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EXTENSION AND REVISION OF THE ARC SPECTRUM OF SILICON

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ABSTRACT

A new survey has been made of the spectrum emitted by neutral silicon atoms. Revised wave lengths and intensities are given for 400 lines between 1565 A in the ultraviolet and 12270 A in the infrared. The fine structure of some red and infrared lines that appear diffuse when emitted by the arcs in air has been resolved by enclosing the light source in an atmosphere of nitrogen at reduced pressure. Nearly all the lines have been classified as combinations between known and new singlet and triplet terms required by atomic theory. These terms belong to various series of three or more members each and yield accordant results for the value of the ground state $3p\ ^3P_0$ of Si I. This value, 65743 cm^{-1}, corresponds to an ionization potential of 8.11 volts. Most of the observed silicon lines longer than 3000 A and many that are not emitted in the arc but are predictable from the terms, correspond to faint Fraunhofer lines heretofore unidentified.

CONTENTS

I. INTRODUCTION

The published descriptions of the arc spectrum of silicon show that its principal features appear in the ultraviolet and in the infrared. Only a few lines lie in the visible region. Fowler's [1] work, nearly 10 years ago, brought to light an extensive spectrum, in the Schumann region, that results from combinations between the ground states of the atom and various higher energy states. Several years later this work was supplemented, at the National Bureau of Standards,[2] by an extension of the spectrum into the infrared as far as the photographic methods would allow. Since that time new types of photographic plates, brought out by the Eastman Kodak Research Laboratories,[3] have made it possible to record the spectrum out to 12270 A, nearly 1000 A beyond the limit reached in the earlier investigation. The new data have led to new classifications of the arc lines of silicon and have suggested corrections of older classifications. As a consequence of the new findings, a resurvey of the entire spectrum has been made, the results of which are presented below.

[1] A. Fowler, Proc. Roy. Soc. (London) [A] **123**, 422 (1929).
[2] C. C. Kiess, BS J. Research **11**, 775 (1933) RP624.
[3] L. S. G. Brooker and G. H. Keyes, J. Franklin Inst. **219**, 255 (1935).

II. EXPERIMENTAL PROCEDURE

The prism and grating spectrographs of the National Bureau of Standards were employed to photograph the arc spectrum of silicon from wave length 1976 A, in the ultraviolet, to 12270 A in the infrared. The region from 2124 to 1976 A was recorded with the Hilger E1 spectrograph, which gives a dispersion ranging from 1.5 A/mm to 1A/mm in this region. The more powerful prism spectrograph, also by Hilger, and carrying a large 60° Cornu prism in combination with a 30° reflecting prism, in the E185 mounting, was used in the range from 3000 to 2120 A, the dispersion varying from 2 A/mm to 0.4 A/mm. The gratings used for the photography of the longer waves were the ones ruled by Anderson with 7,500 lines per inch and the one by Rowland with 20,000 lines per inch. Adequate descriptions of them have been given elsewhere.[4] When the observational work described in this paper was nearing completion, a third grating, by R. W. Wood,[5] ruled with 30,000 lines per inch on an aluminized Pyrex mirror, became available, and was used to photograph the spectrum from 2200 to 8600 A.

The light source with which most of the observations were made was the arc in air between lumps of commercial silicon about 95 percent pure. The currents in the arc ranged from 6 to 15 amperes supplied from a 220-volt d-c circuit. Many of the silicon arc lines in the red and infrared are diffuse and hazy when emitted by the arc in air and are always superimposed upon a background made up of a mixture of impurity lines and band lines due to SiO. These conditions make it impossible to detect the close and faint satellites that accompany some of the stronger lines. Accordingly, a series of observations was made with the silicon arc enclosed in atmospheres of nitrogen at various low pressures ranging from 25 to 350 mm of Hg. The arc chamber was a reproduction of that described and illustrated by Curtis.[6] In order to keep the low-pressure observations free from blends with lines of impurities a search for highly purified silicon was instigated, and when the problem was brought to the attention of R. L. Templin, he very generously donated for the work a piece of the cast silicon rod described by him.[7] Later, when more electrode material was needed some highly purified silicon granules were made available by J. H. Critchett, of the Union Carbide Research Laboratories. This material was alloyed with a small amount of pure silver and cast into rods through the courtesy of W. H. Swanger and A. J. Dornblatt of the Metallurgical Division of this Bureau.

In addition to the observations described above, there were available for measurement several spectrograms covering the Schumann region. These observations were made especially for this investigation by A. G. Shenstone of Princeton University, with the normal-incidence vacuum spectrograph of the Palmer Physical Laboratory. This instrument carries a 2-m glass grating ruled with 30,000 lines to the inch by Wood, and gives a dispersion of 4.2 A/mm. The source was an arc of approximately 3 amperes between electrodes of metallic silicon cut from the piece supplied by Templin and operated in pure nitrogen at atmospheric pressure. No trace of the confusing silicon

[4] W. F. Meggers and K. Burns, BS Sci. Pap. **18**, 191 (1922) S441.
[5] R. W. Wood, Nature **140**, 723 (1937).
[6] H. D. Curtis, J. Opt. Soc. Am. **8**, 697 (1924).
[7] R. L. Templin, Metals and Alloys **3**, 136 (1932).

oxide bands appears on any of the exposures, which ranged from 2 to 75 minutes' duration.

Measurement of all the plates described above was done with the comparators at the National Bureau of Standards. All the spectrograms made at the Bureau bore also the iron or copper spectra to furnish the reference standards for the reduction of the wave lengths; but, in general, there were sufficient numbers of iron lines present as impurities in the silicon exposures to serve as internal standards of reference. The wave lengths of the reference lines were those that have been adopted as international secondary standards [8] or were selected from the lists of Burns and Walters. [9]

For the Princeton plates no comparison spectrum was available. The preliminary wave lengths, derived from the nitrogen and carbon lines that were present as impurities among the silicon lines, were subsequently corrected by amounts derived from term values based on the measurements of National Bureau of Standards spectrograms of silicon.

III. RESULTS

1. WAVE LENGTHS AND INTENSITIES

Only those wave lengths of silicon that have actually been measured at the National Bureau of Standards are given in the first column of tables 1 and 2. For most of the lines these values represent the means of 2 to 10 determinations. For the diffuse and hazy lines no great precision is claimed and errors as great as 0.10 A may be present. For the sharper lines, however, that were measured on the high-dispersion spectrograms, it is believed that the errors are not greater than 0.01 A. This is indicated by a comparison of the strong ultraviolet lines with the interferometer observations made at the Allegheny Observatory,[10] which shows a mean difference of +0.003 A between the two sets of determinations.

TABLE 1.—*Wave lengths in the arc spectrum of silicon emitted by the arc-in-air*

λ_{air}A	Intensity	λ_{sun}	ν_{vac}cm^{-1}	Term combination
12270. 50	2		8147. 40	$4s\,^3P^{\circ}_2-4p\,^3D_2$
12103. 46	5	3. 47	8259. 84	$4s\,^3P^{\circ}_1-4p\,^3D_1$
12031. 49	25		8309. 25	$4s\,^3P^{\circ}_2-4p\,^3D_3$
11991. 57	10		8336. 91	$4s\,^3P^{\circ}_0-4p\,^3D_1$
11984. 20	20		8342. 04	$4s\,^3P^{\circ}_1-4p\,^3D_2$
11821. 80	0*b*		8456. 64	
11640. 58	2*b*		8588. 31	$3d\,^3P^{\circ}_0-4f\,^3D_1$
11611. 49	5*b*	1. 65	8609. 80	$3d\,^3P^{\circ}_2-4f\,^3D_3$
11607. 42	0*b*		8612. 82	$4p\,^1D_2-4d\,^1P_1$
11591. 98	4*b*	2. 27	8624. 30	{ $3d\,^3P^{\circ}_1-4f\,^3D_2$ $3d\,^3P^{\circ}_1-4f\,^3D_1$
11502. 94	3*b*		8691. 05	$3d\,^3P^{\circ}_2-4f\,^3D_2$
11485. 68	2*b*		8704. 11	$4p\,^1D_2-4d\,^1F^{\circ}_3$
11468. 54	1*b*		8717. 12	$3d\,^3F^{\circ}_4-4f\,^3F_4$
11308. 45	2*b*		8840. 52	$3d\,^3F^{\circ}_3-4f\,^3F_2$
11290. 01	10*b*		8854. 96	$3d\,^3F^{\circ}_3-4f\,^3F_4$

[8] Trans. Int. Astron. Union **3**, 77 (1928).
[9] K. Burns and F. M. Walters, Pub. Allegheny Obs. **8**, 27 (1930); 8, 39 (1931).
[10] N. E. Wagman, Univ. Pittsburgh Bul. **34**, 333 (1937). F. J. Sullivan, Univ. Pittsburgh Bul. (in press).

TABLE 1.—*Wave lengths in the arc spectrum of silicon emitted by the arc-in-air*—Con.

λ_{air}A	Intensity	λ_{sun}	ν_{vac}cm^{-1}	Term combination
11254. 97	3*b*		8882. 53	
11253. 22	2*b*		8883. 91	
11202. 02	1*b*		8924. 52	$3d\,^3F^\circ_2-4f\,^3F_2$
11187. 74	20*b*		8935. 91	$3d\,^3F^\circ_2-4f\,^3F_3$
11130. 37	7*b*		8981. 97	$3d\,^3F^\circ_4-4f\,^3G^\circ_5$
11018. 00	70	8. 23	9073. 58	
11013. 31	1*b*		9077. 44	
10984. 24	3*b*	4. 42	9101. 47	$3d\,^3F^\circ_3-4f\,^3G_3$
10982. 28	7*b*	2. 39	9103. 09	$3d\,^3F^\circ_3-4f\,^3G_4$
10979. 27	35	9. 34	9105. 59	$4s^3P^\circ_2-4p\,^3P_1$
10889. 15	0*b*		9180. 94	
10885. 16	10*b*	5. 37	9184. 30	$3d\,^3F^\circ_2-4f\,^3G_3$
10882. 66	5*b*	2. 84	9186. 41	$4p\,^3D_3-4d\,^3F^\circ_3$
10869. 54	125	9. 57	9197. 50	$4s\,^1P^\circ_1-4p\,^1D_2$
10844. 02	25*b*	3. 89	9219. 15	$4p\,^1P_1-4d\,^1D^\circ_2$
10827. 09	100	7. 14	9233. 57	$4s\,^3P^\circ_2-4p\,^3P_2$
10807. 75	1*h*		9250. 09	
10796. 52	0*h*		9259. 70	$3d\,^3F^\circ_2-4f\,^1D_2$
10786. 86	50	6. 85	9268. 00	$4s\,^3P^\circ_1-4p\,^3P_0$
10784. 33	5*b*	4. 58	9270. 18	$4p\,^3D_2-4d\,^3F^\circ_2$
10768. 35	0*h*		9283. 93	
10749. 40	60	9. 37	9300. 30	$4s\,^3P^\circ_1-4p\,^3P_1$
10727. 21	75*b*	7. 41	9319. 53	$4p\,^3D_3-4d\,^3F^\circ_4$
10694. 14	50*b*	4. 23	9348. 35	$4p\,^3D_2-4d\,^3F^\circ_3$
10689. 52	20*b*	9. 73	9352. 39	$4p\,^3D_1-4d\,^3F^\circ_2$
10660. 98	50	0. 98	9377. 43	$4s\,^3P^\circ_0-4p\,^3P_1$
10627. 81	20*b*	7. 63	9406. 70	$4p\,^1P_1-4d\,^3P^\circ_2$
10603. 38	60	3. 44	9428. 38	$4s\,^3P^\circ_1-4p\,^3P_2$
10585. 12	100	5. 165	9444. 64	$4s\,^3P^\circ_2-4p\,^3S_1$
10582. 66	1		9446. 83	$4p\,^1D_2-6s\,^1P^\circ_1$
10498. 86	2		9522. 24	
10371. 23	50	1. 285	9639. 42	$4s\,^3P^\circ_1-4p\,^3S_1$
10288. 83	25	8. 950	9716. 62	$4s\,^3P^\circ_0-4p\,^3S_1$
10155. 88	1	6. 16	9843. 81	$4p\,^3P_2-5d\,^3D^\circ_2$
10100. 84	1		9897. 45	
10067. 84	4*b*		9929. 90	$4p\,^3P_2-5d\,^3D^\circ_3$
10020. 16	1		9977. 15	$3d\,^1D^\circ_2-5p\,^3P_1$
10015. 33	1		9981. 96	$4p\,^1S_0-5d\,^1P^\circ_1$
10009. 82	1		9987. 45	
9967. 46	1		10029. 90	$4p\,^3P_0-5d\,^3D^\circ_1$
9913. 16	1*b*		10084. 84	$4p\,^3P_2-6s\,^3P^\circ_1$
9891. 90	5*b*	1. 61	10106. 51	$4p\,^3S_1-6s\,^3P^\circ_2$
9886. 92	2*b*	7. 06	10111. 60	$4p\,^1D_2-5d\,^1D^\circ_2$
9839. 58	2*b*	9. 36	10160. 25	$4p\,^3P_1-6s\,^3P^\circ_0$
9789. 24	2*h*		10212. 50	$4p\,^3P_1-6s\,^3P^\circ_1$
9770. 10	4*b*	0. 30	10232. 51	
9768. 27	5*b*		10234. 42	$4s\,^3P^\circ_2-4p\,^1D_2$
9758. 08	2*h*		10245. 11	$4p\,^3P_0-6s\,^3P^\circ_1$
9738. 60	6*b*		10265. 61	
9689. 41	8*b*	9. 37	10317. 72	$4p\,^3P_2-6s\,^3P^\circ_2$

TABLE 1.—*Wave lengths in the arc spectrum of silicon emitted by the arc-in-air*—Con.

λ_{air}A	Intensity	λ_{sun}	$\nu_{vac}cm^{-1}$	Term combination
9585. 72	4	5. 70	10429. 33	$4s\ ^3P^{\circ}_1-4p\ ^1D_2$
9570. 08	4	9. 93	10446. 37	{ $3d\ ^1D^{\circ}_2-5p\ ^1D_2$ $4p\ ^3P_1-6s\ ^3P^{\circ}_2$
9505. 28	5		10517. 60	$4p\ ^3S_1-5d\ ^3P^{\circ}_2$
9421. 82	4		10610. 75	$4p\ ^3S_1-5d\ ^3P^{\circ}_1$
9413. 59	200	3. 51	10620. 03	$4s\ ^1P^{\circ}_1-4p\ ^1S_0$
9393. 40	2*b*		10642. 86	$4p\ ^3S_1-5d\ ^3P^{\circ}_0$
9318. 24	4	8. 18	10728. 70	$4p\ ^3P_2-5d\ ^3P^{\circ}_2$
9254. 59	4*h*		10802. 49	
9238. 60	2*h*		10821. 18	$4p\ ^3P_2-5d\ ^3P^{\circ}_1$
9209. 66	1*b*		10855. 19	
9208. 55	5*b*	8. 60	10856. 50	$4p\ ^3P_1-5d\ ^3P^{\circ}_2$
9147. 39	0*h*		10929. 08	
9103. 37	3*b*		10981. 93	{ $4p\ ^3P_1-5d\ ^3P^{\circ}_0$ $4p\ ^3P_0-5d\ ^3P^{\circ}_1$
9064. 06	0*bl*		11029. 56	$3d\ ^3P^{\circ}_1-5f\ ^3D_2$
9052. 57	0*bl*		11043. 56	
9022. 40	2*h*		11080. 49	
9009. 04	5*hl*		11096. 92	{ $3d\ ^3P^{\circ}_2-5f\ ^3D_3$ $3d\ ^3P^{\circ}_2-5f\ ^3D_2$
8949. 33	15*b*	9. 06	11170. 96	$4p\ ^3D_2-6s\ ^3P^{\circ}_1$
8925. 55	8*b*		11200. 72	$4p\ ^3D_1-6s\ ^3P^{\circ}_0$
8899. 50	3*b*		11233. 51	$3d\ ^3F^{\circ}_4-5f\ ^3F^{\circ}_3$
8898. 97	3*b*	8. 99	11234. 18	$3d\ ^3F^{\circ}_4-5f\ ^3F^{\circ}_4$
8892. 97	25*b*	2. 73	11241. 75	$4p\ ^3D_3-6s\ ^3P^{\circ}_2$
8883. 84	4*b*	3. 68	11253. 30	$4p\ ^3D_1-6s\ ^3P^{\circ}_1$
8791. 28	5*b*		11371. 79	{ $3d\ ^3F^{\circ}_3-5f\ ^3F_2$ $4p\ ^1D_2-5d\ ^1F^{\circ}_3$
8790. 88	4*b*		11372. 31	{ $3d\ ^3F^{\circ}_3-5f\ ^3F_4$ $3d\ ^3F^{\circ}_3-5f\ ^3F_3$
8766. 68	3*b*	6. 42	11403. 70	$4p\ ^3D_2-6s\ ^3P^{\circ}_2$
8752. 17	200	2. 02	11422. 60	$3d\ ^1D^{\circ}_2-4f\ ^1F_3$
8742. 60	100	2. 47	11435. 11	$3d\ ^1D^{\circ}_2-4f\ ^3F_3$
8729. 02	5*b*	9. 17	11452. 90	$3d\ ^3F^{\circ}_2-5f\ ^3F_2$
8728. 38	10*b*	8. 02	11453. 74	$3d\ ^3F^{\circ}_2-5f\ ^3F_3$
8648. 89	100*hl*	8. 47	11559. 00	
8606. 43	1*b*	6. 38	11616. 03	$4p\ ^3D_1-6s\ ^1P^{\circ}_1$
8597. 00	2*hl*	7. 059	11628. 77	$3d\ ^3F^{\circ}_3-5f\ ^3G_3$
8579. 15	2*b*	9. 08	11652. 97	
8556. 64	100*b*	6. 795	11683. 63	$3d\ ^1D^{\circ}_2-4f\ ^3G_3$
8536. 80	2*b*	6. 68	11710. 78	
8536. 38	3*b*	6. 16	11711. 36	$3d\ ^3F^{\circ}_2-5f\ ^3G_3$
8503. 17	5	3. 145	11757. 09	
8502. 38	30*b*	2. 228	11758. 32	$3d\ ^1D^{\circ}_2-4f\ ^3D_3$
8501. 50	20*b*	1. 553	11759. 40	$3d\ ^1D^{\circ}_2-4f\ ^1D_2$
8444. 48	3*b*	4. 377	11838. 81	$3d\ ^1D^{\circ}_2-4f\ ^3D_1$
8444. 00	15*b*	3. 975	11839. 48	$3d\ ^1D^{\circ}_2-4f\ ^3D_2$
8338. 43	5*b*	8. 343	11989. 37	$4p\ ^1P_1-6s\ ^3P^{\circ}_1$
8317. 45	2*b*	7. 394	12019. 62	$3d\ ^3D^{\circ}_1-5p\ ^3P_0$
8306. 80	4*b*	6. 699	12035. 02	$3d\ ^3D^{\circ}_2-5p\ ^3P_1$

TABLE 1.—*Wave lengths in the arc spectrum of silicon emitted by the arc-in-air*—Con.

λ_{air}A	Intensity	λ_{sun}	ν_{vac}cm^{-1}	Term combination
8230. 67	15	0. 63	12146. 34	$3d\ {}^3D^\circ_3 - 5p\ {}^3P_2$
8211. 48	2	1. 57	12174. 73	$3d\ {}^3D^\circ_2 - 5p\ {}^3P_2$
8093. 32	25*b*	3. 232	12352. 48	$4p\ {}^1P_1 - 6s\ {}^1P^\circ_1$
8035. 39	7*b*		12441. 53	$4p\ {}^3D_3 - 5d\ {}^3F^\circ_3$
7970. 91	3*b*		12542. 17	
7970. 26	10*b*	0. 300	12543. 20	$4p\ {}^3D_2 - 5d\ {}^3F^\circ_2$
7943. 94	500*b*	4. 001	12584. 75	$4p\ {}^3D_3 - 5d\ {}^3F^\circ_4$
7932. 20	300*b*	2. 351	12603. 38	$4p\ {}^3D_2 - 5d\ {}^3F^\circ_3$
7918. 38	200*b*	8. 383	12625. 38	$4p\ {}^3D_1 - 5d\ {}^3F^\circ_2$
7913. 47	10*b*	3. 438	12633. 21	$4p\ {}^1P_1 - 5d\ {}^3P^\circ_2$
7912. 55	3*b*	2. 384	12634. 68	$4p\ {}^3P_2 - 7s\ {}^3P^\circ_2$
7850. 5	2*H*	0. 88	12734. 54	$3d\ {}^3F^\circ_3 - 6f\ {}^3F_2$
7800. 0	4*H*	0. 009	12816. 99	$3d\ {}^3F^\circ_2 - 6f\ {}^3F_2$
7743. 2	4*h*		12911. 01	
7742. 7	5*h*	2. 722	12911. 84	
7680. 35	100*b*	0. 267	13016. 66	$4p\ {}^1P_1 - 5d\ {}^1D^\circ_2$
7424. 63	20	4. 647	13464. 98	$3d\ {}^3D^\circ_3 - 4f\ {}^3F_3$
7423. 54	500	3. 509	13466. 96	$3d\ {}^3D^\circ_3 - 4f\ {}^3F_4$
7416. 00	250	5. 958	13480. 65	$3d\ {}^3D^\circ_2 - 4f\ {}^1F_3$
7415. 37	15	5. 363	13481. 80	$3d\ {}^3D^\circ_2 - 4f\ {}^3F_2$
7409. 11	100	9. 100	13493. 19	$3d\ {}^3D^\circ_2 - 4f\ {}^3F_3$
7405. 85	300	5. 700	13499. 13	$3d\ {}^3D^\circ_1 - 4f\ {}^3F_2$
7373. 02	10*b*	3. 011	13559. 23	$4p\ {}^3D_3 - 7s\ {}^3P^\circ_2$
7290. 21	10		13713. 25	$3d\ {}^3D^\circ_3 - 4f\ {}^3G_3$
7289. 25	250	9. 199	13715. 06	$3d\ {}^3D^\circ_3 - 4f\ {}^3G_4$
7275. 28	50		13741. 40	$3d\ {}^3D^\circ_2 - 4f\ {}^3G_3$
7250. 69	40	0. 661	13788. 00	$3d\ {}^3D^\circ_3 - 4f\ {}^3D_3$
7235. 86	10	5. 852	13816. 26	$3d\ {}^3D^\circ_2 - 4f\ {}^3D_3$
7235. 32	15	5. 368	13817. 29	$3d\ {}^3D^\circ_2 - 4f\ {}^1D_2$
7226. 20	20	6. 231	13834. 73	$3d\ {}^3D^\circ_1 - 4f\ {}^1D_2$
7208. 20	1	8. 221	13869. 28	$3d\ {}^3D^\circ_3 - 4f\ {}^3D_2$
7193. 89	5		13896. 86	$3d\ {}^3D^\circ_2 - 4f\ {}^3D_1$
7193. 56	8		13897. 50	$3d\ {}^3D^\circ_2 - 4f\ {}^3D_2$
7184. 89	10	4. 930	13914. 27	$3d\ {}^3D^\circ_1 - 4f\ {}^3D_1$
7184. 54	1		13914. 92	$3d\ {}^3D^\circ_1 - 4f\ {}^3D_2$
7165. 62	100*b*	5. 568	13951. 69	$3d\ {}^1D^\circ_2 - 5f\ {}^1D_2$
7164. 75	2*b*	4. 736	13953. 40	$3d\ {}^1D^\circ_2 - 5f\ {}^3F_{3,\ 2}$
7084. 33	2*b*	4. 268	14111. 78	$4p\ {}^3D_3 - 6d\ {}^3F^\circ_3$
7034. 96	50*b*	4. 920	14210. 81	$3d\ {}^1D^\circ_2 - 5f\ {}^3G_3$
7026. 61	2*b*	6. 635	14227. 69	
7017. 98	4*b*	7. 999	14245. 19	$3d\ {}^1D^\circ_2 - 5f\ {}^3D_3$
7017. 68	10*b*	7. 684	14245. 80	$3d\ {}^1D^\circ_2 - 5f\ {}^3D_2$
7005. 84	50*b*	5. 909	14269. 87	$4p\ {}^3D_3 - 6d\ {}^3F^\circ_4$
7003. 58	50*b*	3. 590	14274. 48	$4p\ {}^3D_2 - 6d\ {}^3F^\circ_3$
6976. 53	25*b*	6. 533	14329. 83	$4p\ {}^3D_1 - 6d\ {}^3F^\circ_2$
6848. 65	4*b*	8. 578	14597. 40	$4p\ {}^1P_1 - 7s\ {}^1P^\circ_1$
6741. 74	2*b*	1. 638	14828. 88	
6722. 67	2*b*	2. 718	14870. 94	$4p\ {}^1P_1 - 6d\ {}^1D^\circ_2$
6721. 97	4*b*	1. 853	14872. 49	
6560. 68	2*h*		15238. 12	$4p\ {}^3D_1 - 7d\ {}^3F^\circ_2$

TABLE 1.—*Wave lengths in the arc spectrum of silicon emitted by the arc-in-air*—Con.

λ_{air}A	Intensity	λ_{sun}	ν_{vac}cm^{-1}	Term combination
6555. 20	2*h*		15250. 86	$4p\,^3D_2-7d\,^3F^\circ_3$
6527. 49	3*h*		15315. 60	$4p\,^3D_3-7d\,^3F^\circ_4$
6415. 24	4*b*		15583. 58	
6331. 92	2*b*	1. 971	15788. 64	
6254. 96	2*h*		15982. 90	$3d\,^3D^\circ_3-5f\,^3F_3$
6254. 25	25*h*	4. 179	15984. 71	$3d\,^3D^\circ_3-5f\,^3F_4$
6244. 56	10*h*	4. 483	16009. 52	$3d\,^3D^\circ_2-5f\,^1D_2$
6243. 86	10*h*	3. 829	16011. 31	$3d\,^3D^\circ_2-5f\,^3F_3$
6238. 38	2*h*	8. 396	16025. 38	
6237. 62	5*h*		16027. 33	$3d\,^3D^\circ_1-5f\,^1D_2$
6237. 34	5*h*	7. 334	16028. 05	$3d\,^3D^\circ_1-5f\,^3F_2$
6155. 73	2*h*	5. 715	16240. 54	$3d\,^3D^\circ_3-5f\,^3G_3$
6155. 22	20*h*	5. 148	16241. 89	$3d\,^3D^\circ_3-5f\,^3G_4$
6145. 08	10*h*	5. 030	16268. 69	$3d\,^3D^\circ_2-5f\,^3G_3$
6142. 53	5*h*	2. 499	16275. 44	$3d\,^3D^\circ_3-5f\,^3D_3$
6131. 86	5*h*	1. 868	16303. 76	$3d\,^3D^\circ_2-5f\,^3D_3$
6131. 54	4*h*	1. 583	16304. 61	$3d\,^3D^\circ_2-5f\,^3D_2$
6125. 03	4*h*	5. 032	16321. 94	$3d\,^3D^\circ_1-5f\,^3D_2$
6124. 85	2*h*	4. 83	16322. 42	$3d\,^3D^\circ_1-5f\,^3D_1$
6113. 12	1*h*	3. 136	16353. 74	
6106. 70	1*h*	6. 635	16370. 94	
5948. 584	100	8. 552	16806. 08	$4s\,^1P^\circ_1-5p\,^1D_2$
5797. 912	40	7. 869	17242. 82	$4s\,^3P^\circ_2-5p\,^3D_3$
5793. 128	30	3. 083	17257. 06	$4s\,^3P^\circ_1-5p\,^3D_2$
5780. 452	25	0. 390	17294. 90	$4s\,^3P^\circ_0-5p\,^3D_1$
5772. 258	50	2. 152	17319. 45	$4s\,^1P^\circ_1-5p\,^1S_0$
5754. 258	8*b*		17373. 63	$4s\,^3P^\circ_2-5p\,^3P_1$
5708. 437	75	8. 408	17513. 08	$4s\,^3P^\circ_2-5p\,^3P_2$
5701. 138	25	1. 111	17535. 50	$4s\,^3P^\circ_1-5p\,^3P_0$
5690. 470	40	0. 435	17568. 38	$4s\,^3P^\circ_1-5p\,^3P_1$
5684. 523	50	4. 496	17586. 76	$4s\,^3P^\circ_2-5p\,^3S_1$
5665. 601	25	5. 566	17645. 49	$4s\,^3P^\circ_0-5p\,^3P_1$
5645. 665	25	5. 621	17707. 80	$4s\,^3P^\circ_1-5p\,^3P_2$
5622. 23	3	2. 237	17781. 61	$4s\,^3P^\circ_1-5p\,^3S_1$
4102. 926	25	2. 945	24366. 00	$3p\,^1S_0-4s\,^3P^\circ_1$
3905. 527	100	5. 534	25597. 52	$3p\,^1S_0-4s\,^1P^\circ_1$
2987. 65	25		33461. 39	$3p\,^1D_2-4s\,^3P^\circ_1$
2970. 35	15		33656. 27	$3p\,^1D_2-4s\,^3P^\circ_2$
2881. 595	200*r*		34692. 86	$3p\,^1D_2-4s\,^1P^\circ_1$
2842. 35	3		35171. 84	$3p\,^1S_0-3d\,^3P^\circ_1$
2631. 28	50*r*		37993. 00	$3p\,^1S_0-3d\,^1P^\circ_1$
2577. 13	10		38791. 25	$3p\,^1S_0-4d\,^3D^\circ_1$
2568. 63	15		38919. 60	$3p\,^1S_0-5s\,^3P^\circ_1$
2564. 82	3		38977. 41	$3p\,^1D_2-3d\,^3D^\circ_1$
2563. 67	4		38994. 90	$3p\,^1D_2-3d\,^3D^\circ_2$
2532. 38	20		39476. 68	$3p\,^1S_0-5s\,^1P^\circ_1$
2528. 513	175*r*		39537. 05	$3p\,^3P_2-4s\,^3P^\circ_1$
2524. 112	125*r*		39605. 98	$3p\,^3P_1-4s\,^3P^\circ_0$
2519. 206	100*r*		39683. 11	$3p\,^3P_1-4s\,^3P^\circ_1$
2516. 111	250*r*		39731. 92	$3p\,^3P_2-4s\,^3P^\circ_2$

TABLE 1.—*Wavelengths in the arc spectrum of silicon emitted by the arc-in-air*—Con.

λ_{air}A	Intensity	λ_{sun}	ν_{vac}cm^{-1}	Term combination
2514.320	100*r*		39760.22	$3p\ ^3P_0-4s\ ^3P^\circ_1$
2506.896	150*r*		39878.02	$3p\ ^3P_1-4s\ ^3P^\circ_2$
2452.12	20		40768.69	$3p\ ^3P_2-4s\ ^1P^\circ_1$
2443.37	20		40914.68	$3p\ ^3P_1-4s\ ^1P^\circ_1$
2438.77	25		40991.84	$3p\ ^3P_0-4s\ ^1P^\circ_1$
2435.160	100*r*		41052.60	$3p\ ^1D_2-3d\ ^1D^\circ_2$
2303.03	20		43407.67	$3p\ ^1S_0-4d\ ^1P^\circ_1$
2295.40	1		43551.94	$3p\ ^1D_2-3d\ ^3F^\circ_2$
2291.03	7		43635.01	$3p\ ^1D_2-3d\ ^3F^\circ_3$
2289.61	10		43662.07	$3p\ ^1S_0-5d\ ^3D^\circ_1$
2278.30	7		43878.79	$3p\ ^1S_0-6s\ ^3P^\circ_1$
2261.70	1		44200.82	$3p\ ^1D_2-3d\ ^3P^\circ_2$
2259.58	7		44242.28	$3p\ ^1S_0-6s\ ^1P^\circ_1$
2218.914	25*r*		45053.02	$3p\ ^3P_2-3d\ ^3D^\circ_1$
2218.052	50*r*		45070.53	$3p\ ^3P_2-3d\ ^3D^\circ_2$
2216.670	150*r*		45098.63	$3p\ ^3P_2-3d\ ^3D^\circ_3$
2211.737	75*r*		45199.20	$3p\ ^3P_1-3d\ ^3D^\circ_1$
2210.880	100*r*		45216.72	$3p\ ^3P_1-3d\ ^3D^\circ_2$
2207.972	75*r*		45276.26	$3p\ ^3P_0-3d\ ^3D^\circ_1$
2177.30	8*b*		45914.01	$3p\ ^1S_0-5d\ ^1P^\circ_1$
2167.74	7		46116.47	$3p\ ^1S_0-6d\ ^3D^\circ_1$
2163.78	10*b*		46200.86	$3p\ ^1S_0-7s\ ^3P^\circ_1$
2150.43	5		46487.64	$3p\ ^1S_0-7s\ ^1P^\circ_1$
2147.91	3		46542.18	$3p\ ^1S_0-6d\ ^3P^\circ_1$
2124.111	100*r*		47063.58	$3p\ ^1D_2-3d\ ^1F^\circ_3$
2122.99	10		47088.43	$3p\ ^1D_2-3d\ ^1P^\circ_1$
2121.22	7		47127.72	$3p\ ^3P_2-3d\ ^1D^\circ_2$
2114.59	4*b*		47275.46	$3p\ ^3P_1-3d\ ^1D^\circ_2$
2103.28	5*b*		47529.64	$3p\ ^1S_0-8s\ ^3P^\circ_2$
2094.20	2		47735.70	$3p\ ^1S_0-8s\ ^1P^\circ_1$
2084.47	20		47958.49	$3p\ ^1D_2-4d\ ^3D^\circ_3$
2082.01	15		48015.15	$3p\ ^1D_2-5s\ ^3P^\circ_1$
2067.40	1		48354.42	$3p\ ^3P_2-3p'\ ^3D^\circ_2$
2065.49	5		48399.15	$3p\ ^3P_0-3p'\ ^3D^\circ_1$
2061.18	8		48500.32	$3p\ ^3P_1-3p'\ ^3D^\circ_2$
2058.13	50		48572.18	$3p\ ^1D_2-5s\ ^1P^\circ_1$
2054.81	8		48650.65	$3p\ ^3P_2-3p'\ ^3D^\circ_3$
2010.97	8		49711.10	$3p\ ^3P_2-3d\ ^3F^\circ_3$
2008.43	3		49773.96	$3p\ ^3P_1-3d\ ^3F^\circ_2$
1991.23	5		50203.82	$3p\ ^1D_2-4d\ ^1D^\circ_2$
1988.36	30		50276.27	$3p\ ^3P_2-3d\ ^3P^\circ_2$
1985.73	20		50342.84	$3p\ ^3P_2-3d\ ^3P^\circ_1$
1983.82	3		50391.30	$3p\ ^1D_2-4d\ ^3P^\circ_2$
1982.60	20		50422.28	$3p\ ^3P_1-3d\ ^3P^\circ_2$
1980.00	10		50488.47	$3p\ ^3P_1-3d\ ^3P^\circ_1$
1978.57	12		50524.95	$3p\ ^3P_1-3d\ ^3P^\circ_0$
1976.96	15		50566.08	$3p\ ^3P_0-3d\ ^3P^\circ_1$

TABLE 2.—*Wave lengths in the arc spectrum of silicon emitted by the arc-in-nitrogen*

λ_{vac}A	Intensity	ν_{vac}cm^{-1}	Term combination
1957. 96	0	51021. 44	$3p\ ^1D_2-4d\ ^3F^\circ_2$
1954. 96	6	51151. 94	$3p\ ^1D_2-4d\ ^3F^\circ_3$
1904. 66	12	52502. 80	$3p\ ^1D_2-4d\ ^1P^\circ_1$
1901. 34	50	52594. 48	$3p\ ^1D_2-4d\ ^1F^\circ_3$
1895. 41	2	52759. 03	$3p\ ^1D_2-5d\ ^3D^\circ_1$
1893. 54	4	52811. 13	$3p\ ^1D_2-x'$
1893. 22	25	52820. 06	$3p\ ^1D_2-5d\ ^3D^\circ_3$
1892. 70	3	52834. 57	$3p\ ^1D_2-x''$
1887. 71	12	52974. 24	$3p\ ^1D_2-6s\ ^3P^\circ_1$
1881. 86	12	53138. 92	$3p\ ^3P_2-3d\ ^1F^\circ_3$
1880. 96	5	53164. 34	$3p\ ^3P_2-3d\ ^1P^\circ_1$
1875. 82	10	53310. 02	$3p\ ^3P_1-3d\ ^1P^\circ_1$
1874. 86	25	53337. 32	$3p\ ^1D_2-6s\ ^1P^\circ_1$
1873. 11	8	53387. 15	$3p\ ^3P_0-3d\ ^1P^\circ_1$
1865. 04	2	53618. 15	$3p\ ^1D_2-5d\ ^3P^\circ_2$
1861. 80	1	53711. 46	$3p\ ^1D_2-5d\ ^3P^\circ_1$
1853. 17	10	53961. 60	$3p\ ^3P_2-4d\ ^3D^\circ_1$
1852. 48	25*r*	53981. 69	$3p\ ^3P_2-4d\ ^3D^\circ_2$
1851. 80	10	54001. 51	$3p\ ^1D_2-5d\ ^1D^\circ_2$
1850. 68	50*r*	54034. 19	$3p\ ^3P_2-4d\ ^3D^\circ_3$
1848. 75	18	54090. 60	$3p\ ^3P_2-5s\ ^3P^\circ_1$
1848. 16	20*r*	54107. 88	$3p\ ^3P_1-4d\ ^3D^\circ_1$
1847. 47	35*r*	54128. 08	$3p\ ^3P_1-4d\ ^3D^\circ_2$
1846. 13	12	54167. 37	$3p\ ^3P_1-5s\ ^3P^\circ_0$
1845. 53	25*r*	54184. 98	$3p\ ^3P_0-4d\ ^3D^\circ_1$
1843. 77	15	54236. 70	$3p\ ^3P_1-5s\ ^3P^\circ_1$
1841. 47	20*r*	54304. 45	$3p\ ^3P_2-5s\ ^3P^\circ_2$
1841. 16	10	54313. 58	$3p\ ^3P_0-5s\ ^3P^\circ_1$
1840. 00	2	54347. 83	$3p\ ^1D_2-5d\ ^3F^\circ_2$
1838. 00	10	54406. 96	$3p\ ^1D_2-5d\ ^3F^\circ_3$
1836. 52	20	54450. 81	$3p\ ^3P_1-5s\ ^3P^\circ_2$
1829. 89	7	54648. 09	$3p\ ^3P_2-5s\ ^1P^\circ_1$
1825. 04	1	54793. 32	$3p\ ^3P_1-5s\ ^1P^\circ_1$
1822. 46	10	54870. 90	$3p\ ^3P_0-5s\ ^1P^\circ_1$
1817. 87	2*b*	55009. 44	$3p\ ^1D_2-5d\ ^1P^\circ_1$
1814. 09	30	55124. 05	$3p\ ^1D_2-6d\ ^3D^\circ_2$
1814. 02	50	55126. 18	$3p\ ^1D_2-5d\ ^1F^\circ_3$
1809. 56	3*b*	55262. 06	
1809. 05	30	55277. 64	$3p\ ^1D_2-6d\ ^3D^\circ_3$
1808. 48	4*b*	55295. 05	$3p\ ^1D_2-7s\ ^3P^\circ_1$
1799. 14	10	55582. 11	$3p\ ^1D_2-7s\ ^1P^\circ_1$
1797. 33	3	55638. 18	$3p\ ^1D_2-6d\ ^3P^\circ_1$
1790. 28	4	55857. 19	$3p\ ^1D_2-6d\ ^1D^\circ_2$
1784. 11	1	56050. 36	$3p\ ^1D_2-6d\ ^3F^\circ_2$
1783. 23	8	56078. 02	$3p\ ^1D_2-6d\ ^3F^\circ_3$
1776. 85	10	56279. 36	$3p\ ^3P_2-4d\ ^1D^\circ_2$
1774. 96	0*e*	56339. 29	
1772. 24	1	56425. 76	$3p\ ^3P_1-4d\ ^1D^\circ_2$
1770. 94	10	56467. 18	$3p\ ^3P_2-4d\ ^3P^\circ_2$
1770. 63	8	56477. 07	$3p\ ^3P_2-4d\ ^3P^\circ_1$

TABLE 2.—*Wave lengths in the arc spectrum of silicon emitted by the arc-in-nitrogen*—Continued

λ_{vac}A	Intensity	ν_{vac}cm^{-1}	Term combination
1769.78	15	56504.20	$3p\,^1D_2-6d\,^1F_3^{\circ}$
1769.60	1	56509.95	$3p\,^1D_2-8s\,^3P_1^{\circ}$
1766.34	5	56614.24	$3p\,^3P_1-4d\,^3P_2^{\circ}$
1766.03	6	56624.18	{ $3p\,^1D_2-8s\,^3P_2^{\circ}$ $3p\,^3P_1-4d\,^3P_1^{\circ}$
1765.82	2	56630.92	$3p\,^1D_2-6d\,^1P_1^{\circ}$
1765.61	5*b*	56637.65	$3p\,^1D_2-7d\,^3D_3^{\circ}$
1765.02	5	56656.58	$3p\,^3P_1-4d\,^3P_0^{\circ}$
1763.67	4	56699.96	$3p\,^3P_0-4d\,^3P_1^{\circ}$
1759.56	3	56832.39	$3p\,^1D_2-8s\,^1P_1^{\circ}$
1753.13	4*b*	57040.83	$3p\,^1D_2-7d\,^1D_2^{\circ}$
1752.68	0	57055.48	$3p\,^1D_2-7d\,^3F_3^{\circ}$
1749.74	0	57151.34	$3p\,^3P_2-4d\,^3F_2^{\circ}$
1747.36	4	57229.20	$3p\,^3P_2-4d\,^3F_3^{\circ}$
1745.35	2	57295.10	$3p\,^3P_1-4d\,^3F_2^{\circ}$
1743.88	5*b*	57343.40	$3p\,^1D_2-7d\,^1F_3^{\circ}$
1740.34	3*h*	57460.04	$3p\,^1D_2-8d\,^3D_3^{\circ}$
1736.50	1	57587.10	$3p\,^1D_2-9s\,^1P_1^{\circ}$
1734.70	3	57646.86	
1707.09	0	58579.22	$3p\,^3P_2-4d\,^1P_1^{\circ}$
1704.44	7*r*	58670.29	$3p\,^3P_2-4d\,^1F_3^{\circ}$
1702.81	5	58726.46	$3p\,^3P_1-4d\,^1P_1^{\circ}$
1700.60	4	58802.78	$3p\,^3P_0-4d\,^1P_1^{\circ}$
1700.43	15*r*	58808.65	$3p\,^3P_2-5d\,^3D_2^{\circ}$
1699.70	1	58833.91	$3p\,^3P_2-5d\,^3D_1^{\circ}$
1698.18	4*b*	58886.58	$3p\,^3P_2-x'$
1697.96	20*r*	58894.19	$3p\,^3P_2-5d\,^3D_3^{\circ}$
1697.55	3*b*	58908.43	$3p\,^3P_2-x''$
1696.20	20*r*	58955.31	$3p\,^3P_1-5d\,^3D_2^{\circ}$
1695.50	5*r*	58979.65	$3p\,^3P_1-5d\,^3D_1^{\circ}$
1693.47	5	59050.35	$3p\,^3P_2-6s\,^3P_1^{\circ}$
1693.30	7*r*	59056.28	$3p\,^3P_0-5d\,^3D_1^{\circ}$
1690.77	3	59144.65	$3p\,^3P_1-6s\,^3P_0^{\circ}$
1689.28	3	59196.82	$3p\,^3P_1-6s\,^3P_1^{\circ}$
1687.06	1	59274.71	$3p\,^3P_0-6s\,^3P_1^{\circ}$
1686.83	4	59282.80	$3p\,^3P_2-6s\,^3P_2^{\circ}$
1682.67	3	59429.36	$3p\,^3P_1-6s\,^3P_2^{\circ}$
1676.80	1	59637.40	$3p\,^3P_0-6s\,^1P_1^{\circ}$
1675.23	4*r*	59693.30	$3p\,^3P_2-5d\,^3P_2^{\circ}$
1672.60	3	59787.16	$3p\,^3P_2-5d\,^3P_1^{\circ}$
1671.11	2	59840.46	$3p\,^3P_1-5d\,^3P_2^{\circ}$
1668.52	3	59933.35	$3p\,^3P_1-5d\,^3P_1^{\circ}$
1667.63	3	59965.34	$3p\,^3P_1-5d\,^3P_0^{\circ}$
1666.36	2	60011.04	$3p\,^3P_0-5d\,^3P_1^{\circ}$
1664.54	2	60076.66	$3p\,^3P_2-5d\,^1D_2^{\circ}$
1660.47	0	60223.91	$3p\,^3P_1-5d\,^1D_2^{\circ}$

TABLE 2.—*Wave lengths in the arc spectrum of silicon emitted by the arc-in-nitrogen*—Continued

λ_{vac}A	Intensity	ν_{vac}cm^{-1}	Term combination
1653. 36	1	60482. 89	$3p\,^3P_2-5d\,^3F^\circ_3$
1651. 05	0	60567. 52	$3p\,^3P_1-5d\,^3F^\circ_2$
1633. 99	3	61199. 88	$3p\,^3P_2-6d\,^3D^\circ_2$
1633. 90	4	61203. 26	$3p\,^3P_2-5d\,^1F^\circ_3$
1633. 15	2*r*	61231. 36	$3p\,^3P_1-5d\,^1P^\circ_1$
1631. 11	4*r*	61307. 94	$3p\,^3P_0-5d\,^1P^\circ_1$
1630. 15	7*r*	61344. 05	$3p\,^3P_1-6d\,^3D^\circ_2$
1629. 96	8*r*	61351. 19	$3p\,^3P_2-6d\,^3D^\circ_3$
1629. 47	7*r*	61369. 65	$3p\,^3P_2-7s\,^3P^\circ_1$
1627. 70	2	61436. 38	$3p\,^3P_1-6d\,^3D^\circ_1$
1627. 03	1	61461. 68	$3p\,^3P_1-7s\,^3P^\circ_0$
1625. 71	5*r*	61511. 58	$3p\,^3P_0-6d\,^3D^\circ_1$
1625. 58	1	61516. 51	$3p\,^3P_1-7s\,^3P^\circ_1$
1623. 34	0	61601. 40	$3p\,^3P_2-7s\,^3P^\circ_2$
1622. 87	4*r*	61619. 23	$3p\,^3P_2-6d\,^3P^\circ_2$
1620. 39	3	61713. 54	$3p\,^3P_2-6d\,^3P^\circ_1$
1619. 53	1	61746. 32	$3p\,^3P_1-7s\,^3P^\circ_2$
1619. 00	0	61766. 52	$3p\,^3P_1-6d\,^3P^\circ_2$
1616. 55	3	61860. 14	$3p\,^3P_1-6d\,^3P^\circ_1$
1615. 89	3	61885. 40	$3p\,^3P_0-7s\,^1P^\circ_1$
1614. 60	1	61934. 84	$3p\,^3P_2-6d\,^1D^\circ_2$
1614. 55	3	61936. 76	$3p\,^3P_0-6d\,^3P^\circ_1$
1608. 92	2	62153. 50	$3p\,^3P_2-6d\,^3F^\circ_3$
1605. 87	1	62271. 55	$3p\,^3P_1-6d\,^3F^\circ_2$
1597. 99	3	62578. 60	$3p\,^3P_2-6d\,^1F^\circ_3$
1597. 83	2	62584. 88	$3p\,^3P_2-8s\,^3P^\circ_1$
1595. 82	1	62663. 70	$3p\,^3P_2-7d\,^3D^\circ_2$
1595. 50	1	62676. 28	$3p\,^3P_1-8s\,^3P^\circ_0$
1594. 92	4*r*	62699. 07	$3p\,^3P_2-8s\,^3P^\circ_2$
1594. 53	5*r*	62714. 40	$3p\,^3P_2-7d\,^3D^\circ_3$
1592. 45	1	62796. 32	$3p\,^3P_1-7d\,^3D^\circ_1$
1592. 35	3*r*	62800. 24	$3p\,^3P_1-7d\,^3D^\circ_2$
1592. 15	3*r*	62808. 12	$3p\,^3P_0-8s\,^3P^\circ_1$
1591. 17	0	62846. 82	$3p\,^3P_1-8s\,^3P^\circ_2$
1590. 49	2*r*	62873. 70	$3p\,^3P_0-7d\,^3D^\circ_1$
1589. 60	1	62908. 90	$3p\,^3P_2-8s\,^1P^\circ_1$
1586. 76	1	63021. 51	
1586. 00	1	63051. 70	$3p\,^3P_1-8s\,^1P^\circ_1$
1584. 27	0	63120. 55	$3p\,^3P_2-7d\,^1D^\circ_2$
1583. 97	0	63132. 50	{ $3p\,^3P_0-8s\,^1P^\circ_1$ $3p\,^3P_2-7d\,^3F^\circ_3$
1580. 28	0	63279. 92	
1576. 76	1	63421. 20	$3p\,^3P_2-7d\,^1F^\circ_3$
1574. 69	2	63504. 56	
1573. 85	1*r*	63538. 47	$3p\,^3P_2-8d\,^3D^\circ_3$
1565. 30	1	63885. 52	$3p\,^3P_0-9s\,^1P^\circ_1$

The intensities assigned to the lines are the usual visual estimates, and are not comparable between widely separated regions of the spectrum. The letters following the estimated intensities give a description of the line as emitted by the arc in air, even though for all the lines between 7970 and 6124 A, except a few fainter ones, the recorded wave lengths are for the enclosed arc at reduced pressure.

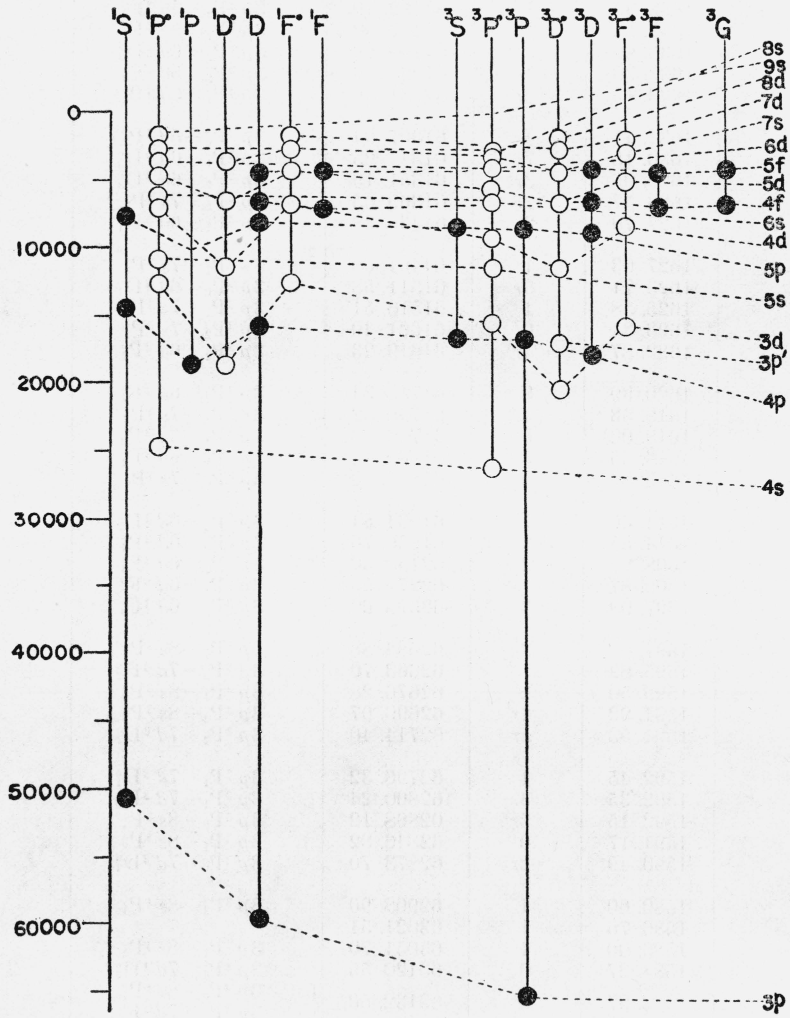

FIGURE 1.—*Terms of the arc spectrum of silicon;* ● *even terms;* ○ *odd terms.*

These letters have the following significance: *b*, widened, not sharp; *e*, enhanced at electrode; *h*, hazy, *H*, very hazy; *l*, unsymmetrically shaded toward red; *r*, reversed.

2. TERM STRUCTURE OF SI I

The terms upon which the arc spectrum of silicon is built result from the interactions of a migrating valence electron with the configurations $3s^2\,3p$ and $3s\,3p^2$. The terms to be expected theoretically from this procedure are set forth in table 3. Those that have actually been established in the analysis of the spectrum, both through Fowler's work and the work at the National Bureau of Standards, are listed in table 4, of which figure 1 is a graphic representation.

TABLE 3.—*Theoretical terms of* Si I

Electron configuration	Terms
$3s^2\,3p^2$	^3P, ^1D, ^1S
$3s^2\,3p\,ns$	$^3P^\circ$, $^1P^\circ$
$3s^2\,3p\,np$	^3D, ^3P, ^3S, ^1D, ^1P, ^1S
$3s^2\,3p\,nd$	$^3F^\circ$, $^3D^\circ$, $^3P^\circ$, $^1F^\circ$, $^1D^\circ$, $^1P^\circ$
$3s^2\,3p\,nf$	^3G, ^3F, ^3D, ^1G, ^1F, ^1D
$3s\,3p^3=3p'$	$^5S^\circ$, $^3D^\circ$, $^3P^\circ$, $^3S^\circ$, $^1D^\circ$, $^1P^\circ$

TABLE 4.—*Observed terms of* Si I.

Term symbol	Term value cm^{-1}	$\Delta\nu$	Term symbol	Term value cm^{-1}	$\Delta\nu$
$3p\,^3P_0$	65743. 00		$3d\,^1D^\circ_2$	18391. 50	
		77. 15	$3d\,^1F^\circ_3$	12380. 59	
$3p\,^3P_1$	65665. 85		$3d\,^1P^\circ_1$	12355. 83	
		146. 16			
$3p\,^3P_2$	65519. 69		$3p'\,^3D^\circ_1$	17343. 85	
		6075. 50			178. 45
$3p\,^1D_2$	59444. 19		$3p'\,^3D^\circ_2$	17165. 40	
		9095. 43			296. 36
$3p\,^1S_0$	50348. 76		$3p'\,^3D^\circ_3$	16869. 04	
$4s\,^3P^\circ_0$	26059. 90		$4p\,^3D_1$	17723. 00	
		77. 10			82. 38
$4s\,^3P^\circ_1$	25982. 80		$4p\,^3D_2$	17640. 62	
		194. 92			161. 97
$4s\,^3P^\circ_2$	25787. 88		$4p\,^3D_3$	17478. 65	
		1036. 62			
$4s\,^1P^\circ_1$	24751. 26		$4p\,^3P_0$	16714. 83	
					32. 38
$3d\,^3D^\circ_1$	20466. 80		$4p\,^3P_1$	16682. 45	
		17. 40			128. 06
$3d\,^3D^\circ_2$	20449. 40		$4p\,^3P_2$	16554. 39	
		28. 26			
$3d\,^3D^\circ_3$	20421. 14		$4p\,^3S_1$	16343. 34	
$3d\,^3F^\circ_2$	15892. 07		$4p\,^1P_1$	18458. 80	
		83. 19	$4p\,^1D_2$	15553. 57	
$3d\,^3F^\circ_3$	15808. 88		$4p\,^1S_0$	14131. 23	
		137. 76			
$3d\,^3F^\circ_4$	15671. 12		$5s\,^3P^\circ_0$	11498. 42	
					69. 32
$3d\,^3P^\circ_2$	15243. 56		$5s\,^3P^\circ_1$	11429. 10	
		−66. 51			213. 98
$3d\,^3P^\circ_1$	15177. 05		$5s\,^3P^\circ_2$	11215. 12	
		−36. 20			343. 11
$3d\,^3P^\circ_0$	15140. 85		$5s\,^1P^\circ_1$	10872. 01	

TABLE 4.—*Observed terms of* Si I.—Continued

Term symbol	Term value cm^{-1}	$\Delta\nu$	Term symbol	Term value cm^{-1}	$\Delta\nu$
			$4f\ ^1F_3$	6968. 82	
$4d\ ^3D^\circ_1$	11558. 03		$4f\ ^1G_4$		
		20. 15	$4f\ ^1D_2$	6632. 09	
$4d\ ^3D^\circ_2$	11537. 88				
		52. 28	x'	6633. 1	
$4d\ ^3D^\circ_3$	11485. 60				22. 6
			x''	6610. 5	
$4d\ ^3P^\circ_2$	9052. 06				
		−9. 90	$6s\ ^3P^\circ_0$	6522. 24	
$4d\ ^3P^\circ_1$	9042. 16				52. 52
		−32. 40	$6s\ ^3P^\circ_1$	6469. 72	
$4d\ ^3P^\circ_0$	9009. 76				232. 89
			$6s\ ^3P^\circ_2$	6236. 83	
$4d\ ^3F^\circ_2$	8370. 56				130. 17
		78. 26	$6s\ ^1P^\circ_1$	6106. 66	
$4d\ ^3F^\circ_3$	8292. 30				
		133. 15	$5d\ ^3D^\circ_1$	6686. 30	
$4d\ ^3F^\circ_4$	8159. 15				−24. 28
			$5d\ ^3D^\circ_2$	6710. 58	
$4d\ ^1D^\circ_2$	9240. 00				86. 09
$4d\ ^1P^\circ_1$	6941. 00		$5d\ ^3D^\circ_3$	6624. 49	
$4d\ ^1F^\circ_3$	6849. 72				
			$5d\ ^3P^\circ_2$	5825. 65	
$5p\ ^3D_1$	8765. 00				−92. 75
		39. 26	$5d\ ^3P^\circ_1$	5732. 90	
$5p\ ^3D_2$	8725. 74				−32. 38
		180. 68	$5d\ ^3P^\circ_0$	5700. 52	
$5p\ ^3D_3$	8545. 06				
			$5d\ ^3F^\circ_2$	5097. 51	
$5p\ ^3P_0$	8447. 24				60. 41
		32. 88	$5d\ ^3F^\circ_3$	5037. 10	
$5p\ ^3P_1$	8414. 36				143. 23
		139. 54	$5d\ ^3F^\circ_4$	4893. 87	
$5p\ ^3P_2$	8274. 82				
			$5d\ ^1D^\circ_2$	5443. 08	
$5p\ ^3S_1$	8201. 14		$5d\ ^1P^\circ_1$	4434. 68	
			$5d\ ^1F^\circ_3$	4319. 00	
$5p\ ^1D_2$	7945. 18				
$5p\ ^1P_1$	9317. 9?		$5f\ ^3F_2$	4438. 50	
$5p\ ^1S_0$	7431. 81				0. 36
			$5f\ ^3F_3$	4438. 14	
$4f\ ^3F_2$	6967. 56				1. 71
		11. 36	$5f\ ^3F_4$	4436. 43	
$4f\ ^3F_3$	6956. 20				
		2. 20	$5f\ ^3G_3$	4180. 63	
$4f\ ^3F_4$	6954. 00				1. 38
			$5f\ ^3G_4$	4179. 25	
$4f\ ^3G_3$	6707. 85		$5f\ ^3G_5$		
		1. 85			
$4f\ ^3G_4$	6706. 00		$5f\ ^3D_3$	4145. 88	
		16. 84			−0. 78
$4f\ ^3G_5$	6689. 16		$5f\ ^3D_2$	4145. 10	
					−0. 70
$4f\ ^3D_3$	6633. 25		$5f\ ^3D_1$	4144. 40	
		−81. 09			
$4f\ ^3D_2$	6552. 16		$5f\ ^1F_3$		
		0. 44	$5f\ ^1G_4$		
$4f\ ^3D_1$	6552. 60		$5f\ ^1D_2$	4439. 72	

TABLE 4.—*Observed terms of* Si I.—Continued

Term symbol	Term value cm⁻¹	Δν	Term symbol	Term value cm⁻¹	Δν
$7s\,^3P^\circ_0$	4203. 00				
		54. 80	$6f\,^3F_2$	3074. 50	
$7s\,^3P^\circ_1$	4148. 20				
		228. 64	$8s\,^3P^\circ_0$	2989. 95	
$7s\,^3P^\circ_2$	3919. 56				55. 90
		58. 06	$8s\,^3P^\circ_1$	2934. 05	
$7s\,^1P^\circ_1$	3861. 50				114. 80
			$8s\,^3P^\circ_2$	2819. 25	
$6d\,^3D^\circ_1$	4232. 29				206. 85
		−86. 78	$8s\,^1P^\circ_1$	2612. 40	
$6d\,^3D^\circ_2$	4319. 07				
		151. 87	$7d\,^3D^\circ_1$	2869. 10	
$6d\,^3D^\circ_3$	4167. 20				1. 28
			$7d\,^3D^\circ_2$	2867. 82	
$6d\,^3P^\circ_2$	3897. 04				61. 12
		−90. 90	$7d\,^3D^\circ_3$	2806. 70	
$6d\,^3P^\circ_1$	3806. 14				
		−33. 42	$7d\,^3F^\circ_2$	2485. 39	
$6d\,^3P^\circ_0$	3772. 72				96. 09
			$7d\,^3F^\circ_3$	2389. 30	
$6d\,^3F^\circ_2$	3393. 73				226. 93
		27. 41	$7d\,^3F^\circ_4$	2162. 37	
$6d\,^3F^\circ_3$	3366. 32				
		157. 78	$7d\,^1D^\circ_2$		
$6d\,^3F^\circ_4$	3208. 54		$7d\,^1F^\circ_3$	2100. 45	
			$7d\,^1P^\circ_1$		
$6d\,^1D^\circ_2$	3587. 80				
$6d\,^1P^\circ_1$			$8d\,^3D^\circ_3$	1984. 65	
$6d\,^1F^\circ_3$	2941. 00		$9s\,^1P^\circ_1$	1858. 05	

Comparison of the present list of terms with those reported in the earlier papers will reveal that several corrections and additions have been made. In the $4p$ group, which are responsible for the intense infrared lines, new values have been assigned to the ^3D terms and also to $^3P_0$ and $^1P_1$. The uncertainties that have attended the identification of some of the $4f$ and $5f$ terms, owing to the diffuseness of the lines and the presence of unresolved satellites, have now been removed with the aid of the enclosed arc observations. The numeration of Fowler's odd ^3D terms proposed in my earlier paper is here retained despite Robinson's [11] criticism based on his application of the irregular doublet law to the sequence of isoelectronic spectra beginning with Si I. The reassignment of Fowler's $3p'\,^3D^\circ$ and $^3P^\circ$ terms to the $3d$ configuration is supported by the discovery of the companion term, $3d\,^3F^\circ$, and also of the $^3D^\circ$ term at 17200, which satisfies the combination requirements of a $3p'$ term, but not those of a $3d$ term. It is to be noted that the odd $^3F^\circ$ terms are all new and make it possible to fill out the complement of terms required for the nd configurations. The extension of the nd terms to higher values of n is due largely to the excellent spectrograms that Shenstone has made of the Schumann region. In particular, these observations have brought to light

[11] H. A. Robinson, Phys. Rev. **49**, 304 (1936).

several new combinations with the $3p\ ^1S_0$ term that are masked by a band structure extending below 2000 A in observations made with the arc in air.

3. SERIES AND IONIZATION POTENTIAL OF Si I

In the light of the present analysis it is now possible to extend to higher members several of Fowler's Si I series. Others must be amended, and still others that are new may be described. Fowler's most reliable series for determination of absolute term values are those from the *ns* electron. Reference to table 4 will show that the series $3p\ ^3P - ns\ ^3P^\circ$ are now represented by five members. A Ritz formula of the type

$$\nu = L - R/\left(m + \alpha + \frac{\beta}{m^2}\right)^2,$$

in which $R_{\mathrm{Si}} = 109735.3$, has been found sufficient to reproduce most of the series of Si I, especially those of the *ns* and *nf* configurations, with great fidelity. Applied to the series $3p\,^3P_0 - ns\,^3P_1^\circ$ the formula

$$\nu = 65722 - R/\left(m - 1.8182 - \frac{2.0142}{m^2}\right)^2,\ m = 4, 5, 6\ \ldots$$

fits the first three members of the series exactly and reproduces the fifth and sixth members with residuals of +25 and −13 cm^{-1}, respectively. It will be noted that the term value $3p\ ^3P_0 = 65722$ is in close agreement with Fowler's value, 65765.

The Ritz type of formula also appears to give a more satisfactory representation of the $ns\ ^1P_1^\circ$ terms than does the Hicks formula employed by Fowler. For the series $3p\ ^3P_0 - ns\ ^1P_1^\circ$ the formula

$$\nu = 65995 - R/\left(m - 1.7992 - \frac{1.6618}{m^2}\right)^2,\ m = 4, 5, 6\ \ldots$$

reproduces the observed lines with the residuals −46, +45, 0, 0, +15, respectively. In this case the value of the limit, $L = 65995$, represents the distance of $3p\ ^3P_0$ from the Si II parent term, $^2P_{3/2}$, of the $ns\ ^1P_1^\circ$ terms. According to Fowler's analysis of Si II[12] the components of the ground state ^2P are separated by 287 cm^{-1}. Deduction of this amount from 65995 gives a value of 65708 for the distance separating $3p\ ^3P_0$ from the lowest term of Si II, in excellent agreement with the result from the $ns\ ^3P_1^\circ$ terms which converge toward $^2P_{1/2}^\circ$. Fowler adds also the term $9s\ ^1P_1^\circ$ to this series, which is reproduced by the above formula with a residual of +18 cm^{-1}.

We may expect equally satisfactory results from the *nf* terms, since they are nearly hydrogenic. Only two members have been found for most of these sequences, but for the $nf\ ^3F_2$ terms there are three members observed. A satisfactory Ritz formula for the series $3d\ ^3F_2^\circ - nf\ ^3F_2$ is

$$\nu = 15915 - R/\left(m - 0.0569 + \frac{0.3256}{m^2}\right)^2,\ m = 4, 5, 6\ \ldots$$

[12] A. Fowler, Phil. Trans. Roy. Soc. (London) [A] 225, 24 (1925).

The term $3d\,^3F_2^\circ$ lies 49,851 units above $3p\,^3P_0$, whence we derive a value 65766 for the ground term of Si I.

Owing to the revisions and additions to the *nd* terms that have been described above, the sequences in this group are new except for the $^1P^\circ$ and $^1F^\circ$ series. They may all be represented with varying degrees of accuracy by properly evaluated Ritz formulas. These are as follows:

Series $3p\,^1D_2-nd\,^1F_3^\circ$; limit $^2P_{3/2}$ in Si II.

$$\nu=59583-R/\left(m-0.0326-\frac{0.0511}{m^2}\right)^2,\ m=3,\ 4,\ 5\ \ldots$$

$3p\,^3P_0=59583-287+6299=65595.$

Series $3p\,^1D_2-nd\,^1D_2^\circ$, limit $^2P_{3/2}$ in Si II

$$\nu=59710-R/\left(m-0.6384+\frac{0.5728}{m^2}\right)^2,\ m=3,\ 4,\ 5\ \ldots$$

$3p\,^3P_0=65722.$

Series $3p\,^1S_0-nd\,^1P_1^\circ$, limit $^2P_{1/2}$ in Si II

$$\nu=50328-R/\left(m-0.0142-\frac{0.0314}{m^2}\right)^2,\ m=3,\ 4,\ 5\ \ldots$$

$3p\,^3P_0=50328+15394=65722.$

Series $4p\,^3D_3-nd\,^3F_4^\circ$, limit $^2P_{3/2}$ in Si II

$$\nu=17775-R/\left(m-0.4105+\frac{0.2094}{m^2}\right)^2,\ m=3,\ 4,\ 5\ \ldots$$

$3p\,^3P_0=17775-287+48264=65752.$

Series $3p\,^3P_1-nd\,^3F_2^\circ$, limit $^2P_{1/2}$ in Si II

$$\nu=65791-R/\left(m-0.4394+\frac{0.5116}{m^2}\right)^2,\ m=3,\ 4,\ 5\ \ldots$$

$3p\,^3P_0=65791+77=65868.$

Series $3p\,^3P_2-nd\,^3D_3^\circ$, limit $^2P_{3/2}$ in Si II

$$\nu=65943-R/\left(m-1.2478+\frac{4.8083}{m^2}\right)^2,\ m=3,\ 4,\ 5\ \ldots$$

$3p\,^3P_0=65943-287+223=65879.$

Series $3p\,^3P_1-nd\,^3D_2^\circ$, limit $^2P_{3/2}$ in Si II

$$\nu=65932-R/\left(m-1.2434+\frac{4.8952}{m^2}\right)^2,\ m=3,\ 4,\ 5\ \ldots$$

$3p\,^3P_0=65932-287+77=65722.$

Series $3p\,^3P_0-nd\,^3D_1$, limit $^2P_{3/2}$ in Si II

$$\nu=66107-R/\left(m-1.2480+\frac{4.8158}{m^2}\right)^2,\ m=3,\ 4,\ 5\ \ldots$$

$3p\,^3P_0=66107-287=65820.$

Series $3p\,^3P_2-nd\,^3P_2^\circ$, Limit $^2P_{1/2}$ in Si II

$$\nu=65500-R/\left(m-0.8165+\frac{4.5540}{m^2}\right)^2,\ m=3,\ 4,\ 5\ \ldots$$

$3p\,^3P_0=65500+223=65723.$

Series $3p\,^3P_0-nd\,^3P_1^\circ$, limit $^2P_{1/2}$ in Si II

$$\nu=66001-R/\left(m-0.9928+\frac{6.8477}{m^2}\right)^2,\ m=3,\ 4,\ 5\ \ldots$$

$3p\,^3P_0=66001-287=65714.$

An inspection of the results presented in the foregoing paragraphs will show that the component series of the *ns* terms approach their limits according to the theory of Hund.[13] With the *nd* series, however, another procedure is followed. This was already forecast by Fowler, who noted that the *nd* $^1P_1^\circ$ terms of Si I converge toward $^2P_{1/2}^\circ$ instead of $^2P_{3/2}^\circ$ of Si II. This behavior is confirmed by the present analysis and, in addition, it is seen that the *nd* $^3P_2^\circ$ terms also converge toward $^2P_{1/2}^\circ$ of Si II, while the three components of the *nd* $^3D^\circ$ group converge toward $^2P_{3/2}^\circ$. This is shown graphically in figure 2. Although the coordination of individual series with their proper limits presented herein differs with Hund's theoretical scheme, nevertheless, the quantum requirements are fulfilled that series terms with inner quantum numbers, 4, 3, 3, 2, 2, 1, 1, 0 converge toward $^2P_{3/2}^\circ$ and those with inner quantum numbers 3, 2, 2, 1, converge toward $^2P_{1/2}^\circ$. The sequences of *np* and *nf* terms have for the most part only two members and are therefore not adequate for the coordination of their components with limits in Si II.

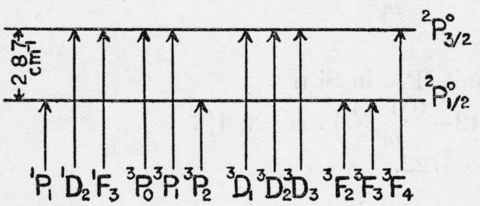

FIGURE 2.—*Coordination of component series of the d-electron with limits in* Si II.

From the various series described above a mean value of 65743 cm^{-1} is found for the separation of 3*p* $^3P^\circ$ of Si I and 3*p* $^2P_{0\,1/2}^\circ$ of Si II, corresponding, therefore, to an ionization potential of 8.11 volts. This value differs only by 22 cm^{-1} from Fowler's value of 65765.

4. SILICON IN THE SUN

The presence of silicon in the sun has long been established through the 4*s*−5*p* lines in the yellow and the 3*p*−4*s* lines in the violet. Subsequently, identification of red and infrared solar lines with silicon was made by Meggers [14] with the aid of unpublished National Bureau of Standards observations. As more extensions of both solar and silicon spectra became available for comparison, it was found that nearly all the stronger lines emitted by the Si arc have their counterparts in the sun. Such a comparison is set forth in table 1, in the third column of which are given the values of the solar wave lengths taken either from the Revision of Rowland's Preliminary Table [15] or from Babcock's published [16] and unpublished lists of infrared solar lines.

However, the silicon atom is capable of emitting more lines than those listed in tables 1 and 2. Very few of the multiplets that have been described in this paper are emitted with their full complement of lines by the arc sources described above. In table 5 are listed unobserved lines calculated from term combinations and with them the nearest solar lines. A group of lines in the blue-green may be expected from the 4*s*−6*p* transition. The 6*p* terms have not yet been detected in the laboratory but the lines resulting from their combination with the 4*s* terms are in all probability present in the sun.

[13] F. Hund, Linienspektren, p. 184 (Julius Springer, Berlin, 1927).
[14] W. F. Meggers, Pub. Allegheny Obs., **6**, 13 (1919).
[15] Carnegie Institution of Washington Publication 396, (1928).
[16] H. D. Babcock, Trans. Int. Astron. Union **5**, 90 (1935) Astrophys. J. **83**, 103 (1936).

TABLE 5.—*Comparison of computed* Si I *lines with solar lines*

Computed wave length of Si I	Wave length in sun	Solar intensity	Wave number ν	Term combination
11890.29	0.51	−1	8407.92	$4s\ ^1P^\circ_1-4p\ ^3S_1$
10976.25	6.30	−1	9108.09	$4p\ ^3D_3-4d\ ^3F^\circ_2$
10616.59	6.71	1	9416.64	$4p\ ^1P_1-4d\ ^3P^\circ_1$
10580.20	0.61	−3	9449.04	$4p\ ^1P_1-4d\ ^3P^\circ_0$
10179.38	9.36	−1	9821.10	$4p\ ^3S_1-6s\ ^3P^\circ_0$
10125.22	4.92	−2	9873.62	$4p\ ^3S_1-6s\ ^3P^\circ_1$
10025.45	5.86	2*n*	9971.87	$4p\ ^3P_1-5d\ ^3D^\circ_2$
10001.15	1.31	−1	9996.15	$4p\ ^3P_1-5d\ ^3D^\circ_1$
9453.00	3.12	−2	10575.79	$4p\ ^3P_1-6s\ ^1P^\circ_1$
9405.71	5.80	0*N*	10628.93	$4p\ ^3D_3-4d\ ^1F^\circ_3$
9393.43	3.44	−3	10642.82	$4p\ ^3S_1-5d\ ^3P^\circ_0$
9078.16	8.28	1*d*? C	11012.42	$4p\ ^3D_1-5d\ ^3D^\circ_2$
8928.37	8.17	−3	11197.18	$4p\ ^1S_0-8s\ ^3P^\circ_1$
8780.00	0.17	−3	11386.40	$4p\ ^1D_2-6d\ ^3D^\circ_3$
8766.24	6.42	−1	11404.27	$4p\ ^1D_2-5d\ ^1P^\circ_1$
8703.73	3.73	−2*N*, Mn	11486.17	$4p\ ^3D_1-6s\ ^3P^\circ_2$
8680.22	0.10	−1	11517.29	$4p\ ^3P_2-5d\ ^3F^\circ_3$
8679.05	8.95	−2 S	11518.83	$4p\ ^1S_0-8s\ ^1P^\circ_1$
8667.07	7.37	−1	11533.96	$4p\ ^3D_2-6s\ ^1P^\circ_1$
8579.13	9.08	−2	11653.00	$4p\ ^3D_3-5d\ ^3P^\circ_2$
8576.53	6.48	−3	11656.53	$4p\ ^1D_2-6d\ ^3P^\circ_2$
8550.46	0.37	1	11692.07	$4p\ ^1D_2-7s\ ^1P^\circ_1$
8511.40	1.45	−3	11745.75	$4p\ ^3D_2-5d\ ^3P^\circ_1$
8510.16	0.25	−1	11747.43	$4p\ ^1D_2-6d\ ^3P^\circ_1$
8492.00	2.08	−2	11772.50	$4p\ ^1P_1-5d\ ^3D^\circ_1$
8461.51	1.47	−3	11814.97	$4p\ ^3D_2-5d\ ^3P^\circ_2$
8337.93	7.92	−3	11990.10	$4p\ ^3D_1-5d\ ^3P^\circ_1$
8305.75	5.62	−1	12036.55	$4p\ ^3D_3-5d\ ^1D^\circ_2$
8198.48	8.28	−3	12194.04	$4p\ ^3S_1-5d\ ^1P^\circ_1$
8195.46	5.45	−2	12198.52	$4p\ ^3D_2-5d\ ^1D^\circ_2$
8145.61	5.48	−1 Fe	12273.18	$4p\ ^1S_0-7d\ ^1P^\circ_1$
8086.12	6.18	−3	12363.38	$4p\ ^3P_1-6d\ ^3D^\circ_2$
8074.58	4.43	−2 Atm?	12381.14	$4p\ ^3D_3-5d\ ^3F^\circ_2$
8070.64	0.62	−1	12387.19	$4p\ ^3P_2-6d\ ^3D^\circ_3$
7976.65	6.59	−1 Atm?	12533.15	$4p\ ^3P_1-5d\ ^1P^\circ_1$
7898.37	8.38	−3	12657.35	$4p\ ^3P_2-6d\ ^3P^\circ_2$
7855.83	5.82	−3 Co	12725.90	$4p\ ^1P_1-5d\ ^3P^\circ_1$
7725.16	5.17	−1	12941.17	$4p\ ^1D_2-8s\ ^1P^\circ_1$
7523.11	3.22	−3	13288.72	$4p\ ^3P_1-6d\ ^3F^\circ_2$
7518.50	8.66	−3*N*	13296.87	$4p\ ^3D_3-5d\ ^1F^\circ_3$
7504.60	4.61	−3	13321.55	$4p\ ^3D_2-6d\ ^3D^\circ_2$
7486.67	6.67	−2	13353.39	$4p\ ^3S_1-8s\ ^3P^\circ_0$
7482.25	2.21	−1	13361.29	$4p\ ^1P_1-5d\ ^3F^\circ_2$
7458.44	8.38	−2	13403.93	$4p\ ^3D_1-6d\ ^3D^\circ_2$
7456.00	6.35	−3	13408.33	$4p\ ^3D_2-6d\ ^3D^\circ_1$

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TABLE 5.—*Comparison of computed* Si I *lines with solar lines*—Continued

Computed wave length of Si I	Wave length in sun	Solar intensity	Wave number ν	Term combination
7455. 44	5. 39	−3	13409. 29	$4p\,^3S_1-8s\,^3P^\circ_1$
7431. 17	1. 14	−3	13453. 12	$4p\,^1D_2-7d\,^1F^\circ_3$
7410. 14	9. 99	−3	13491. 32	$4p\,^3D_2-5d\,^1P^\circ_1$
7409. 53	9. 69	−3	13492. 42	$4p\,^3D_2-7s\,^3P^\circ_1$
7392. 18	2. 13	−3*N*	13524. 09	$4p\,^3S_1-8s\,^3P^\circ_2$
7367. 75	7. 76	−3	13568. 92	$4p\,^1D_2-7d\,^1F^\circ_3$
7365. 16	5. 30	0 Atm	13573. 70	$4p\,^3D_1-5d\,^1P^\circ_1$
7364. 56	4. 65	−3*N*	13574. 80	$4p\,^3D_1-7s\,^3P^\circ_1$
7360. 87	0. 81	−3	13581. 61	$4p\,^3D_3-6d\,^3P^\circ_2$
7278. 60	8. 52	−2	13735. 14	$4p\,^3P_2-8s\,^3P^\circ_2$
7114. 05	4. 19	−3 Atm?	14052. 82	$4p\,^3D_2-6d\,^1D^\circ_2$
7097. 80	7. 68	−3	14084. 92	$4p\,^3D_3-6d\,^3F^\circ_2$
7072. 59	2. 81	−3	14135. 20	$4p\,^3D_1-6d\,^1D^\circ_2$
7017. 19	7. 33	−1*Nd*	14246. 89	$4p\,^3D_2-6d\,^3F^\circ_2$
6865. 41	5. 46	−3	14561. 76	$4p\,^1P_1-6d\,^3P^\circ_2$
6842. 35	2. 38	−3*d*?	14610. 83	$4p\,^3D_3-7d\,^3D^\circ_2$
6819. 68	9. 86	−2*d*?	14659. 40	$4p\,^3D_3-8s\,^3P^\circ_2$
6813. 85	3. 92	−3*N*	14671. 95	$4p\,^3D_3-7d\,^3D^\circ_3$
6807. 29	7. 39	−3*d*?	14686. 08	$4p\,^1P_1-6d\,^3P^\circ_0$
6767. 92	8. 01	−3	14771. 52	$4p\,^3D_2-7d\,^3D^\circ_1$
6767. 33	7. 36	−3*d*?	14772. 80	$4p\,^3D_2-7d\,^3D^\circ_2$
6739. 45	9. 53	0 Fe	14833. 92	$4p\,^3D_2-7d\,^3D^\circ_3$
6730. 39	0. 32	−2*N*	14853. 90	$4p\,^3D_1-7d\,^3D^\circ_1$
6729. 80	9. 75	−2*N*, Cr?	14855. 18	$4p\,^3D_1-7d\,^3D^\circ_2$
6722. 65	2. 72	−3*N*	14871. 00	$4p\,^1P_1-6d\,^1D^\circ_2$
6500. 92	0. 85	−3	15378. 20	$4p\,^3D_3-7d\,^1F^\circ_3$
6462. 82	2. 98	−3	15468. 85	$4p\,^1P_1-8s\,^3P^\circ_0$
6439. 55	9. 58	−3	15524. 75	$4p\,^1P_1-8s\,^3P^\circ_1$
6308. 84	8. 84	−2*N*	15846. 40	$4p\,^1P_1-8s\,^1P^\circ_1$
6022. 16	2. 23	−3	16600. 75	$4p\,^1P_1-9s\,^1P^\circ_1$
3345. 54	5. 49	−2	29881. 96	$3p\,^1S_0-3d\,^3D^\circ_1$

5. LINES OF Si II

Several lines of Si II were measured repeatedly while the work described in this paper was in progress. The mean values of these determinations are given at this time in table 6 to complete the observational record.

TABLE 6.—*Wave lengths of some* Si II *lines*

Wave length	Intensity	Wave number	$\Delta\nu$	Term combination
6371. 33	15	15690. 98	59. 98	$4s\ ^2S_{0\frac{1}{2}}-4p\ ^2P^{\circ}_{0\frac{1}{2}}$
6347. 07	30	15750. 96		$4s\ ^2S_{0\frac{1}{2}}-4p\ ^2P^{\circ}_{1\frac{1}{2}}$
1817. 42	2	55023. 05		$3p\ ^2P^{\circ}_{1\frac{1}{2}}-3p'\ ^2D_{1\frac{1}{2}}$
1816. 94	8	55037. 58	286. 38	$3p\ ^2P^{\circ}_{1\frac{1}{2}}-3p'\ ^2D_{2\frac{1}{2}}$
1808. 01	7	55309. 43		$3p\ ^2P^{\circ}_{0\frac{1}{2}}-3p'\ ^2D_{1\frac{1}{2}}$
1533. 44	5	65212. 85	287. 90	$3p\ ^2P^{\circ}_{1\frac{1}{2}}-4s\ ^2S_{0\frac{1}{2}}$
1526. 70	4	65500. 75		$3p\ ^2P^{\circ}_{0\frac{1}{2}}-4s\ ^2S_{0\frac{1}{2}}$

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