RP521

FURTHER DESCRIPTION AND ANALYSIS OF THE FIRST SPECTRUM OF XENON

By C. J. Humphreys and W. F. Meggers

ABSTRACT

An entirely new description of the first spectrum of Xenon has been completed. Geissler tubes with a small bore capillary, exposed end on, were used as sources and afforded sufficient intensity to permit the use of spectrographs of high resolving power to a greater extent than in the preliminary investigation previously reported. The new description covers the region between 3,340 and 11,140 A. The spectrum has been photographed by aid of a Rowland 20,000-line per inch grating over the range included between 3,440 and 9,800 A. Interferometer measurements have been made on 130 lines, including 45 reported in a previous paper. Several new lines have been found in the ultra-violet between 3,340 and 3,440 where the use of a source of higher intensity has led to the detection of several higher members of the $1s_5-mp_i$ series. Most of the new data have been obtained in the infra-red region. Each of the new types of Eastman red and infra-red sensitive plates, F, N, P, and Q have been exposed to the radiation in the spectral region for which their respective sensitivity is greatest. It is believed that the spectrum has been completely recorded throughout the region investigated.

Of the 538 lines included in the description all but 13 have been classified. Almost all terms predicted by the Hund theory have been obtained. The new term table embodies a small change in the absolute term values indicated by new measurements of greater precision, several newly discovered terms, and extensions to practically all the series. Some rearrangement of the d-terms has been made necessary, due to the elimination of uncertainties in the assignment of j-values. A new f-type sequence, lying very close to mZ, and designated by mT, has been found.

CONTENTS

I. INTRODUCTION

A preliminary description and analysis of the first spectrum of xenon was published in 1929.[1] As in the case of the investigation of Kr I which was undertaken simultaneously, it was expected to give in later publications extensions of the series to higher members permitted by the detection of fainter lines, interferometer comparisons of wave lengths, and measurements of hyperfine structures. Interferometer measurements of 45 xenon lines,[2] and measurements of the hyperfine structures of 6 xenon lines,[3] are presented in two papers by

[1] W. F. Meggers, T. L. deBruin, and C. J. Humphreys, B. S. Jour. Research, vol. 3 (RP115), p. 731, 1929.
[2] C. J. Humphreys, B. S. Jour. Research, vol. 5 (RP245), p. 1041, 1930.
[3] C. J. Humphreys, B. S. Jour. Research, vol. 7 (RP351), p. 453, 1931.

one of us in which the results of a similar investigation of Kr I are given. In the case of the first spectrum of krypton it was found that a large number of new lines could be recorded by using as a source a Geissler tube exposed end on. A much more intense illumination of the slit could be obtained in this manner than with the usual type of tube, the construction of which permits only side-on exposures. Extended and improved measurements of Kr I are contained in a paper published about a year ago.[4] The present paper represents a more complete description of Xe I than could then be made in the case of krypton because in the meantime new photosenstitizing dyes have been discovered which have greatly extended both the speed of recording and the upper limit of the range of investigation in the infra-red region. All the rare gas spectra have been reinvestigated, using these specially sensitized plates, and "end on" Geissler tubes (from Robert Goetze in Leipzig). The results for those other than xenon are being published in separate papers. The use of more intense sources and more sensitive plates has made possible additional interferometer comparisons, the results of which for Xe I lines are incorporated in the present description. The application of these superior infra-red sensitive photographic plates to spectrographic investigations has created a demand for accurate standards of wave length in the extended range now accessible and it appears that the emission spectra of the noble gases will be useful for this purpose. The results for Xe I lines presented here may be regarded as a contribution to standard wave lengths, since many of the lines have been measured interferometrically either in terms of neon standards or of sharp xenon lines so determined and enough of the spectral terms have thus been accurately fixed in relative value to guarantee the calculated values of the remaining classified lines to within 0.01 A.

Since the publication of our first paper, the spectrum of Xe I has been investigated by Gremmer[5] and by Rasmussen.[6] Gremmer's classification is essentially the same as ours. He succeeded in obtaining 16 classified lines not recorded in our first description in the ultra-violet region. These are in all cases higher members of known series. Rasmussen found a considerable number of lines in the infra-red, gave classifications for 80 additional lines, and introduced a number of changes in term designations which are confirmed by the present investigation.

II. EXPERIMENTAL DETAILS

New spectograms have been made over the entire region of the Xe I spectrum accessible to photography in air. The Hilger E1 spectograph was used to describe the ultra-violet region. The last recorded line appears at 3,340 A. There is no Xe I radiation to be expected between the $1s_5$ series limit at 3,250 A and the Schumann region. Between 3,440 and 9,800 A the Rowland grating with 20,000 lines per inch was used, which gives a scale of 3.7 A/mm in the first order spectrum. The description previously published (RP115) was made for the most part with a grating of 7,500 lines per inch, giving a scale of 10.4 A/mm. The region between 6,600 and 8,600 A was also photographed with a scale of 2.7 A/mm, given by a plane grating with 20,000 lines per inch and lenses of 16 feet focal length. The published obser-

[4] W. F. Meggers, T. L. deBruin, C. J. Humphreys, B. S. Jour. Research, vol. 7 (RP 364), p. 643, 1931.
[5] W. Gremmer, Zeit. f. Physik, vol. 59, p. 154, 1930.
[6] E. Rasmussen, Zeit. f. Physik, vol. 73, p. 779, 1932.

vations beyond 9,800 A have been made with the 7,500-line-per-inch grating, although the infra-red region was also photographed by aid of a Hilger E2 prism spectograph with glass optics. Interferometer measurements have been made of the wave lengths of 130 Xe lines including those reported in RP245. For lines shown by the interference observations to have hyperfine structure, the wave length of the strongest component only is here reported. A pair of crystal quartz interferometer plates of 60 mm aperture, silvered by the evaporation method, have been used in the more recent work. The fixed étalon method has been employed, using invar separators of 3, 6, 10, 15, and 25 mm length.

In the red and infra-red regions, plates prepared with the new types of sensitizers developed by the Eastman laboratories and designated F, N, P, and Q have been used. The characteristics of these special plates are discussed in a recent paper by Mees.[7] We have used the F plate to cover the region from 5,000 to 6,600 A, the N plate from 6,500 to 8,500, the P plate between 8,000 and 9,000, and the Q plate above 9,000. There is considerable overlapping of the regions of sensitivity of these emulsions except that the F type falls off rather abruptly above 6,800 A. The N plate shows two maxima near 7,000 and 8,200 A. The respective maxima of the P and Q types lie at 8,600 and 9,700 A, respectively. Exposures of from 2 to 24 hours have been made. One exposure was prolonged to 40 hours in order to observe the resolution of the pair of lines at 9,374A with the Rowland grating, which was necessary to establish experimentally the existence of the mT series as discussed below. The stronger lines are considerably overexposed in the case of the longer exposures and, in the work with the Rowland grating, show from 1 to 8 orders of Rowland ghosts. It is believed that the spectrum has been completely recorded in the region studied. Radiometric investigation of still longer waves is highly desirable.

III. WAVE-LENGTH MEASUREMENTS

The wave-length measurements have been made relative to the international standards in the iron arc spectrum. The results from each spectrogram were brought to the scale of the interference measurements by applying a correction where a systematic difference was noted. While such corrections were usually of the order of from 0.01 to 0.02 A, it was found necessary to apply a correction as great as 0.1 A in the region above 9,000 A. The cause of this displacement between the xenon, and second order comparison spectrum of iron, too great to be accounted for by atmospheric dispersion, appears to lie in some unexplained temperature displacement of the plate or mounting during prolonged exposure. Wave lengths which have been determined by interference methods are given to thousandths or ten-thousandths of an angstrom unit and can thus be distinguished from those lines for which only prism or grating measurements are available. The vacuum wave numbers corresponding to the wave lengths determined by interference methods have been computed directly from the atmospheric dispersion formula of Meggers and Peters.[8] The use of spectrographs of higher dispersion and resolving power, together with

[7] C. E. K. Mees, J. Opt. Soc. Am., vol. 22, p. 204, 1932.
[8] W. F. Meggers and C. G. Peters, B. S. Sci. papers, vol. 14 (S. P. 327), p. 722; 1918.

the application of interference methods to one-fourth of the lines, has not only greatly increased the accuracy of the wave-length determinations, but has made possible the resolution of nearly all close pairs of lines. Such pairs occur at 6,111, 6,163, 6,206, 6,840, 7,584, 7,642, 7,664, 8,348, 8,952, and 9,374 A. In a few cases, notably 7,119 A, lines formerly regarded as double for purposes of classification are now shown to be single.

The list of Xe I wave lengths as finally adopted is presented in Table 1. After eliminating known lines due to Xe II, faint unclassified lines of doubtful origin, and identifiable Rowland ghosts, we have retained 538 lines. The real lines were in practically all cases distinguished from false lines or ghosts by repeated observations with different gratings. With but 13 exceptions, all of the lines are accounted for by combinations of identified spectral terms. The calculated values of the wave numbers of all classified lines, computed from the experimental terms, are also given in Table 1, and indicate the degree of accuracy of the wave-length determinations.

TABLE 1.—*List of Xe I lines*

Intensity	Wave length	Wave number observed	Combination	Wave number calculated	Intensity	Wave length	Wave number observed	Combination	Wave number calculated
1−	3, 340. 04	29, 931. 18	$1s_5-11p_8$	1. 2	1	3, 742. 22	26, 714. 54	$1s_4-6V$	. 752
1−	3, 348. 63	29, 854. 41	$1s_5-11U$	3. 97	10	3, 745. 38	26, 692. 00	$1s_4-6Y$	1. 95
1*h*−	3, 358. 17	29, 769. 60	$1s_5-10p_6$	. 60	4	3, 745. 69	26, 689. 79	$1s_4-6X$	. 750
1*h*−	3, 358. 96	29, 762. 60	$1s_5-10p_8$	. 60	3	3, 795. 95	26, 336. 42	$1s_5-5V$	. 437
1*h*	3, 370. 34	29, 662. 11	$1s_5-10U$	1. 95	40	3, 796. 30	26, 333. 99	$1s_5-5U$	. 95
1	3, 383. 20	29, 549. 36	$1s_5-9p_6$	. 36	30	3, 801. 39	26, 298. 73	$1s_5-5Y$	. 717
1	3, 384. 36	29, 539. 23	$1s_5-9p_8$	. 23	3	3, 801. 90	26, 295. 20	$1s_5-5X$	. 152
2	3, 400. 07	29, 402. 75	$1s_5-9U$	. 19	30	3, 809. 84	26, 240. 40	$1s_4-5p_5$	. 35
1−	3, 400. 79	29, 396. 53	$1s_5-9Y$	5. 73	10	3, 823. 74	26, 145. 02	$1s_4-5p_6$	. 09
2	3, 418. 37	29, 245. 35	$1s_5-8p_6$	. 35	15	3, 826. 86	26, 123. 70	$1s_4-5p_7$	. 70
2	3, 420. 00	29, 231. 41	$1s_5-8p_8$	. 41	2	3, 835. 6	26, 064. 2	$1s_4-5p_9$	5. 00
3	3, 442. 66	29, 039. 01	$1s_5-8U$	8. 77	2	3, 942. 29	25, 358. 81	$1s_4-5V$	. 821
1	3, 443. 83	29, 029. 15	$1s_5-8Y$	8. 77	60	3, 948. 163	25, 321. 095	$1s_4-5Y$	. 101
4	3, 469. 81	28, 811. 80	$1s_5-7p_6$	. 86	10	3, 948. 72	25, 317. 52	$1s_4-5X$	. 536
4	3, 472. 36	28, 790. 64	$1s_5-7p_8$	. 64	120	3, 950. 925	25, 303. 393	$1s_5-4p_6$	. 395
1	3, 496. 86	28, 588. 93	$1s_4-9p_5$	. 93	6	3, 956. 85	25, 265. 50	$1s_5-4p_7$	. 541
5	3, 506. 74	28, 508. 39	$1s_5-7U$	. 43	200	3, 967. 541	25, 197. 423	$1s_5-4p_8$	. 423
2	3, 508. 42	28, 494. 74	$1s_5-7Y$	5. 032	40	3, 974. 417	25, 153. 835	$1s_5-4p_9$	. 837
2	3, 517. 90	28, 417. 95	$1s_4-9Y$	8. 12	30	3, 985. 202	25, 085. 762	$1s_5-4p_{10}$	. 762
2	3, 533. 48	28, 292. 66	$1s_4-8p_5$	. 66	100	4, 078. 8207	24, 509. 996	$1s_4-4p_5$	. 996
1−	3, 536. 61	28, 267. 62	$1s_4-8p_6$	. 74	60	4, 109. 7093	24, 325. 782	$1s_4-4p_6$	. 779
1	3, 537. 35	28, 261. 70	$1s_4-8p_7$	. 70	80	4, 116. 1151	24, 287. 925	$1s_4-4p_7$	. 925
10	3, 549. 86	28, 162. 11	$1s_5-6p_6$	. 05	20	4, 135. 1337	24, 176. 222	$1s_4-4p_9$	. 221
10	3, 554. 04	28, 128. 99	$1s_5-6p_8$	. 99	2	4, 146. 78	24, 108. 32	$1s_4-4p_{10}$	. 146
1	3, 555. 92	28, 114. 12	$1s_5-6p_9$	. 12	20	4, 193. 01	23, 842. 52	$1s_5-4V$	. 536
3	3, 563. 80	28, 051. 95	$1s_4-8Y$	2. 16	150	4, 193. 5296	23, 839. 567	$1s_5-4U$	. 567
4	3, 587. 02	27, 870. 37	$1s_4-7p_5$	. 37	50	4, 203. 6945	23, 781. 922	$1s_5-4Y$	. 921
1	3, 591. 67	27, 834. 29	$1s_4-7p_6$	. 25	10	4, 205. 404	23, 772. 254	$1s_5-4X$	. 253
2	3, 592. 80	27, 825. 53	$1s_4-7p_7$	. 53	20	4, 372. 287	22, 864. 925	$1s_4-4V$	. 920
15	3, 610. 32	27, 690. 51	$1s_5-6U$	. 53	100	4, 383, 9092	22, 804. 306	$1s_4-4Y$	. 305
8	3, 613. 06	27, 669. 50	$1s_5-6Y$	. 56	70	4, 385. 7693	22, 794. 635	$1s_4-4X$	. 637
6	3, 633. 06	27, 517. 19	$1s_4-7Y$	. 416	500	4, 500. 9772	22, 211. 188	$1s_5-2p_2$	. 186
10	3, 669. 91	27, 240. 90	$1s_4-6p_5$	. 90	400	4, 524. 6805	22, 094. 833	$1s_5-2p_3$	. 833
2	3, 677. 54	27, 184. 38	$1s_4-6p_6$	. 44	2	4, 576. 60	21, 844. 18		
4	3, 679. 31	27, 171. 30	$1s_4-6p_7$	. 30	300	4, 582. 7474	21, 814. 878	$1s_4-2p_1$	. 875
40	3, 685. 90	27, 122. 72	$1s_5-5p_6$	. 70	100	4, 611. 8896	21, 677. 034	$1s_5-3p_7$	. 034
1	3, 688. 80	27, 101. 40	$1s_5-5p_7$	. 32	1,000	4, 624. 2757	21, 618. 973	$1s_5-3p_6$	. 973
40	3, 693. 49	27, 066. 99	$1s_5-5p_8$	. 99	2,000	4, 671. 226	21, 401. 685	$1s_5-3p_8$	. 685
4	3, 696. 82	27, 042. 61	$1s_5-5p_9$	. 61	100	4, 690. 9711	21, 311. 603	$1s_5-2p_4$	. 600
2	3, 702. 74	26, 999. 37	$1s_5-5p_{10}$	. 41	300	4, 697. 020	21, 284. 155	$1s_5-3p_9$	. 154

TABLE 1.—*List of Xe I lines*—Continued

Intensity	Wave length	Wave number observed	Combination	Wave number calculated
5	4, 708. 21	21, 233. 57	$1s_4-2p_2$	. 570
600	4, 734. 1524	21, 117. 217	$1s_4-2p_3$	. 217
150	4, 792. 6192	20, 859. 605	$1s_5-3p_{10}$	. 605
500	4, 807. 019	20, 797. 118	$1s_4-3p_5$	. 118
400	4, 829. 709	20, 699. 415	$1s_4-3p_7$	. 418
300	4, 843. 294	20, 641. 357	$1s_4-3p_6$	. 357
500	4, 916. 508	20, 333. 981	$1s_4-2p_4$	. 984
500	4, 923. 1522	20, 306. 538	$1s_4-3p_9$	. 538
3*h*	5, 023. 88	19, 899. 40	$1s_3-8X$	. 47
200	5, 028. 2796	19, 881. 989	$1s_4-3p_{10}$	. 989
10	5, 162. 711	19, 364. 290	$1s_3-7X$	. 290
1*h*	5, 164. 39	19, 357. 99	$2p_{10}-10d_3$	. 94
1*h*	5, 167. 30	19, 347. 09	$2p_{10}-10d_5$	. 08
2*h*	5, 185. 85	19, 277. 89	$1s_2-9Y$	8. 22
1	5, 206. 07	19, 203. 01	$2p_{10}-8s_5$	2. 99
4*h*	5, 245. 27	19, 059. 51	$2p_{10}-9d_3$	. 48
4*h*	5, 248. 98	19, 046. 03	$2p_{10}-9d_5$	. 02
2*h*	5, 251. 89	19, 035. 48		
1*h*	5, 273. 48	18, 957. 55	$1s_3-6p_{10}$	. 59
2*h*	5, 283. 30	18, 922. 31	$1s_2-8V$	. 31
4*h*	5, 286. 11	18, 912. 25	$1s_2-8Y$	. 26
3*h*	5, 286. 38	18, 911. 29	$1s_2-8X$	. 20
3	5, 306. 37	18, 840. 05	$2p_{10}-7s_5$	. 08
1*h*—	5, 335. 91	18, 735. 75	$2p_9-11d_1''$	. 78
2*h*	5, 337. 89	18, 728. 80	{ $2p_9-11d_4$ $2p_8-13d_4'$	. 80
1	5, 356. 80	18, 662. 68	$2p_{10}-8d_1''$	. 66
15	5, 362. 244	18, 643. 739	$2p_{10}-8d_5$	. 739
30	5, 364. 626	18, 635. 459	$2p_{10}-8d_3$	. 459
6	5, 367. 03	18, 627. 11		
1*h*—	5, 373. 74	18, 603. 85	$2p_8-12d_4'$	. 85
100	5, 392. 795	18, 538. 119	$1s_3-6X$	. 119
20	5, 394. 738	18, 531. 443	$2p_{10}-8d_6$	. 443
1*h*	5, 397. 63	18, 521. 51	{ $2p_9-10d_1''$ $2p_8-10s_5$	. 55 . 54
4*h*	5, 400. 45	18, 511. 84	$2p_9-10d_4$	. 84
5	5, 418. 02	18, 451. 81		
2*h*	5, 421. 76	18, 439. 08	$2p_8-11d_4'$	. 08
5*h*	5, 435. 60	18, 392. 13	$1s_2-7V$	. 13
30	5, 439. 923	18, 377. 519	$1s_2-7Y$	. 519
15	5, 440. 39	18, 375. 94	$1s_2-7X$	6. 022
1*h*	5, 444. 87	18, 360. 82	$2p_9-8s_4$	. 82
1*h*	5, 454. 54	18, 328. 27	$2p_8-9s_5$	. 27
2	5, 456. 45	18, 321. 85	$2p_{10}-6s_4$	. 83
15	5, 460. 037	18, 309. 820	$2p_{10}-6s_5$	. 820
1*h*	5, 479. 12	18, 246. 05	$2p_8-10d_1'$	. 01
1*h*	5, 481. 33	18, 238. 69	$2p_9-9d_1'$	. 77
1*h*	5, 484. 16	18, 229. 28	$2p_8-10d_4$	8. 60
4*h*	5, 484. 46	18, 228. 28	$2p_9-9d_1''$	. 24
6*h*	5, 487. 03	18, 219. 75	$2p_8-10d_4'$	. 75
20*h*	5, 488. 555	18, 214. 684	$2p_9-9d_4$	. 684
2*h*	5, 532. 78	18, 069. 10	$2p_8-8s_5$	. 08
3*h*	5, 540. 38	18, 044. 30	{ $1s_2-6p_6$ $2p_{10}-7d_1''$	. 34 . 270
80	5, 552. 385	18, 005. 291	$2p_{10}-7d_3$	. 291
3*h*	5, 553. 10	18, 002. 97	$2p_9-7s_4$	. 97
1—	5, 555. 06	17, 996. 62	$1s_2-6p_9$	. 61
2	5, 557. 28	17, 989. 43	$2p_9-7s_5$	. 43
2	5, 563. 50	17, 969. 32	$1s_2-6p_{10}$	. 32
5*h*	5, 566. 22	17, 960. 54		
100	5, 566. 615	17, 959. 264	$2p_{10}-7d_5$	. 264
2*h*	5, 567. 77	17, 955. 54	$2p_8-9d_1'$	. 51
2*h*	5, 575. 27	17, 931. 38	$2p_8-9d_4$	. 425
40	5, 579. 28	17, 918. 50	$2p_8-9d_4'$	. 50
50	5, 581. 784	17, 910. 458	$2p_{10}-7d_6$	. 458
1—	5, 585. 18	17, 899. 57	$2p_7-11d_1''$	. 54
6	5, 594. 37	17, 870. 16	$1s_3-5p_{10}$	. 17

Intensity	Wave length	Wave number observed	Combination	Wave number calculated
3	5, 607. 99	17, 826. 76	$2p_9-8d_1'$	. 820
15	5, 612. 65	17, 811. 96	$2p_9-8d_1''$	2. 01
80	5, 618. 878	17, 792. 220	$2p_9-8d_4$	. 220
1	5, 621. 24	17, 784. 74	$2p_9-8d_3$	. 805
5	5, 646. 19	17, 706. 16	$2p_8-7s_5$	. 17
2*h*	5, 652. 84	17, 685. 33	$2p_7-10d_1''$	. 31
1*h*—	5, 654. 31	17, 680. 73	$2p_9-8d_6$	. 77
1*h*	5, 664. 46	17, 649. 05	$2p_6-11d_1'$	. 05
40	5, 688. 373	17, 574. 855	$1s_2-6V$	. 855
100	5, 695. 750	17, 552. 094	$1s_2-6Y$	. 094
80	5, 696. 479	17, 549. 845	$1s_2-6X$	. 851
8	5, 698. 54	17, 543. 50	$2p_8-8d_1'$	. 561
1	5, 703. 34	17, 528. 73	$2p_8-8d_1''$	. 75
3	5, 706. 87	17, 517. 89	$2p_{10}-5s_4$	. 954
10*h*	5, 709. 80	17, 508. 90	$2p_8-8d_4$	. 961
2	5, 712. 21	17, 501. 52	$2p_8-8d_3$	. 546
70	5, 715. 716	17, 490. 780	$2p_{10}-5s_5$	. 783
80	5, 716. 252	17, 489. 140	$2p_8-8d_4'$	. 140
15*h*	5, 722. 14	17, 471. 15	$2p_9-6s_4$	. 18
1*h*	5, 723. 26	17, 467. 72	$2p_7-9d_2$	. 74
4	5, 726. 10	17, 459. 06	$2p_9-6s_5$	. 131
4*h*	5, 733. 48	17, 436. 59	$2p_6-10d_1'$	. 60
6	5, 740. 17	17, 416. 27	$2p_{10}-6d_2$	. 29
1*h*	5, 740. 73	17, 414. 57	$2p_6-10d_3$	. 62
8*h*	5, 748. 20	17, 391. 94	$2p_7-9d_1''$	2. 00
1*h*	5, 754. 60	17, 372. 59	$2p_7-9d_3$	. 59
1*h*	5, 792. 26	17, 259. 64	$2p_6-8s_5$	. 67
15	5, 807. 311	17, 214. 912	$2p_9-7d_1'$	. 922
60	5, 814. 505	17, 193. 614	$2p_9-7d_1''$	. 616
25	5, 820. 52	17, 175. 84	$2p_8-6s_5$	. 907
300	5, 823. 890	17, 165. 906	$1s_3-5X$	. 907
150	5, 824. 800	17, 163. 225	$2p_9-7d_4$	. 225
1	5, 827. 72	17, 154. 63	$2p_9-7d_3$	. 636
20*h*	5, 830. 63	17, 146. 06	$2p_6-9d_1'$	. 10
4*h*	5, 840. 83	17, 116. 12	$2p_6-9d_3$	. 16
5	5, 843. 43	17, 108. 51	$2p_9-7d_5$	. 610
1	5, 845. 46	17, 102. 56	$2p_6-9d_5$	. 70
2	5, 846. 21	17, 100. 37	$1s_2-5p_5$	. 45
3*h*	5, 849. 85	17, 089. 73	$2p_7-8d_2$	. 74
15	5, 856. 509	17, 070. 300	$2p_{10}-6d_1''$	. 300
100	5, 875. 018	17, 016. 519	$2p_{10}-6d_3$	. 519
6	5, 878. 92	17, 005. 23	$1s_2-5p_6$	. 19
20	5, 889. 12	16, 975. 77	$2p_7-8d_1''$	. 77
100	5, 894. 988	16, 958. 874	$2p_{10}-6d_5$	. 874
2*h*	5, 895. 62	16, 957. 05	$2p_7-8d_5$	6. 850
8	5, 898. 56	16, 948. 60	$2p_7-8d_3$	. 570
20	5, 904. 462	16, 931. 663	$2p_8-7d_1'$	. 663
3	5, 906. 76	16, 925. 07	$1s_2-5p_9$	. 10
5	5, 911. 90	16, 910. 36	$2p_8-7d_1''$	. 357
4	5, 916. 65	16, 896. 78	$2p_6-7s_5$	. 76
10	5, 921. 85	16, 881. 95	$1s_2-5p_{10}$	. 90
20	5, 922. 550	16, 879. 953	$2p_8-7d_4$	. 966
6	5, 925. 56	16, 871. 38	$2p_8-7d_3$	. 377
80	5, 931. 241	16, 855. 219	$2p_{10}-6d_6$	. 220
100	5, 934. 172	16, 846. 894	$2p_8-7d_4'$	. 894
1—	5, 970. 41	16, 744. 64	$3d_5-10V$	. 64
1*h*	5, 972. 82	16, 737. 88	$3d_5-10X, Y$	
40	5, 974. 152	16, 734. 153	$2p_6-8d_1'$	. 153
2	5, 978. 29	16, 722. 57	$3d_4'-11T, Z$	. 57
1	5, 979. 42	16, 719. 41	$2p_6-8d_1''$	. 34
4	5, 986. 23	16, 700. 39	$2p_6-8d_5$	. 418
20	5, 989. 18	16, 692. 16	$2p_6-8d_3$	. 138
30	5, 998. 115	16, 667. 300	$2p_9-5s_4$	. 300
15	6, 007. 909	16, 640. 128	$2p_9-5s_5$	. 128
8	6, 009. 78	16, 634. 94	$2p_7-6s_4$	. 94

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TABLE 1.—*List of Xe I lines*—Continued

Intensity	Wave length	Wave number observed	Combination	Wave number calculated	Intensity	Wave length	Wave number observed	Combination	Wave number calculated
1h	6, 014. 10	16, 623. 00	$2p_7-6s_5$	2. 931	20	6, 430. 155	15, 547. 436	$2p_8-5s_5$	. 461
1h−	6, 022. 89	16, 598. 74	$3d_3-11U$	. 74	2h	6, 448. 70	15, 502. 72	$3d_4-9W$	. 71
4	6, 026. 76	16, 588. 08	$2p_6-8d_6$	. 10	7	6, 450. 48	15, 498. 45	$2p_9-2s_2$	. 45
1h−	6, 031. 36	16, 575. 43	$2p_5-10d_2$	. 46	10hl	6, 451. 79	15, 495. 30	$3d_4-9Z$	. 30
2	6, 034. 92	16, 565. 65	$2p_9-6d_2$	. 64	3	6, 461. 50	15, 472. 02	$2p_5-6s_4$	. 01
10	6, 043. 38	16, 542. 46	$2p_7-7d_2$	. 45	300	6, 469. 705	15, 452. 394	$2p_{10}-5d_3$	. 394
6h	6, 048. 00	16, 529. 82	$3d_4'-10T$, Z	. 82	150	6, 472. 841	15, 444. 906	$2p_{10}-5d_2$	. 906
1h	6, 064. 91	16, 483. 74	$3d_5-9V$	. 74	120	6, 487. 765	15, 409. 378	$2p_{10}-5d_1''$	. 383
2h	6, 067. 52	16, 476. 65	$3d_5-9Y$	. 62	30hl	6, 497. 43	15, 386. 46	$3d_4'-7W$	. 48
1h	6, 067. 77	16, 475. 97	$3d_5-9X$	. 98	100	6, 498. 718	15, 383. 407	$2p_7-6d_1''$	. 411
3	6, 093. 38	16, 406. 72	$3d_3-10U$	. 72	15	6, 500. 37	15, 379. 50	$2p_5-7d_2$	. 52
1−	6, 095. 15	16, 401. 96	$3d_3-10X$, Y		200h	6, 504. 18	15, 370. 49	{ $3d_4'-7T$, Z { $1s_2-4p_5$	. 49 . 10
3	6, 103. 88	16, 378. 50	$2p_6-6s_4$	. 51					
8	6, 108. 37	16, 366. 46	$2p_6-6s_5$	. 519	3	6, 507. 50	15, 362. 65		
30	6, 111. 759	16, 357. 384	$2p_7-7d_1''$	. 381	40	6, 521. 508	15, 329. 648	$2p_7-6d_3$	. 630
40	6, 111. 951	16, 356. 870	$2p_8-5s_5$	. 869	100	6, 533. 159	15, 302. 312	$2p_9-4s_4$	. 312
10	6, 114. 86	16, 349. 09	$2p_{10}-2s_2$	. 10	40	6, 543. 360	15, 278. 456	$2p_9-4s_5$	. 455
5	6, 123. 91	16, 324. 93	$3d_6-8X$	. 96	20	6, 546. 12	15, 272. 01	$2p_7-6d_5$	1. 985
15	6, 126. 36	16, 318. 40	$2p_7-7d_3$	. 401	4	6, 553. 66	15, 254. 45	$3d_3-7V$	. 43
1	6, 131. 47	16, 304. 80	$2p_5-9d_2$	. 80	50hl	6, 554. 196	15, 253. 196	$3d_3-7U$	. 20
1h	6, 142. 13	16, 276. 50	$3d_4'-9W$	. 53	25	6, 559. 97	15, 239. 77	$3d_3-7Y$	. 80
4	6, 143. 70	16, 272. 34	$2p_7-7d_5$	. 375	4h	6, 560. 65	15, 238. 19	$3d_3-7X$	. 30
20hw	6, 144. 97	16, 268. 98	$3d_4'-9T$, Z	. 98	20	6, 583. 27	15, 185. 83	$1s_2-4p_6$	. 882
20	6, 152. 069	16, 250. 206	$2p_9-6d_1'$	. 201	8	6, 590. 86	15, 168. 35	$2p_7-6d_6$	. 331
3	6, 162. 16	16, 223. 60	$2p_7-7d_6$	. 569	100	6, 595. 561	15, 157. 534	$2p_6-6d_1'$	. 534
90	6, 163. 660	16, 219. 648	$2p_9-6d_1''$	. 646	4h	6, 602. 87	15, 140. 75	$3d_4-8W$	. 75
80	6, 163. 935	16, 218. 924	$1s_2-5V$	. 924	30h	6, 607. 41	15, 130. 35	$3d_4-8Z$	. 30
150	6, 178. 302	16, 181. 209	$1s_2-5Y$	. 204	10	6, 608. 87	15, 127. 01	$2p_6-6d_1''$	6. 979
120	6, 179. 665	16, 177. 640	$1s_2-5X$	. 639	2	6, 630. 44	15, 077. 80	$2p_6-6d_4$	. 765
300	6, 182. 420	16, 170. 431	$2p_9-6d_4$	. 432	50	6, 632. 464	15, 073. 198	$2p_6-6d_3$	. 198
3	6, 184. 16	16, 165. 88	$2p_9-6d_3$	. 865	3	6, 648. 75	15, 036. 28	$1s_2-4p_9$	. 324
20	6, 189. 10	16, 152. 98	$2p_{10}-4s_4$	. 966	20	6, 657. 92	15, 015. 57	$2p_6-6d_5$	. 553
4h	6, 191. 40	16, 146. 98	$3d_3-9U$	. 96	4	6, 664. 85	14, 999. 95		
1h	6, 193. 89	16, 140. 49	$3d_3-9Y$	. 50	60	6, 666. 965	14, 995. 196	$2p_8-4s_5$	. 196
1	6, 195. 49	16, 136. 32	$1s_3-4p_7$	. 296	150	6, 668. 920	14, 990. 800	$2p_{10}-5d_6$	. 800
100	6, 198. 260	16, 129. 108	$2p_{10}-4s_5$	. 109	25	6, 678. 972	14, 968. 239	$1s_2-4p_{10}$	. 249
60	6, 200. 890	16, 122. 266	$2p_6-7d_1'$	. 255	20	6, 681. 036	14, 963. 615	$3d_6-6X$	. 613
3h	6, 201. 49	16, 120. 71	$3d_5-8V$	. 71	1	6, 706. 46	14, 906. 89	$3d_3-6p_6$	. 82
6h	6, 205. 35	16, 110. 68	$3d_5-8Y$	. 66	200	6, 728. 008	14, 859. 146	{ $2p_{10}-5d_5$ { $3d_3-6p_9$	. 148 8. 89
4	6, 205. 75	16, 109. 64	$3d_5-8X$	. 60					
20	6, 206. 297	16, 108. 220	$2p_9-6d_5$	. 220	10	6, 767. 12	14, 773. 27	$3d_5-6V$	. 26
3	6, 209. 11	16, 100. 92	$2p_6-7d_1''$	. 949	50	6, 777. 57	14, 750. 48	$3d_5-6Y$	. 49
1	6, 220. 84	16, 070. 56	$2p_6-7d_4$	. 558	40	6, 778. 60	14, 748. 25	$3d_5-6X$	. 251
40	6, 224. 169	16, 061. 968	$2p_6-7d_3$	. 969	12	6, 815. 64	14, 668. 09	$2p_5-5s_4$	. 129
8	6, 242. 09	16, 015. 85	$2p_6-7d_5$	. 943	15	6, 818. 38	14, 662. 20	$2p_7-2s_2$	. 21
50	6, 261. 212	15, 966. 942	$2p_8-6d_1'$	. 942	200	6, 827. 315	14, 643. 014	$1s_3-4X$	. 008
40	6, 265. 301	15, 956. 522	$1s_3-4p_{10}$	. 517	8	6, 840. 96	14, 613. 80	$2p_9-5d_1'$	. 804
1h	6, 268. 34	15, 948. 78	$3d_4-11Z$	. 78	20	6, 841. 50	14, 612. 65	$3d_4-7W$	. 66
10	6, 273. 23	15, 936. 35	$2p_8-6d_1''$	. 387	1	6, 844. 27	14, 606. 74	$3d_4-7V$	. 73
4	6, 276. 99	15, 926. 81	$2p_5-8d_2$	. 81	2h	6, 844. 84	14, 605. 52	$3d_4-7U$	. 50
5h	6, 281. 81	15, 914. 58	$3d_4'-8W$	. 57	60	6, 846. 613	14, 601. 740	$2p_9-5d_3$	. 740
100	6, 286. 011	15, 903. 950	$3d_4'-8T$	. 95	50	6, 848. 82	14, 597. 04	$3d_4-7Z$	. 05
50	6, 292. 649	15, 887. 173	$2p_8-6d_4$	. 173	30	6, 850. 13	14, 594. 24	$2p_9-5d_2$	. 252
15	6, 294. 45	15, 882. 63	$2p_8-6d_3$	. 608	40	6, 860. 19	14, 572. 84	$3d_4'-6W$	. 82
15	6, 314. 97	15, 831. 02	$2p_7-5s_4$	. 065	20	6, 863. 20	14, 566. 45	$2p_8-6d_2$	. 47
500	6, 318. 062	15, 823. 273	$2p_8-6d_4'$	. 273					
2	6, 325. 81	15, 803. 89	$2p_7-5s_5$	. 893	5	6, 865. 58	14, 561. 40	$3d_4'-6U$	. 42
20	6, 331. 50	15, 789. 69	$3d_6-7X$	. 784	50	6, 866. 838	14, 558. 734	$2p_9-5d_1''$	. 729
40hl	6, 333. 97	15, 783. 53	$3d_3-8U$	. 54	100	6, 872. 107	14, 547. 571	$3d_4'-6T$	. 57
8hl	6, 337. 58	15, 774. 64	$3d_3-8Y$	. 54	300	6, 882. 155	14, 526. 332	$2p_9-5d_4$	. 333
					30	6, 910. 82	14, 466. 08	$2p_7-4s_4$	. 077
2h	6, 344. 98	15, 756. 14	$3d_4-10Z$	. 15					
20	6, 355. 77	15, 729. 40	$2p_7-6d_2$	. 40	8	6, 922. 22	14, 442. 25	$2p_7-4s_5$	. 220
10	6, 412. 38	15, 590. 53	$3d_6-7V$	. 55	15	6, 924. 67	14, 437. 15	$3d_3-6V$	. 14
30	6, 418. 41	15, 575. 89	$3d_6-7Y$	. 92	100	6, 925. 53	14, 435. 35	$3d_3-6U$	. 30
30h	6, 418. 98	15, 574. 50	{ $2p_6-5s_4$ { $3d_6-7X$	. 633 . 42	50	6, 935. 62	14, 414. 35	$3d_3-6Y$	. 37
					8	6, 936. 69	14, 412. 13	$3d_3-6X$	. 13

TABLE 1.—*List of Xe I lines*—Continued

Intensity	Wave length	Wave number observed	Combination	Wave number calculated
1	6,949.76	14,385.02		
100	6,976.182	14,330.542	$2p_8-5d_1'$	.545
30	6,982.05	14,318.50	$2p_8-5d_3$	.481
1	6,991.65	14,298.84	$3d_5-5p_6$	.85
4	7,003.10	14,275.46	$2p_8-5d_1''$	.470
30	7,019.02	14,243.08	$2p_8-5d_4$	.073
3	7,034.80	14,211.13		
20	7,035.53	14,209.66	$2p_6-4s_4$	.645
30	7,047.37	14,185.79	$2p_6-4s_5$	.788
1h	7,049.07	14,182.36	$3d_6-5p_7$	.21
1h	7,049.36	14,181.78	$3d_1''-8V$	.75
3	7,051.06	14,178.36	$2p_{10}-3s_1''''$	.34
1	7,078.46	14,123.48	$3d_5-5p_9$	.50
500	7,119.598	14,041.872	$2p_8-5d_4'$	.872
15	7,136.57	14,008.48	$2p_9-5d_5$	.491
10	7,172.70	13,937.92	$3d_4'-5p_8$	.88
15	7,200.79	13,883.54	$2p_{10}-3s_1''$	.51
5	7,209.14	13,867.46	$3d_3-5p_6$	.47
1	7,220.24	13,846.14	$3d_3-5p_7$	.09
3	7,238.20	13,811.79	$3d_3-5p_8$	.76
20	7,244.94	13,798.94	$3d_4-6W$	9.00
2	7,249.92	13,789.46	$3d_4-6V$	.44
5h	7,250.87	13,787.66	{ $3d_3-5p_9$ $3d_4-6U$	.38 .60
60	7,257.94	13,774.22	$3d_4-6Z$	.23
20	7,262.54	13,765.50	$2p_7-5d_3$	.505
25	7,266.49	13,758.02	$2p_7-5d_2$	.017
40	7,283.961	13,725.018	$1s_2-4Y$	.023
60	7,285.301	13,722.494	$2p_7-5d_1''$	.494
5h	7,307.37	13,681.05	$3d_1'-8W$	.01
1h	7,313.01	13,670.50	$3d_1'-8Z$	.56
70	7,316.272	13,664.405	$1s_2-4Y$	.408
20	7,316.87	13,663.28	$2p_{10}-3s_4$	.290
15	7,319.94	13,657.56	$3d_1''-7W$	.52
80	7,312.452	13,654.737	$1s_2-4X$	.740
2	7,323.05	13,651.76	$3d_1''-7V$	.59
50	7,336.480	13,626.767	$2p_9-3s_1'''$	.767
40	7,355.58	13,591.38	$3d_6-5X$	.401
100	7,386.002	13,535.397	$2p_{10}-3s_5$	.396
150	7,393.793	13,521.140	$2p_6-5d_1'$	.137
30	7,400.41	13,509.04	$2p_6-5d_3$	.077
12	7,404.51	13,501.57	$2p_6-5d_2$	.585
3	7,405.77	13,499.26	$2p_5-2s_2$	.28
20	7,424.05	13,466.03	$2p_6-5d_1''$	.062
20	7,441.94	13,433.66	$2p_6-5d_4$	.665
25	7,451.00	13,417.33	$3d_5-5V$	.33
40	7,472.01	13,379.60	$3d_5-5Y$	.61
25	7,474.01	13,376.02	$3d_5-5X$	.04
20	7,492.23	13,343.49	$2p_8-3s_1'''$	.508
20	7,501.13	13,327.66	$2p_9-3s_1''''$	.69
8	7,514.54	13,303.88	$2p_7-5d_6$	.911
3	7,514.96	13,303.13	$2p_5-4s_4$	.141
40	7,559.79	13,224.25	$3d_4'-5W$	.23
6	7,570.93	13,204.79	$3d_4'-5U$	.84
10	7,584.29	13,181.53	$3d_4'-5Z$	.57
200	7,584.680	13,180.849	$3d_4'-5T$	.85
6	7,589.61	13,172.28	$2p_7-5d_5$	.257
1	7,594.36	13,164.04	$3d_4-5p_8$	.06
10	7,600.77	13,152.95	$3d_1'-7W$	.92
2h	7,604.97	13,145.68	$3d_1'-7U$	.80
5	7,608.46	13,139.65	$3d_4-5p_9$	.68
3	7,609.82	13,137.30	$3d_1'-7Z$	.31
500	7,642.025	13,081.940	$1s_3-2p_2$	.941
	7,642.30	13,081.47	$3d_3-5V$	.21
100	7,643.91	13,078.71	$3d_3-5U$	.72
10	7,664.02	13,044.40	$2p_5-3s_1''''$	.43
30	7,664.56	13,043.48	$3d_3-5Y$	.49

Intensity	Wave length	Wave number observed	Combination	Wave number calculated
10	7,666.61	13,039.99	$3d_3-5X$	.92
1	7,670.81	13,032.85	$2p_9-3s_1''$	.86
40	7,740.31	12,915.83	$2p_6-5d_5$	.825
50	7,783.66	12,843.90	$3d_1''-6W$	.86
15	7,789.42	12,834.40	$3d_1''-6Y$	.30
1	7,790.53	12,832.57	$3d_1''-6U$	.46
100	7,802.651	12,812.636	$2p_9-3s_4$	.636
10	7,832.98	12,763.02	$2p_{10}-4d_2$	.00
15	7,841.23	12,749.60	$2p_8-3s_1''$	.60
100	7,881.320	12,684.745	$2p_9-3s_5$	.742
300	7,887.395	12,674.975	$1s_2-2p_1$	.978
40	7,937.41	12,595.11	$2p_5-5d_2$	.081
4	7,954.22	12,568.49	$3d_5-4p_5$	.50
500	7,967.341	12,547.792	$1s_3-3p_7$	.789
8	7,976.03	12,534.12	$2p_6-3s_1'''$	.100
10	8,003.26	12,491.48	$2p_7-3s_1''''$	.45
100	8,029.67	12,450.39	$3d_4-5W$	.41
10	8,040.56	12,433.53	$3d_4-5V$	.51
15	8,042.18	12,431.02	$3d_4-5U$	.02
200	8,057.258	12,407.762	$3d_4-5Z$	.75
150	8,061.340	12,401.480	$2p_8-3s_5$	.483
2	8,064.94	12,395.94	$3d_4-5Y$	.79
1	8,073.99	12,382.05	$3d_6-4p_{10}$	.011
3	8,097.24	12,346.50	$3d_6-4p_7$	.43
100	8,101.98	12,339.27	$3d_1'-6W$	.26
6	8,107.91	12,330.25	$3d_1'-6V$	9.71
15	8,109.46	12,327.89	$3d_1'-6U$	.86
15	8,118.29	12,314.48	$3d_1'-6Z$	.49
2	8,123.29	12,306.90	$3d_1'-6Y$	.93
2	8,165.37	12,243.48		
100	8,171.02	12,235.01	{ $3d_5-4p_9$ $2p_6-3s_1''''$	4.74 .02
1−	8,182.93	12,217.21	$3d_2-8V$	.40
2	8,196.73	12,196.63	$2p_7-3s_1''$	.62
700	8,206.341	12,182.354	$1s_3-2p_4$	.355
10,000	8,231.6348	12,144.921	$1s_5-2p_6$	.923
500	8,266.519	12,093.671	$1s_2-2p_2$	.673
7,000	8,280.1163	12,073.811	$1s_4-2p_5$	.811
15	8,297.71	12,048.21	$3d_3-4p_6$	.16
2	8,323.90	12,010.31	$3d_3-4p_7$	.31
20	8,324.58	12,009.32	$2p_5-5d_5$	.301
2,000	8,346.823	11,977.318	$1s_2-2p_3$	.320
60	8,347.45	11,976.42	$2p_7-3s_4$	.401
40	8,349.05	11,974.12	$2p_{10}-4d_1''$	.10
3	8,371.38	11,942.18	$3d_3-4p_8$	.19
5	8,372.79	11,940.17	$2p_6-3s_1''$	.19
20	8,392.37	11,912.32	$2p_9-4d_2$	.35
5	8,402.03	11,898.62	$3d_3-4p_9$	.60
2,000	8,409.190	11,888.489	$1s_5-2p_7$	.491
10	8,437.55	11,848.53	$2p_7-3s_5$	.507
1h	8,450.37	11,830.55	$3d_3-4p_{10}$	.53
1	8,501.02	11,760.07		
30	8,522.55	11,730.35	$1s_3-3p_{10}$	.360
30	8,530.10	11,719.98	$2p_6-3s_4$	.969
2	8,553.97	11,687.27	$3d_2-7V$	.24
1−	8,564.7	11,672.63	$3d_2-7Y$	.60
200	8,576.01	11,657.24	$1s_2-3p_5$	.221
80	8,624.24	11,592.04	$2p_6-3s_5$	.075
250	8,648.54	11,559.47	$1s_2-3p_7$	.521
100	8,692.20	11,501.41	$1s_2-3p_6$	.460
200	8,696.86	11,495.25	$3d_1''-5W$	.27
40	8,709.64	11,478.38	$3d_1''-5V$	.37
2	8,711.54	11,475.88	$3d_1''-5U$	.88
300	8,739.39	11,439.31	$2p_{10}-4d_3$	.31
100	8,758.20	11,414.74	$2p_9-4d_1'$	.75
5,000	8,819.412	11,335.515	$1s_5-2p_8$	.515

TABLE 1.—*List of Xe I lines*—Continued

Intensity	Wave length	Wave number observed	Combination	Wave number calculated	Intensity	Wave length	Wave number observed	Combination	Wave number calculated
1	8,851.44	11,294.50	$3d_4-4p_3$	.49	3	9,605.80	10,407.53	$3d_1''-4p_7$	.47
300	8,862.32	11,280.63	$2p_{10}-4d_5$	.63	1	9,614.43	10,398.18		
10	8,885.71	11,250.94	$3d_4-4p_9$	.90	1	9,616.95	10,395.46		
200	8,908.73	11,221.87	$2p_{10}-4d_6$	.87	1	9,668.94	10,339.56		
200	8,930.83	11,194.10	$1s_2-2p_4$	4.087	150	9,685.32	10,322.08	$2p_6-4d_1'$	.08
1,000	8,952.254	11,167.309	$1s_4-2p_8$	.307	20	9,700.99	10,305.40	$2p_8-4d_3$	.40
50	8,952.78	11,166.65	$1s_2-3p_9$	.641	2	9,710.03	10,295.81	$3d_1''-4p_9$	.76
100	8,981.05	11,131.50	$2p_8-4d_1'$	.49	100	9,718.16	10,287.20	$2p_7-4d_1''$	.21
200	8,987.57	11,123.43	$2p_9-4d_1''$	.45	2,000	9,799.699	10,201.600	$1s_5-2p_{10}$	.602
30	9,025.98	11,076.09	$2p_7-4d_2$	.11	3,000	9,923.192	10,074.643	$1s_4-2p_9$	.640
50	9,032.18	11,068.49	$3d_6-4X$	.502	10	9,966.58	10,030.78	$2p_6-4d_1''$	.78
400	9,045.446	11,052.256	$1s_5-2p_9$	.256	50	10,023.72	9,973.60	$3d_4-4W$	.58
50	9,096.13	10,990.67	$3d_1'-5W$	.67	1	10,056.84	9,940.76		
4	9,112.24	10,971.24	$3d_1'-5U$	.28	5	10,057.96	9,939.66	$3d_4-4V$	.60
3	9,131.59	10,947.99	$3d_1'-5Z$	.01	10	10,060.96	9,936.69	$3d_4-4U$	.63
2	9,141.8	10,935.8	$3d_1'-5Y$	6.05	20	10,084.79	9,913.21	$2p_5-4d_2$	.18
20	9,152.12	10,923.44	$3d_5-4V$	.42	80	10,107.34	9,891.10	$3d_4-4Z$	.08
2	9,158.38	10,915.97			1	10,119.8	9,878.88	$3d_4-4Y$	.99
500	9,162.654	10,910.877	$1s_4-2p_7$	.875	20	10,125.47	9,873.38	$3d_5-2p_1$	.38
100	9,167.52	10,905.09	$2p_9-4d_4$	.09	10	10,188.36	9,812.44	$2p_8-4d_4$	.42
2	9,197.18	10,869.92	$3d_2-6V$	.96	20	10,251.07	9,752.41	$2p_7-4d_3$	.42
30	9,203.20	10,862.81	$3d_5-4Y$	.81	1	10,420.52	9,593.83	$2p_7-4d_5$	.74
25	9,211.38	10,853.16	$3d_5-4X$	.14	8	10,484.83	9,534.98	$2p_7-4d_6$	.98
1	9,216.51	10,847.12	$3d_2-6Y$	.18	6	10,507.91	9,514.03	$3d_2-5V$	.02
5	9,222.39	10,840.20	$2p_8-4d_1''$	.19	10	10,515.15	9,507.48	$3d_6-2p_2$	.44
3	9,245.18	10,813.48	$2p_5-3s_4$	.465	40	10,527.84	9,496.03	$2p_6-4d_3$	5.99
30	9,301.95	10,747.49	$3d_4'-4W$	.40	4	10,549.75	9,476.30	$3d_2-5Y$	.30
40	9,306.64	10,742.07	$1s_2-3p_{10}$	.092	25	10,706.77	9,337.33	$2p_6-4d_5$	.31
3	9,334.08	10,710.49	$3d_4'-4U$	.45	15	10,758.85	9,292.13	$3d_5-2p_2$	.07
10	9,374.02	10,664.86	$3d_4'-4Z$	.90	100	10,838.37	9,223.95	$1s_4-2p_{10}$	.986
100	9,374.76	10,664.02	$3d_4'-4T$	.02	10	10,895.39	9,175.68	$3d_5-2p_3$	.72
60	9,412.01	10,621.81	$2p_8-4d_4$	.83	10	11,085.39	9,018.42	$3d_1''-4W$	.44
20	9,441.46	10,588.68	$2p_9-4d_3$	.66	2	11,127.29	8,984.46	$3d_1''-4V$	.46
20	9,442.68	10,587.31	$3d_3-4V$	.30	1	11,140.90	8,973.48		
80	9,445.34	10,584.33	$3d_3-4U$	.33					
4	9,487.76	10,537.01							
40	9,497.07	10,526.68	$3d_3-4Y$	.69					
10	9,505.78	10,517.03	$3d_3-4X$	.02					
200	9,513.379	10,508.633	$2p_8-4d_4'$	.633					
20	9,585.14	10,429.96	$2p_9-4d_5$	.98					

IV. DISCUSSION OF Xe I TERMS

The numerical values of previously known terms have been subject to only slight revisions. The new term table incorporates the changes due to more precise data, the extensions of series, new low terms and changes in the assignment of quantum numbers. The values of the $1s$, $2p$, and $3p$ terms as determined from interference measurements (RP245) form the basis of the present table. The numerical values of a considerable number of terms can now be completely determined from interference measurements. These are given to three places of decimals. Table 2 gives the final set of terms and effective quantum numbers. In calculating the effective quantum numbers for non-Ritzian terms, the value of the displacement constant A was taken as 10,540, representing the level separation of the ground doublet ($^2P^o_{1\frac{1}{2},\frac{1}{2}}$) identified[9] in the Xe II spectrum.

[9] C. J. Humphreys, T. L. deBruin, and W. F. Meggers, B. S. Jour. Research, vol. 6 (RP275), p. 287, 1931.

Electron		9		10		11		12	
p									
s	0	1, 102. 57	9. 9764	909. 3	10. 98				
	0								
p	3	1, 227. 12	9. 4565	1, 003. 75	10. 4559	835. 2	11. 46		
	3								
	0	1, 216. 99	9. 4958	996. 75	10. 4926				
	5	1, 199. 80	9. 5112						
d	7	1, 512. 34	8. 5183	1, 211. 09	9. 5190	991. 76	10. 5191	826. 99	11. 5193
	4	1, 499. 413	8. 5549	1, 202. 24	9. 5539	985. 30	10. 5534		
	3	1, 505. 27	8. 5383	1, 206. 81	9. 5319				
	1	1, 518. 73	8. 5003	1, 217. 67	9. 4932				
	9	1, 410. 12	8. 8216	1, 139. 47	9. 8135				
	4	1, 485. 86	8. 5939	1, 192. 55	9. 5926	978. 32	10. 5909		
	2	1, 475. 33	8. 6245	1, 184. 83	9. 6238	972. 39	10. 6232		
f	0	1, 371. 26	8. 9457						
	3	1, 370. 62	8. 9478						
	2	1, 368. 12	8. 9560	1, 107. 27	9. 9552	914. 64	10. 9535		
	9	1, 368. 26	8. 9556	1, 107. 42	9. 9545	914. 67	10. 9533		
	0	1, 364. 16	8. 9690	1, 104. 40	9. 9681	912. 38	10. 9671		
	4	1, 363. 50	8. 9712	1, 102. 60	9. 9762				
	3	1, 360. 71	8. 9804						

TABLE 2.—*Terms and effective quantum numbers of XI*

Electron	j	Paschen notation		1		2		3		4		5		6	
p	0	p_0	07, 834. 8												
s	2	s_5		30, 766. 353	1. 8886			7, 029. 355	3. 9511	4, 435. 642	4. 9739	3, 073. 969	5. 9748	2, 254. 931	6. 9760
	1	s_4		29, 788. 737	1. 9193			6, 901. 461	3. 9876	4, 411. 785	4. 9873	3, 046. 797	6. 0014	2, 242. 92	6. 9947
	0	s_3		21, 637. 108	1. 8467										
	1	s_2		20, 648. 840	1. 8758	4, 215. 65	2. 7271								
p	1	p_{10}				20, 564. 751	2. 3100	9, 906. 748	3. 3282	5, 680. 591	4. 3952	3, 766. 94	5. 3974	2, 679. 52	6. 3994
	2	p_0				10, 714. 097	2. 3593	9, 482. 109	3. 4019	5, 612. 516	4. 4218	3, 723. 74	5. 4286	2, 652. 23	6. 4324
	3	p_9				10, 430. 838	2. 3764	9, 364. 668	3. 4232	5, 568. 930	4. 4391	3, 699. 36	5. 4464	2, 637. 36	6. 4505
	1	p_7				18, 877. 862	2. 4110	9, 080. 310	3. 4746	5, 500. 812	4. 4665	3, 665. 03	5. 4719	2, 617. 43	6. 4750
	2	p_6				18, 621. 430	2. 4276	9, 147. 380	3. 4636	5, 462. 958	4. 4819	3, 643. 65	5. 4870	2, 604. 30	6. 4913
	0	p_5				17, 714. 926	2. 4889	8, 991. 619	3. 4935	5, 278. 741	4. 5595	3, 548. 39	5. 5611	2, 547. 83	6. 5628
	1	p_4				9, 454. 753	2. 3427								
	2	p_3				8, 671. 520	2. 3000								
	1	p_2				8, 555. 167	2. 3972								
	0	p_1				7, 973. 862	2. 4682								
d	0	d_6						18, 062. 602	2. 4648	9, 342. 88	3. 4272	5, 573. 951	4. 4370	3, 709. 531	5. 4390
	4	d_1'						17, 637. 24	2. 4944	8, 922. 205	3. 5070	5, 388. 966	4. 5126	3, 607. 565	5. 5153
	3	d_4						16, 863. 42	2. 5510	8, 809. 01	3. 5295	5, 187. 765	4. 5992	3, 543. 665	5. 5648
	2	d_3						17, 511. 12	2. 5035	9, 125. 44	3. 4678	5, 112. 357	4. 6330	3, 548. 232	5. 5612
	1	d_5						17, 847. 24	2. 4797	9, 284. 12	3. 4380	5, 705. 605	4. 3856	3, 605. 877	5. 5166
	1	d_2						13, 043. 93	2. 8053	7, 801. 75	3. 7504	5, 119. 845	4. 6297	3, 148. 46	5. 9037
	2	d_1''						15, 908. 28	2. 6264	8, 590. 65	3. 5741	5, 155. 368	4. 6137	3, 494. 451	5. 6039
	3	d_1'						15, 403. 68	2. 6691	8, 299. 35	3. 6363	5, 100. 293	4. 6385	3, 463. 896	5. 6285
	2	s_1''						6, 681. 24	2. 5243						
	2	s_1''''						6, 386. 41	2. 5462						
	3	s_1'''						6, 087. 330	2. 5600						
	1	s_1'.													
f	1	X								6, 994. 100	3. 9610	4, 471. 201	4. 9541	3, 098. 089	5. 9507
	2	Y								6, 984. 432	3. 9638	4, 467. 636	4. 9561	3, 096. 746	5. 9528
	4	Z								6, 972. 34	3. 9672	4, 455. 67	4. 9627	3, 089. 19	5. 9601
	5	T								6, 973. 22	3. 9670	4, 456. 39	4. 9623	3, 089. 67	5. 9596
	3	U								6, 926. 786	3. 9802	4, 432. 40	4. 9757	3, 075. 82	5. 9731
	2	V								6, 923. 817	3. 9811	4, 429. 916	4. 9771	3, 073. 985	5. 9748
	3	W								6, 889. 84	3. 9909	4, 413. 01	4. 9866	3, 064. 42	5. 9841

Electron	j	Paschen notation	7		8		9		10		11		12	
p	0	p_0												
s	2	s_5	1, 724. 67	7. 9767	1, 361. 76	8. 9769	1, 102. 57	9. 9764	009. 3	10. 08				
	1	s_4	1, 711. 12	8. 0082	1, 353. 27	9. 0056								
	0	s_3												
	1	s_2												
p	1	p_{10}												
	2	p_0												
	3	p_9	1, 975. 71	7. 4528	1, 534. 94	8. 4553	1, 227. 12	9. 4565	1, 003. 75	10. 4559	835. 2	11. 46		
	1	p_7	1, 963. 20	7. 4764	1, 527. 03	8. 4773								
	2	p_6	1, 954. 49	7. 4931	1, 521. 00	8. 4940	1, 216. 99	9. 4058	006. 75	10. 4926				
	0	p_5	1, 918. 36	7. 5633	1, 496. 07	8. 5645	1, 199. 80	0. 5112						
	1	p_4												
	2	p_3												
	1	p_2												
	0	p_1												
d	0	d_6	2, 654. 293	6. 4298	2, 033. 308	7. 3164								
	4	d_1'	2, 583. 944	6. 5168	1, 941. 698	7. 5177	1, 512. 34	8. 5183	1, 211. 09	9. 5109	991. 76	10. 5191	826. 99	11. 5193
	3	d_4	2, 550. 872	6, 5589	1, 921. 877	7. 5564	1, 499. 413	8. 5549	1, 202. 24	0. 5539	085. 30	10. 5531		
	2	d_3	2, 559. 461	6. 5479	1, 929. 292	7. 5418	1, 505. 27	8. 5383	1, 206. 81	9. 5319				
	1	d_5	2, 605. 487	6. 4897	1, 921. 012	7. 5581	1, 518. 73	8. 5003	1, 217. 67	9. 4932				
	1	d_2	2, 335. 41	6. 8548	1, 788. 12	7. 8339	1, 410. 12	8. 8216	1, 139. 47	0. 8135				
	2	d_1''	2, 520. 481	6. 5084	1, 002. 09	7. 5954	1, 485. 86	8. 5039	1, 192. 55	9. 5926	978. 32	10. 5909		
	3	d_1'	2, 499. 175	6. 6264	1, 887. 277	7. 6252	1, 475. 33	8. 6245	1, 184. 83	0. 6238	972. 39	10. 6232		
	2	s_1''												
	2	s_1''''												
	3	s_1'''												
	1	s_1'.												
f	1	X	2, 272. 818	6. 0484	1, 737. 64	7. 9469	1, 371. 26	8. 9457						
	2	Y	2, 271. 321	6. 9508	1, 736. 58	7. 9493	1, 370. 62	8. 9178						
	4	Z	2, 266. 37	6. 9584	1, 733. 12	7. 9572	1, 368. 12	8. 0560	1, 107. 27	9. 9552	014. 61	10. 9535		
	5	T	2, 266. 75	6. 9578	1, 733. 29	7. 9569	1, 368. 26	8. 9556	1, 107. 42	0. 9515	914. 67	10. 9533		
	3	U	2, 257. 92	6. 9715	1, 727. 58	7. 9700	1, 364. 16	8. 9600	1, 101. 40	9. 0681	012. 38	10. 0671		
	2	V	2, 256. 69	6. 9733	1, 726. 53	7. 9724	1, 363. 50	8. 0712	1, 102. 60	9. 9762				
	3	W	2, 250. 76	6. 9825	1, 722. 67	7. 9813	1, 360. 71	8. 9804						

TABLE 3.—*Determination of absolute term values of Xe I*

$2p_8 - md_4'$ $(5_p{}^3D_3 - 5d^3F_4)$

$$\nu = A - \frac{R}{[m + \mu + \alpha(A - \nu)]^2}$$

$R_{Xe} = 109{,}736.965$

$A = 19{,}430.838$

$\mu = +0.5208392314$

$\alpha = -0.000001534768614$

m	Int.	$\lambda_{obs.}$	$\nu_{obs.}$	$\nu_{calc.}$	$\nu_{calc.} - \nu_{obs.}$
2	--------	--------------	[1, 793. 60]	1, 784. 900	+8. 70
3	200	9, 513. 32	10, 508. 70	10, 509. 189	−. 49
4	500	7, 119. 598	14, 041. 872	14, 041. 873	−. 001
5	300	6, 318. 062	15, 823. 272	15, 823. 272	−. 000
6	100	5, 934. 170	16, 846. 900	16, 846. 946	−. 046
7	70	5, 716. 255	17, 489. 131	17, 489. 217	−. 086
8	40	5, 579. 276	17, 918. 51	17, 918. 584	−. 07
9	6h	5, 487. 026	18, 219. 76	18, 219. 760	−. 000
10	2h	5, 421. 756	18, 439. 10	18, 439. 144	−. 04
11	1h−	5, 373. 74	18, 603. 85	18, 603. 886	−. 04

$2p_8 = 19{,}430.838$

$1s_5 - 2p_8 = 11{,}335.515$

$\therefore 1s_5 = 30{,}766.353$

The absolute value of the term $1s_5$ has been redetermined using the more accurate wave length data now available and a new value of the Rydberg constant for xenon calculated from the value of R_∞ given by Birge.[10] The new value of $1s_5$ differs very slightly from the old, 30,766.353 as compared with 30,766.98 previously calculated. This revised term value represents the precision attainable with the data selected for the determination. It is still subject to a variation of from 1 to 2 wave number units, depending on the series chosen for computation. As in the work previously reported, we have estimated $1s_5$ from the limit of the series $2p_8$–md'_4 and the combination $1s_5$–$2p_3$. All other terms are fixed relative to $1s_5$, so that the error in absolute value is the same for all terms.

The sequence ms_5 remains unchanged except that it has been extended to the tenth member. Attempts to find $2s_5$ from combina tions in the infra-red region have not been successful, and it seems probable that the required combinations are beyond our range of photographic observations. The sequence ms_4 has also been extended. The term 13,943.93 previously given as $2s_4$ is now interpreted as $3d_2$. The reason for the new assignment will be discussed in connection with the *d*-series. The old terms, $2s_3$ and $2s_2$, originally obtained from the interpretation of the ultra-violet data of Abbink and Dorgelo [11] are not confirmed by expected combinations in the range of the present observations and are not retained. The term, 4,215.65, is a new term, interpreted as $2s_2$ by Rasmussen, and is confirmed by observed combinations.

No changes have been made in the interpretation of the *p*-series. Higher members have been found in the case of all sequences which form Ritz series. The sequence mp_8 is the longest; it has been extended to $11p_8$

A considerable number of changes have been introduced in the interpretation of the *d*-series. Several new terms have been found

[10] R. T. Birge, Reviews of Modern Physics, vol. 1, p. 1, 1929.
[11] J. H. Abbink and H. B. Dorgelo, Zeit. f. Phys., vol. 47, p. 221, 1928.

and all Ritzian series except md_6 have been extended. In the work previously reported, the failure to find all expected combinations, due to the faintness of the sources used and the lack of the superior sensitizers now available for the infra-red region, left the assignment of inner quantum numbers uncertain in many cases. With the more extended and accurate data now available these ambiguities have been eliminated and it is believed that the j-values are now determined correctly for all the d-terms. In the work of Rasmussen referred to above, new interpretations have been placed on many of the old terms and several additional d-terms have been found. The present work entirely confirms Rasmussen's assignment of j-values, and we agree also on interpretation of the terms in most cases.

The md_6-sequence has been altered only by the substitution of the new term 9,342.88 for $4d_6$ in place of 9,125.44, which by virtue of its j-value 2 is assigned to $4d_3$.

The md_4' sequence is left unchanged. It is the longest as well as the most regular of the d-series, and has been extended in the present work to $12d_4'$. Attention is again called to Table 3 in which a Ritz formula is applied to the series $2p_8$–md_4'. The only large departure from the calculated position of a line is in the case of the photographically inaccessible infra-red line $2p_8$–$3d_4'$, at 1,793.60 cm^{-1}. The position of this line is predicted accurately from the known values of both terms, and differs from the position given by the series formula by 8.70 cm^{-1}.

The first term only of the md_4 sequence has been changed. The term 16,863.42, previously assigned to $3d''$, is now designated $3d_4$; 17,511.12, formerly called $3d_4$, becomes the first term of the new sequence md_3 with inner quantum number 2. Subsequent terms of md_3 are assembled from members of other d-series incorrectly interpreted. The second number $4d_3$ is 9,125.44, formerly $4d_6$, the third $5d_3$ is 5,112.357, formerly $5d''$, whereas the remaining terms of md_3 are taken from the old md_5 sequence.

The md_5 sequence begins as before with 17,847.24, as $3d_5$. The term 9,284.12, formerly $4d_2$, is now assigned to $4d_5$. The term 5,705.605 was formerly designated as $3s_1'''$. It is now certain that its j-value is 1. Rasmussen designated it as $5d_5$. We give it the same classification with reservations, since its interpretation as the missing non-Ritzian term $3s_1'$ seems equally probable. The present classification introduces a sharp downward inflection in the graph of the effective quantum numbers, which is not paralleled for Kr I. In any case either $5d_5$ or $3s_1'$ has not been found.

With the exception of the first and third members, the md_2 sequence is made up of newly found terms. The term 13,943.93 is now designated as $3d_2$ instead of $2s_4$. This assignment is supported by the effective quantum number which fits better into this d-series than into the s_4-series where an unexpected deviation from an otherwise fairly regular series would occur. Furthermore, if $2s_4$ is found, $2s_5$ should also be observed, since the combinations would be displaced to shorter wave lengths than those of $2s_4$. The combination of 13,944 with the ground term giving the line, 83,891.2 cm^{-1}, found in Abbink and Dorgelo's data is permitted with either interpretation. The term 5,119.845, designated $5d_2$, was formerly $5d_5$. Three new terms, 7,801.75, 3,148.46, 2,335.41, have been interpreted by Rasmussen as

$4d_2$, $6d_2$, and $7d_2$, respectively. We have how extended the series to $10d_2$.

The first three members of the d_1'' sequence have been replaced. The first member 15,908.28, now $3d_1''$, was formerly $3d_1'$. The term 8,289.42, appearing in the original table, is not supported by observed combinations and is obviously spurious. It is replaced by 8,590.65, designated $4d_1''$ instead of $4d_5$ as before. The third term, 5,155.368, has been changed to $5d_1''$ from $5d_2$. The original interpretation has been retained for subsequent members of the series.

A new term 15,403.68 has been interpreted by Rasmussen as $3d_1'$. The md_1' sequence is otherwise unchanged.

Of the original group of d-type non-Ritzian terms, two are retained; 6,087 is designated $3s_1'''$ instead of $3s_1''''$, and 6,386, now $3s_1''''$, was formerly $3s_1''$. These changes were suggested by Rasmussen to make the notation uniform among the rare gas spectra. A new term 6,681 becomes $3s_1''$. Our old $3s_1'$ term is not confirmed. The only remaining possibility for $3s_1'$ is 5,705 as explained above.

Changes in the f-type or hydrogenlike terms have been limited to small corrections and extensions of series, except that one entirely new sequence mT has been found. A discrepancy between observed and calculated wave numbers, too great to be accounted for by errors of observation, was found in the case of the series of lines formerly designated $3d_4'-mZ$. Examination of the first and second members of the series at 9,374 and 7,584 A with the Rowland grating revealed a companion line in each case in the calculated position of the corresponding member of the mZ series. The stronger series was, therefore, given a separate designation mT and the weaker retained as mZ. The separation is 0.9 cm^{-1} for the first member 0.7 cm^{-1} for the second, the two series merging in the higher members. Members beyond the second can not be resolved not only because the wave number separation is smaller, but also since the wave length difference diminishes much more rapidly as one goes to shorter wave lengths.

The data here presented, because of greater completeness, accuracy, and the elimination of errors, should be regarded as superseding those given in RP115.

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