g	7g ²G 7f ²F°	3½	107469.679	107479.406	0.0009
7g, 7h	7g ²G 7h ²H°	4½	107469.679	107479.406	0.0006
7h, 7i	7i ²I 7h ²H°	5½	107469.680	107479.407	0.0004
7i	7i ²I	6½	107469.680	107479.407	
8p	8p ²P°	0½	107994.419	108004.194	0.0006
8s	8s ²S	0½	107994.420	108004.194	0.0052
8p, 8d	8d ²D 8p ²P°	1½	107994.425	108004.199	0.0019
8d, 8f	8d ²D 8f ²F°	2½	107994.427	108004.201	0.0009
8f, 8g	8g ²G 8f ²F°	3½	107994.428	108004.202	0.0006
8g, 8h	8g ²G 8h ²H°	4½	107994.428	108004.203	0.0004
8h, 8i	8i ²I 8h ²H°	5½	107994.429	108004.203	0.0003
8i, 8k	8i ²I 8k ²K°	6½	107994.429	108004.203	0.0002
8k	8k ²K°	7½	107994.429	108004.204	

D and T—Continued

Config.	Desig.	*J*	D Level	T Level	Interval
9*p*	9*p* ²P°	0½	108354.188	108363.995	0.0004
9*s*	9*s* ²S	0½	108354.188	108363.995	0.0036
9*p*, 9*d*	9*d* ²D 9*p* ²P°	1½	108354.192	108363.999	0.0013
9*d*, 9*f*	9*d* ²D 9*f* ²F°	2½	108354.193	108364.000	0.0007
9*f*, 9*g*	9*g* ²G 9*f* ²F°	3½	108354.194	108364.001	0.0004
9*g*, 9*h*	9*g* ²G 9*h* ²H°	4½	108354.194	108364.001	0.0003
9*h*, 9*i*	9*i* ²I 9*h* ²H°	5½	108354.195	108364.002	0.0002
9*i*, 9*k*	9*i* ²I 9*k* ²K°	6½	108354.195	108364.002	0.0001
9*k*, 9*l*	9*l* ²L 9*k* ²K°	7½	108354.195	108364.002	0.0001
9*l*	9*l* ²L	8½	108354.195	108364.002	

Config.	Desig.	*J*	D Level	T Level	Interval
10*p*	10*p* ²P°	0½	108611.528	108621.359	0.0003
10*s*	10*s* ²S	0½	108611.529	108621.359	0.0026
10*p*, 10*d*	10*d* ²D 10*p* ²P°	1½	108611.531	108621.362	0.0010
10*d*, 10*f*	10*d* ²D 10*f* ²F°	2½	108611.532	108621.363	0.0005
10*f*, 10*g*	10*g* ²G 10*f* ²F°	3½	108611.533	108621.363	0.0003
10*g*, 10*h*	10*g* ²G 10*h* ²H°	4½	108611.533	108621.363	0.0002
10*h*, 10*i*	10*i* ²I 10*h* ²H°	5½	108611.533	108621.364	0.0001
10*i*, 10*k*	10*i* ²I 10*k* ²K°	6½	108611.533	108621.364	0.0001
10*k*, 10*l*	10*l* ²L 10*k* ²K°	7½	108611.533	108621.364	0.0001
10*l*, 10*m*	10*l* ²L 10*m* ²M°	8½	108611.534	108621.364	0.0001
10*m*	10*m* ²M°	9½	108611.534	108621.364	
	....	....	....	....	
	Limit		109708.608	109718.538	

February 1972.

DEUTERIUM

Part B

$D(^2_1H\ \text{I})$

I P 13.602 eV   Limit 109708.608 cm⁻¹   911.506 Å (Vac)

Anal A   List C   February 1972

REFERENCE

A J. D. Garcia and J. E. Mack, J. Opt. Soc. Am. **55**, No. 6, 654–685 (1965). I P, T, C L; W L 925.9737 Å to 123652.691 Å. For higher values of *n* where the terms are unresolved, the wavelength derived from the statistical mean of the components is quoted.

New Multiplet Numbers have been assigned.

D

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Vac						
1215.3376	A		0.00	10.20	0½–1½	$1s\ ^2S - 2p\ ^2P^\circ$
1215.3430	A		0.00	10.20	0½–0½	UV 1
1025.4429	A		0.00	12.09	0½–1½	$1s\ ^2S - 3p\ ^2P^\circ$
1025.4401	A		0.00	12.09	0½–0½	UV 2
972.2721	A		0.00	12.75	0½–1½	$1s\ ^2S - 4p\ ^2P^\circ$
972.2725	A		0.00	12.75	0½–0½	UV 3
949.4846	A		0.00	13.06	0½–1½	$1s\ ^2S - 5p\ ^2P^\circ$
949.4848	A		0.00	13.06	0½–0½	UV 4
937.5483	A		0.00	13.22	0½–1½	$1s\ ^2S - 6p\ ^2P^\circ$
937.5484	A		0.00	13.22	0½–0½	UV 5
930.4951	A		0.00	13.32	0½–	$1s\ ^2S - 7p\ ^2P^\circ$ UV 6
925.9737	A		0.00	13.39	0½–	$1s\ ^2S - 8p\ ^2P^\circ$ UV 7
....	....	....	....	....	....	....
911.5055	A		0.00	13.60	0½–	$1s\ ^2S$ — Limit UV 8

D

I A	Ref	Int	E P Low	E P High	J	Multiplet No.
Air						
6561.0104	A	Dα	10.20	12.09		$2p\ ^2P^\circ - 3d\ ^2D$ etc. 1 etc.
4860.0028	A	Dβ	10.20	12.75		$2p\ ^2P^\circ - 4d\ ^2D$ etc. 2 etc.
4339.2829	A	Dγ	10.20	13.06		$2p\ ^2P^\circ - 5d\ ^2D$ etc. 3 etc.
4100.6191	A	Dδ	10.20	13.22		$2p\ ^2P^\circ - 6d\ ^2D$ etc. 4 etc.
3968.9922	A	Dε	10.20	13.32		$2p\ ^2P^\circ - 7d\ ^2D$ etc. 5 etc.
3887.9909	A		10.20	13.39		$2p\ ^2P^\circ - 8d\ ^2D$ etc. 6 etc.
18745.914	A		12.09	12.75		$3d\ ^2D - 4f\ ^2F^\circ$ etc. 7 etc.
12814.595	A		12.09	13.06		$3d\ ^2D - 5f\ ^2F^\circ$ etc. 8 etc.
10935.120	A		12.09	13.22		$3d\ ^2D - 6f\ ^2F^\circ$ etc. 9 etc.
10046.640	A		12.09	13.32		$3d\ ^2D - 7f\ ^2F^\circ$ etc. 10 etc.
9543.375	A		12.09	13.39		$3d\ ^2D - 8f\ ^2F^\circ$ etc. 11 etc.

TRITIUM

Part B T($^3_1$H I)

I P 13.603 eV Limit 109718.538 cm^{-1} 911.423 Å (Vac)

Anal A List D February 1972

REFERENCE

A J. D. Garcia and J. E. Mack, J. Opt. Soc. Am. **55**, No. 6, 654–685 (1965). I P, T, C L; W L 925.8900 Å to 123641.500 Å
For higher values of *n* where the terms are unresolved, the wavelength derived from the statistical mean of the components is quoted.

T

I A	Ref	Int	E P Low	E P High	*J*	Multiplet No.
Vac						
1215.2276	A		0.00	10.20	0½–1½	1*s* ^{2}S — 2*p* ^{2}P°
1215.2330	A		0.00	10.20	0½–0½	UV 1
1025.3501	A		0.00	12.09	0½–1½	1*s* ^{2}S — 3*p* ^{2}P°
1025.3512	A		0.00	12.09	0½–0½	UV 2
972.1841	A		0.00	12.75	0½–1½	1*s* ^{2}S — 4*p* ^{2}P°
972.1845	A		0.00	12.75	0½–0½	UV 3
949.3987	A		0.00	13.06	0½–1½	1*s* ^{2}S — 5*p* ^{2}P°
949.3989	A		0.00	13.06	0½–0½	UV 4
937.4635	A		0.00	13.23	0½–1½	1*s* ^{2}S — 6*p* ^{2}P°
937.4636	A		0.00	13.23	0½–0½	UV 5
....	....	....	....	....	....	....
911.4230	A		0.00	13.60		1*s* ^{2}S — Limit
						UV 6

T

I A	Ref	Int	E P Low	E P High	*J*	Multiplet No.
Air						
6560.4166	A	Tα	10.20	12.09		2*p* ^{2}P° — 3*d* ^{2}D
						etc. 1 etc.
4859.5630	A	Tβ	10.20	12.75		2*p* ^{2}P° — 4*d* ^{2}D
						etc. 2 etc.
4338.8902	A	Tγ	10.20	13.06		2*p* ^{2}P° — 5*d* ^{2}D
						etc. 3 etc.
4100.2479	A	Tδ	10.20	13.23		2*p* ^{2}P° — 6*d* ^{2}D
						etc. 4 etc.
3968.6329	A	Tε	10.20	13.33		2*p* ^{2}P° — 7*d* ^{2}D
						etc. 5 etc.

Publications in the National Standard Reference Data Series National Bureau of Standards

You may use this listing as your order form by checking the proper box of the publication(s) you desire or by providing the full identification of the publication you wish to purchase. The full letter symbols with each publication number and full title of the publication and author must be given in your order, e.g. NSRDS–NBS–21, **Kinetic Data on Gas Phase Unimolecular Reactions,** by S. W. Benson and H. E. O'Neal.

Pay for publications by check, money order, or Superintendent of Documents coupons or deposit account. Make checks and money orders payable to Superintendent of Documents. Foreign remittances should be made either by international money order or draft on an American bank. Postage stamps are not acceptable.

No charge is made for postage to destinations in the United States and possessions, Canada, Mexico, and certain Central and South American countries. To other countries, payments for documents must cover postage. Therefore, one-fourth of the price of the publication should be added for postage.

Send your order together with remittance to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

- ☐ NSRDS-NBS 1, **National Standard Reference Data System—Plan of Operation,** by E. L. Brady and M. B. Wallenstein, 1964 (15 cents), SD Catalog No. C13.48:1.
- ☐ NSRDS-NBS 2, **Thermal Properties of Aqueous Uni-univalent Electrolytes,** by V. B. Parker, 1965 (45 cents), SD Catalog No. C13.48:2.
- ☐ NSRDS-NBS 3, Sec. 1, **Selected Tables of Atomic Spectra, Atomic Energy Levels and Multiplet Tables, Si II, Si III, Si IV,** by C. E. Moore, 1965 (35 cents), SD Catalog No. C13.48:3/Sec.1.
- ☐ NSRDS-NBS 3, Sec. 2, **Selected Tables of Atomic Spectra, Atomic Energy Levels and Multiplet Tables, Si I,** by C. E. Moore, 1967 (20 cents), SD Catalog No. C13.48:3/Sec.2.
- ☐ NSRDS-NBS 3, Sec. 3, **Selected Tables of Atomic Spectra, Atomic Energy Levels and Multiplet Tables, C I, C II, C III, C IV, C V, C VI,** by C. E. Moore, 1970 ($1), SD Catalog No. C13.48:3/Sec.3.
- ☐ NSRDS-NBS 3, Sec. 4, **Selected Tables of Atomic Spectra, Atomic Energy Levels and Multiplet Tables, N IV, N V, N VI, N VII,** by C. E. Moore, 1971 (55 cents), SD Catalog No. C13.48:3/Sec.4.
- ☐ NSRDS–NBS 3, Sec. 6, **Selected Tables of Atomic Spectra, Atomic Energy Levels and Multiplet Tables, H I, D, T,** by C. E. Moore, 1971 (In press), SD Catalog No. C13.48:3/Sec. 6.
- ☐ NSRDS-NBS 4, **Atomic Transition Probabilities, Vol. I, Hydrogen Through Neon,** by W. L. Wiese, M. W. Smith, and B. M. Glennon, 1966 ($2.50), SD Catalog No. C13.48:4/Vol. I.
- ☐ NSRDS-NBS 5, **The Band Spectrum of Carbon Monoxide,** by P. H. Krupenie, 1966 (70 cents), SD Catalog No. C13.48:5.
- ☐ NSRDS-NBS 6, **Tables of Molecular Vibrational Frequencies, Part 1,** by T. Shimanouchi, 1967 (40 cents), SD Catalog No. C13.48:6/Pt.1. Superseded by NSRDS-NBS 39.
- ☐ NSRDS-NBS 7, **High Temperature Properties and Decomposition of Inorganic Salts, Part 1. Sulfates,** by K. H. Stern and E. L. Weise, 1966 (35 cents), SD Catalog No. C13.48:7/Pt.1.
- ☐ NSRDS-NBS 8, **Thermal Conductivity of Selected Materials,** by R. W. Powell, C. Y. Ho,

and P. E. Liley, 1966 ($3). PB189698*

- ☐ NSRDS-NBS 9, **Tables of Bimolecular Gas Reactions,** by A. F. Trotman-Dickenson and G. S. Milne, 1967 ($2), SD Catalog No. C13.48:9.
- ☐ NSRDS-NBS 10, **Selected Values of Electric Dipole Moments for Molecules in the Gas Phase,** by R. D. Nelson, Jr., D. R. Lide, Jr., and A. A. Maryott, 1967 (40 cents), SD Catalog No. C13.48:10.
- ☐ NSRDS-NBS 11, **Tables of Molecular Vibrational Frequencies, Part 2,** by T. Shimanouchi, 1967 (30 cents), SD Catalog No. C13.48:11/Pt.2. Superseded by NSRDS-NBS 39.
- ☐ NSRDS-NBS 12, **Tables for the Rigid Asymmetric Rotor: Transformation Coefficients from Symmetric to Asymmetric Bases and Expectation Values of P_z^2, P_z^4, and P_z^6,** by R. H. Schwendeman, 1968 (60 cents), SD Catalog No. C13.48:12.
- ☐ NSRDS-NBS 13, **Hydrogenation of Ethylene on Metallic Catalysts,** by J. Horiuti and K. Miyahara, 1968 ($1), SD Catalog No. C13.48:13.
- ☐ NSRDS-NBS 14, **X-Ray Wavelengths and X-Ray Atomic Energy Levels,** by J. A. Bearden, 1967 (40 cents), SD Catalog No. C13.48:14.
- ☐ NSRDS-NBS 15, **Molten Salts: Vol. 1, Electrical Conductance, Density, and Viscosity Data,** by G. J. Janz, F. W. Dampier, G. R. Lakshminarayanan, P. K. Lorenz, and R. P. T. Tomkins, 1968 ($3), SD Catalog No. C13.48:15/Vol.1.
- ☐ NSRDS-NBS 16, **Thermal Conductivity of Selected Materials, Part 2,** by C. Y. Ho, R. W. Powell, and P. E. Liley, 1968 ($2), SD Catalog No. C13.48:16/Pt.2.
- ☐ NSRDS-NBS 17, **Tables of Molecular Vibrational Frequencies, Part 3,** by T. Shimanouchi, 1968 (30 cents), SD Catalog No. C13.48:17/Pt.3. Superseded by NSRDS-NBS 39.
- ☐ NSRDS-NBS 18, **Critical Analysis of the Heat-Capacity Data of the Literature and Evaluation of Thermodynamic Properties of Copper, Silver, and Gold from 0 to 300 K,** by G. T. Furukawa, W. G. Saba, and M. L. Reilly, 1968 (40 cents), SD Catalog No. C13.48:18.
- ☐ NSRDS-NBS 19, **Thermodynamic Properties of Ammonia as an Ideal Gas,** by L. Haar, 1968 (20 cents), SD Catalog No. C13.48:19.
- ☐ NSRDS-NBS 20, **Gas Phase Reaction Kinetics of Neutral Oxygen Species,** by H. S. Johnston, 1968 (45 cents), SD Catalog No. C13.48:20.
- ☐ NSRDS-NBS 21, **Kinetic Data on Gas Phase Unimolecular Reactions,** by S. W. Benson and H. E. O'Neal, 1970 ($7), SD Catalog No. C13.48:21.
- ☐ NSRDS-NBS 22, **Atomic Transition Probabilities, Vol. II, Sodium Through Calcium, A Critical Data Compilation,** by W. L. Wiese, M. W. Smith, and B. M. Miles, 1969 ($4.50), SD Catalog No. C13.48:22/Vol.II.
- ☐ NSRDS-NBS 23, **Partial Grotrian Diagrams of Astrophysical Interest,** by C. E. Moore and P. W. Merrill, 1968 (55 cents), SD Catalog No. C13.48:23.
- ☐ NSRDS-NBS 24, **Theoretical Mean Activity Coefficients of Strong Electrolytes in Aqueous Solutions from 0 to 100 °C,** by Walter J. Hamer, 1968 ($4.25), SD Catalog No. C13.48:24.
- ☐ NSRDS-NBS 25, **Electron Impact Excitation of Atoms,** by B. L. Moiseiwitsch and S. J. Smith, 1968 ($2), SD Catalog No. C13.48:25.
- ☐ NSRDS-NBS 26, **Ionization Potentials, Appearance Potentials, and Heats of Formation of Gaseous Positive Ions,** by J. L. Franklin, J. G. Dillard, H. M. Rosenstock, J. T. Herron, K. Draxl, and F. H. Field, 1969 ($4), SD Catalog No. C13.48:26.
- ☐ NSRDS-NBS 27, **Thermodynamic Properties of Argon from the Triple Point to 300 K at Pressures to 1000 Atmospheres,** by A. L. Gosman, R. D. McCarty, and J. G. Hust, 1969 ($1.25), SD Catalog No. C13.48:27.
- ☐ NSRDS-NBS 28, **Molten Salts: Vol. 2, Section 1. Electrochemistry of Molten Salts: Gibbs Free Energies and Excess Free Energies from Equilibrium-Type Cells,** by G. J. Janz and C. G. M. Dijkhuis; **Section 2. Surface Tension Data,** by G. J. Janz, G. R. Lakshminarayanan, R. P. T. Tomkins, and J. Wong, 1969 ($2.75), SD Catalog No. C13.48:28/Vol.2.
- ☐ NSRDS-NBS 29, **Photon Cross Sections, Attenuation Coefficients, and Energy Absorption Coefficients from 10 keV to 100 GeV,** by J. H. Hubbell, 1969 (75 cents), SD Catalog No. C13.48:29.
- ☐ NSRDS-NBS 30, **High Temperature Properties and Decomposition of Inorganic Salts, Part 2. Carbonates,** by K. H. Stern and E. L. Weise, 1969 (45 cents), SD Catalog No. C13.48:30/Pt.2.
- ☐ NSRDS-NBS 31, **Bond Dissociation Energies**

---

*Available from National Technical Information Service, Springfield, Virginia 22151.

in Simple Molecules, by B. deB. Darwent, 1970 (55 cents), SD Catalog No. C13.48:31.

- ☐ NSRDS-NBS 32, **Phase Behavior in Binary and Multicomponent Systems at Elevated Pressures: *n*-Pentane and Methane-*n*-Pentane,** by V. M. Berry and B. H. Sage, 1970 (70 cents), SD Catalog No. C13.48:32.
- ☐ NSRDS-NBS 33, **Electrolytic Conductance and the Conductances of the Halogen Acids in Water,** by W. J. Hamer and H. J. DeWane, 1970 (50 cents), SD Catalog No. C13.48:33.
- ☐ NSRDS-NBS 34, **Ionization Potentials and Ionization Limits Derived from the Analyses of Optical Spectra,** by C. E. Moore, 1970 (75 cents), SD Catalog No. C13.48:34.
- ☐ NSRDS-NBS 35, **Atomic Energy Levels as Derived from the Analyses of Optical Spectra, Vol. I, ^{1}H to ^{23}V; Vol. II, ^{24}Cr to ^{41}Nb; Vol. III, ^{42}Mo to ^{57}La, ^{72}Hf to ^{89}Ac,** by C. E. Moore, 1971 (Vol. I, $5; Vol. II, $4.25; Vol. III, $4.50), SD Catalog No. C13.48:35/Vols. I, II, and III.
- ☐ NSRDS-NBS 36, **Critical Micelle Concentrations of Aqueous Surfactant Systems,** by P. Mukerjee and K. J. Mysels, 1971 ($3.75), SD Catalog No. C13.48:36.
- ☐ NSRDS-NBS 37, **JANAF Thermochemical Tables, 2d Edition,** by D. R. Stull, H. Prophet, et al., 1971 ($9.75), SD Catalog No. C13.48:37.
- ☐ NSRDS-NBS 38, **Critical Review of Ultraviolet Photoabsorption Cross Sections for Molecules of Astrophysical and Aeronomic Interest,** by R. D. Hudson, 1971 ($1), SD Catalog No. C13.48:38.
- ☐ NSRDS–NBS 39, **Tables of Molecular Vibrational Frequencies, Consolidated Tables,** by T. Shimanouchi, 1972 (In press), SD Catalog No. C13.48:39.
- ☐ NSRDS–NBS 40, **A Multiplet Table of Astrophysical Interest** (Reprint of 1945 Edition), by C. E. Moore, 1972 ($2), SD Catalog No. C13.48:40.
- ☐ NSRDS–NBS 41, **Crystal Structure Transformations in Binary Halides,** by C. N. R. Rao, 1972 (In press), SD Catalog No. C13.48:41.
- ☐ NSRDS–NBS 42, **Selected Specific Rates of Reactions of the Solvated Electron in Alcohols,** by E. Watson, Jr., and S. Roy, 1972 (In press), SD Catalog No. C13.48:42.
- ☐ NSRDS–NBS 43, **Selected Specific Rates of Reactions of Transients from Water in Aqueous Solution,** by M. Anbar, M. Bambenek, and A. B. Ross, 1972 (In press), SD Catalog No. C13.48:43.
- ☐ NSRDS–NBS 44, **The Radiation Chemistry of Gaseous Ammonia,** by D. B. Peterson, 1972 (In press), SD Catalog No. C13.48:44.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1972 O—464-680

Announcement of New Publications in

National Standard Reference Data Series

Superintendent of Documents,
Government Printing Office,
Washington, D.C. 20402

Dear Sir:

Please add my name to the announcement list of new publications to be issued in the series: National Standard Reference Data Series—National Bureau of Standards.

Name ....

Company ....

Address ....

City .... State .... Zip Code ....

(Notification key N-337)

FORM NBS-114A (1-71)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NSRDS-NBS 3, Section 6	2. Gov't Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE Selected Tables of Atomic Spectra	5. Publication Date September 1972 6. Performing Organization Code
7. AUTHOR(S) Charlotte E. Moore	8. Performing Organization
9. PERFORMING ORGANIZATION NAME AND ADDRESS NATIONAL BUREAU OF STANDARDS DEPARTMENT OF COMMERCE WASHINGTON, D.C. 20234	10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address Same	13. Type of Report & Period Covered N/A 14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

The present publication is the sixth Section of a series being prepared in response to the persistent need for a current revision of two sets of tables containing data on atomic spectra as derived from analyses of optical spectra. As in the previous sections, Part A contains the atomic energy levels and Part B the multiplet tables. The spectra of hydrogen and of the isotopes deuterium and tritium are included. The form of presentation is described in detail in the text to Section 1.

17. KEY WORDS (Alphabetical order, separated by semicolons)
Atomic energy levels, H I, D, T; hydrogen spectra, H I, D, T; multiplet tables, H I, D, T; spectra H I, D, T; wavelengths, hydrogen spectra H I, D, T.

18. AVAILABILITY STATEMENT	19. SECURITY CLASS (THIS REPORT)	21. NO. OF PAGES
☒ UNLIMITED.	UNCLASSIFIED	36
☐ FOR OFFICIAL DISTRIBUTION. DO NOT RELEASE TO NTIS.	20. SECURITY CLASS (THIS PAGE) UNCLASSIFIED	22. Price 40 cents

USCOMM-DC 66244-P71

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH reports National Bureau of Standards research and development in physics, mathematics, and chemistry. Comprehensive scientific papers give complete details of the work, including laboratory data, experimental procedures, and theoretical and mathematical analyses. Illustrated with photographs, drawings, and charts. Includes listings of other NBS papers as issued.

Published in two sections, available separately:

- **Physics and Chemistry**

Papers of interest primarily to scientists working in these fields. This section covers a broad range of physical and chemical research, with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Issued six times a year. Annual subscription: Domestic, $9.50; $2.25 additional for foreign mailing.

- **Mathematical Sciences**

Studies and compilations designed mainly for the mathematician and theoretical physicist. Topics in mathematical statistics, theory of experiment design, numerical analysis, theoretical physics and chemistry, logical design and programming of computers and computer systems. Short numerical tables. Issued quarterly. Annual subscription: Domestic, $5.00; $1.25 additional for foreign mailing.

TECHNICAL NEWS BULLETIN

The best single source of information concerning the Bureau's measurement, research, developmental, cooperative, and publication activities, this monthly publication is designed for the industry-oriented individual whose daily work involves intimate contact with science and technology—*for engineers, chemists, physicists, research managers, product-development managers, and company executives.* Includes listing of all NBS papers as issued. Annual subscription: Domestic, $3.00; $1.00 additional for foreign mailing.

Bibliographic Subscription Services

The following current-awareness and literature-survey bibliographies are issued periodically by the Bureau: Cryogenic Data Center Current Awareness Service (weekly), Liquefied Natural Gas (quarterly), Superconducting Devices and Materials (quarterly), and Electromagnetic Metrology Current Awareness Service (monthly). Available only from NBS Boulder Laboratories. Ordering and cost information may be obtained from the Program Information Office, National Bureau of Standards, Boulder, Colorado 80302.

NONPERIODICALS

Applied Mathematics Series. Mathematical tables, manuals, and studies.

Building Science Series. Research results, test methods, and performance criteria of building materials, components, systems, and structures.

Handbooks. Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications. Proceedings of NBS conferences, bibliographies, annual reports, wall charts, pamphlets, etc.

Monographs. Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

National Standard Reference Data Series. NSRDS provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated.

Product Standards. Provide requirements for sizes, types, quality, and methods for testing various industrial products. These standards are developed cooperatively with interested Government and industry groups and provide the basis for common understanding of product characteristics for both buyers and sellers. Their use is voluntary.

Technical Notes. This series consists of communications and reports (covering both other-agency and NBS-sponsored work) of limited or transitory interest.

Federal Information Processing Standards Publications. This series is the official publication within the Federal Government for information on standards adopted and promulgated under the Public Law 89–306, and Bureau of the Budget Circular A–86 entitled, Standardization of Data Elements and Codes in Data Systems.

Consumer Information Series. Practical information, based on NBS research and experience, covering areas of interest to the consumer. Easily understandable language and illustrations provide useful background knowledge for shopping in today's technological marketplace.

CATALOGS OF NBS PUBLICATIONS

NBS Special Publication 305, Publications of the NBS. 1966-1967. When ordering, include Catalog No. C13.10:305. Price $2.00; 50 cents additional for foreign mailing.

NBS Special Publication 305, Supplement 1, Publications of the NBS, 1968-1969. When ordering, include Catalog No. C13.10:305/Suppl. 1. Price $4.50; $1.25 additional for foreign mailing.

NBS Special Publication 305, Supplement 2, Publications of the NBS, 1970. When ordering, include Catalog No. C13.10:305/Suppl. 2. Price $3.25; 85 cents additional for foreign mailing.

Order NBS publications (except Bibliographic Subscription Services) from: Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

OFFICIAL BUSINESS

Penalty for Private Use, $300

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
215

U.S.MAIL