

The Arc Spectrum of Vanadium in the Violet

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(Received February 25, 1939)

From new measurements between 2173A and 1848A, six new odd terms and 33 miscellaneous odd levels have been found. Almost all lines of intensity 10 and greater have thus been classified, but it has not been possible to fit them all into multiplets. Five of the new terms and one previously known term may form two triads and probably belong to the $(3d)^3 4s \cdot 5p$ configuration.

AN extensive analysis of the V I spectrum has been published.¹ At that time, observations in the violet were incomplete. Recently, however, the arc spectrum has been photographed in this region and a total of 263 arc lines measured between 2173A and 1848A. Six new terms and 33 new miscellaneous odd levels have been found. These are listed in Table I, in which the notation

is continued from the previous work. A colon denotes doubtful levels. One term, o^4F^0 , which has been published, is repeated here with slightly revised values. Six of the terms in Table I may possibly form two triads, n^4D^0 , o^4F^0 , q^4G^0 and m^4D^0 , n^4F^0 , p^4G^0 . They probably belong to the $(3d)^3 4s \cdot 5p$ configuration, but the array of terms from this configuration is so complicated that no attempt has been made to assign a limit to either triad. The intensities of the combinations between a^4F and these suggested triads are given in Table II.

TABLE I. Terms of V I.

TERM	LEVEL	DIFF.	TERM	LEVEL
$q^4G_{5/2}^0$	47690.5		$2a_{11/2}^0$	45353.69*
$q^4G_{7/2}^0$	47823.24	133.19	$4_{3/2, 5/2}^0$	46322.39:
$q^4G_{9/2}^0$	48014.18	190.94	$5_{5/2}^0$	46500.64
$q^4G_{11/2}^0$	48191.04	176.86	$6_{3/2}^0$	46707.18
			$7_{7/2}^0$	47348.14
$o^4F_{3/2}^0$	47801.6		$8_{7/2}^0$	47615.56
$o^4F_{5/2}^0$	47915.9	114.3	$9_{3/2, 5/2}^0$	47682.68
$o^4F_{7/2}^0$	48139.4	223.5	$10_{5/2}^0$	47809.20
$o^4F_{9/2}^0$	48328.8	189.4	$11_{5/2}^0$	47925.49:
			$12_{5/2, 7/2}^0$	48001.8:
$n^4D_{1/2}^0$	49189.74		$13_{7/2}^0$	48023.68
$n^4D_{3/2}^0$	49283.77	94.03	$14_{7/2}^0$	48047.63
$n^4D_{5/2}^0$	49440.31	156.54	$15_{5/2}^0$	48070.91
$n^4D_{7/2}^0$	49584.09	143.78	$16_{5/2, 7/2}^0$	48201.79
			$17_{7/2}^0$	48289.8
$r^2F_{5/2}^0$	50404.14		$18_{5/2}^0$	48881.48
$r^2F_{7/2}^0$	50539.27	135.13	$19_{5/2}^0$	48964.99
			$20_{3/2}^0$	49000.82
$p^4G_{5/2}^0$	50452.6:		$21_{5/2}^0$	49302.61
$p^4G_{7/2}^0$	50579.6	127.0	$22_{7/2, 9/2}^0$	49341.90:
$p^4G_{9/2}^0$	50742.4	162.8	$23_{7/2}^0$	50090.28
$p^4G_{11/2}^0$	50933.58:	191.2	$24_{5/2}^0$	50130.6
			$25_{7/2}^0$	50154.35
$n^4F_{3/2}^0$	50909.7		$26_{5/2, 7/2}^0$	50333.59
$n^4F_{5/2}^0$	51021.2	111.5	$27_{3/2}^0$	50355.89
$n^4F_{7/2}^0$	51174.50	153.3	$28_{5/2, 7/2}^0$	50438.35
$n^4F_{9/2}^0$	51366.6	192.1	$29_{7/2}^0$	50529.67
			$30_{7/2}^0$	50595.73
$m^4D_{1/2}^0$	50976.5:		$31_{3/2, 5/2}^0$	51194.2
$m^4D_{3/2}^0$	51067.7	91.2	$32_{3/2}^0$	51830.69
$m^4D_{5/2}^0$	51212.2:	144.5	$33_{5/2, 7/2}^0$	52008.09
$m^4D_{7/2}^0$	51398.1:	185.9	$34_{5/2}^0$	55202.44
			$35_{3/2, 5/2}^0$	55877.82:

* Observed $g=1.26$ for this level; calculated from 3556A and 3379A, having observed Zeeman patterns (0) 1.27 and (0) 1.08, respectively.

¹ W. F. Meggers and H. N. Russell, Nat. Bur. Stand. J. Research 17, 125 (1936).

Table III contains the newly classified lines

TABLE II. Intensities in multiplets of V I.

	$a^4F_{9/2}$	$a^4F_{7/2}$	$a^4F_{5/2}$	$a^4F_{3/2}$
$n^4D_{7/2}^0$	90	50	0	
$n^4D_{5/2}^0$		80	40	1
$n^4D_{3/2}^0$			90	40
$n^4D_{1/2}^0$				60
$o^4F_{9/2}^0$	60r	30r?*		
$o^4F_{7/2}^0$	25	30	30r?*	
$o^4F_{5/2}^0$		25	10r?*	20
$o^4F_{3/2}^0$			30	20r
$q^4G_{11/2}^0$	40			
$q^4G_{9/2}^0$	15	20*		
$q^4G_{7/2}^0$	0	15	20	
$q^4G_{5/2}^0$		1	15	20*
$m^4D_{7/2}^0$	60	50*	—	
$m^4D_{5/2}^0$		60	50*	—
$m^4D_{3/2}^0$			70	12
$m^4D_{1/2}^0$				60
$n^4F_{9/2}^0$	80r?	30		
$n^4F_{7/2}^0$	10	60	30	
$n^4F_{5/2}^0$		15	60	40
$n^4F_{3/2}^0$			15	60
$p^4G_{11/2}^0$	50			
$p^4G_{9/2}^0$	0	50		
$p^4G_{7/2}^0$	—	12	40	
$p^4G_{5/2}^0$		—	—	40

* Blend.

TABLE III. Classified Lines of V I.

REF.	$\lambda(\text{AIR})\text{\AA}$	I(ARC) AND TEMP. CLASS	WAVE NO. VAC CM^{-1}	MULTIPLY DESIGNATION	REF.	$\lambda(\text{AIR})\text{\AA}$	I(ARC) AND TEMP. CLASS	WAVE NO. VAC CM^{-1}	MULTIPLY DESIGNATION
4	3915.36	2 II	25533.26	$b^4D_{5/2}-4^0$	1	2597.73	1?	38483.66	$a^2G_{9/2}-n^4D_{7/2}^0$
4	3863.40*	1	25876.64	$b^4D_{1/2}-6_{3/2}^0$	1	2559.81	2h?	39053.70	$a^2G_{9/2}-25^0$
4	3697.98	1	27034.11	$b^4D_{5/2}-q^4G_{7/2}^0$	1	2550.40	1h	39197.78	$a^2G_{7/2}-23^0$
4	3659.45	2 III	27318.74	$b^2G_{7/2}-19_{5/2}^0$	1	2549.834	5	39206.48	$a^4D_{3/2}-9^0$
7	3645.626	3 II	27422.34	$a^2F_{7/2}-5_{5/2}^0$	8	2549.62	3 III Fe?	39209.77	$a^4D_{7/2}-11_{5/2}^0$
4	3636.95	1 III	27487.78	$a^2S_{5/2}-q^4G_{5/2}^0$	1	2535.835*	1	39422.90	$a^4D_{5/2}-12^0$
5	3632.964	1	27517.92	$b^2P_{3/2}-6_{3/2}^0$	1	2535.441	2	39429.02	$a^2G_{9/2}-29_{7/2}^0$
4	3559.28	1	28087.60	$a^2S_{5/2}-17^0?$	1	2534.825	15h	39438.61	$a^2G_{9/2}-r^2F_{7/2}^0$
7	3556.241	4 II	28111.58	$a^4G_{11/2}-2a_{11/2}^0$	1	2532.280	5	39478.24	$b^4F_{7/2}-34_{5/2}^0$
5	3529.474*	[2]	28324.77	$b^2H_{9/2}-7_{7/2}^0$	1	2531.778	3	39486.07	$a^4D_{7/2}-16^0$
6	3503.181	1 III	28537.35	$a^2F_{7/2}-8_{7/2}^0$	1	2531.20	4h	39495.08	$a^2G_{9/2}-30_{7/2}^0$
4	3476.35	1	28757.61	$b^2G_{7/2}-r^2F_{5/2}^0$	1	2523.505	5h	39615.51	$a^4P_{5/2}-n^4D_{5/2}^0$
5	3460.099*	1 IIIA	28892.66	$b^2G_{7/2}-r^2F_{7/2}^0$	1	2521.615	(3h) III	39645.20	$a^4P_{1/2}-n^4D_{1/2}^0$
6	3454.881*	3 IV	28936.30	$b^2G_{9/2}-r^2F_{7/2}^0$	1	2521.512	6h	39646.82	$a^4P_{3/2}-n^4D_{3/2}^0$
6	3442.006*	2 IV	29044.54	$a^2F_{5/2}-15_{5/2}^0$	1	2515.649	6h	39739.22	$a^2G_{7/2}-r^2F_{7/2}^0$
5	3427.486	1 IV	29167.57	$b^2H_{9/2}-q^4G_{11/2}^0$	1	2514.41	10h	39758.79	$a^4P_{1/2}-n^4D_{3/2}^0$
4	3408.46	1 IIA	29330.41	$b^2G_{9/2}-p^4G_{11/2}^0$	1	2514.41	10h	39758.79	$a^4P_{5/2}-n^4D_{7/2}^0?$
5	3401.894*	-1	29386.99	$b^4D_{7/2}-25^0$	1	2482.711	(15h) III	40266.39	$a^2G_{9/2}-n^4F_{9/2}^0$
4	3385.91	1	29525.69	$b^4D_{1/2}-27_{3/2}^0$	1	2481.11	10h	40292.37	$a^4P_{5/2}-23^0?$
4	3383.76	1	29544.46	$b^4D_{5/2}-26^0$	1	2455.41	2h	40714.07	$a^4H_{7/2}-34_{5/2}^0$
4	3379.35	2 IV	29583.00	$b^4F_{9/2}-2a_{11/2}^0$	1	2454.79	1	40724.35	$a^4D_{3/2}-n^4D_{1/2}^0$
5	3370.196*	1	29663.37	$b^4D_{5/2}-p^4G_{5/2}^0$	1	2449.78	1	40807.63	$a^4D_{5/2}-21_{5/2}^0$
4	3345.01	tr IV	29886.70	$a^2F_{7/2}-19_{5/2}^0$	1	2446.150	3h	40868.18	$a^4D_{7/2}-n^4D_{5/2}^0$
5	3242.440	0	30832.11	$a^4G_{9/2}-q^4G_{9/2}^0$	1	2412.81	1?	41432.84	$a^4P_{1/2}-m^4D_{1/2}^0?$
5	3230.441*	1	30946.62	$a^4G_{5/2}-12^0$	1	2407.517	5	41523.93	$a^4P_{1/2}-m^4D_{3/2}^0?$
4	3225.63	1 IIIA	30992.76	$a^4G_{5/2}-14_{7/2}^0$	1	2404.544	5h	41575.26	$a^4P_{3/2}-m^4D_{5/2}^0$
5	3211.323*	0	31130.85	$b^2H_{9/2}-25^0$	1	2231.412	30	44800.71	$a^4P_{5/2}-25^0$
4	3180.09	1 IV	31436.56	$b^4P_{3/2}-0_{3/2}^0$	1	2196.56*	2?	45511.47	$a^4F_{9/2}-2a_{11/2}^0$
6	3147.255	8 IV	31764.56	$a^4G_{7/2}-18_{5/2}^0$	1	2172.75	7	46010.1	$a^6D_{7/2}-q^4G_{7/2}^0$
8	3143.2	1 IV	31805.6	$a^6S_{5/2}-33^0$	1	2170.74†	60R	46052.7	$a^4F_{3/2}-r^4G_{5/2}^0$
8	3109.42	1 IV	32151.03	$b^2H_{9/2}-n^4F_{7/2}^0$	1	2169.85	8	46071.6	46071.6
8	3108.56	[1] IV	32159.92	$a^4G_{9/2}-22^0$	1	2164.88	15	46177.4	$a^4F_{7/2}-5_{5/2}^0$
8	3099.59	2h IV	32252.96	$b^4F_{9/2}-13_{7/2}^0$	1	2164.54	3	46184.6	$a^4F_{5/2}-4^0$
8	3096.04	2 IV	32289.93	$b^4F_{7/2}-q^4G_{9/2}^0$	1	2158.12	15	46322.0	$a^4F_{3/2}-4^0$
8	3092.85	1 IV	32323.33	$b^4F_{7/2}-14_{7/2}^0$	5	2157.80	5	46328.9	46328.9
6	3038.710	10 IV	32899.16	$a^4H_{7/2}-10_{5/2}^0$	1	2146.64	10	46569.7	$a^4F_{5/2}-6_{3/2}^0$
4	3027.07	2 IV	33025.64	$b^2P_{1/2}-32_{3/2}^0$	5	2146.28	6	46577.5	$a^6D_{7/2}-18_{5/2}^0$
8	3009.66*	[1] IV	33216.63	$a^4G_{7/2}-26^0$	5	2145.20	3	46601.0	
6	3003.288	5 IV	33287.16	$a^4G_{7/2}-r^2F_{5/2}^0$	5	2144.13	5	46624.2	$a^4D_{5/2}-34_{5/2}^0$
8	3001.05	1h IV	33312.02	$b^4F_{5/2}-20_{3/2}^0$	5	2142.45	0	46660.8	$a^6D_{5/2}-18_{5/2}^0$
8	2994.61	2h IV	33383.63	$a^4G_{5/2}-28^0$	5	2140.33	1	46707.0	$a^4F_{5/2}-6_{3/2}^0$
8	2991.14*	2 IV	33422.35	$a^4G_{7/2}-r^2F_{7/2}^0$	5	2139.45	0	46726.4	$a^4D_{3/2}-34_{5/2}^0$
8	2979.21	2 IV	33556.15	$a^2D_{3/2}-15_{5/2}^0$	5	2138.62	10	46744.3	$a^6D_{5/2}-19_{5/2}^0$
8	2956.57	1h IV	33813.14	$b^4F_{9/2}-n^4D_{7/2}^0$	5	2137.71	2	46764.2	46764.2
8	2949.91*	2h IV	33889.46	$a^2P_{3/2}-q^4G_{5/2}^0$	5	2136.27	1N§§	46795.7	$a^4F_{9/2}-7_{7/2}^0$
8	2941.11*	1 IIIA	33990.83	$a^2P_{1/2}-a^4F_{3/2}^0$	5	2135.54	1	46811.7	$a^6D_{3/2}-19_{5/2}^0$
8	2939.26	2h V	34012.22	$b^4P_{5/2}-n^4D_{7/2}^0$	5	2135.18	0	46819.6	$a^4F_{7/2}-s^2F_{7/2}^0$
8	2895.16	4h V	34530.27	$a^4H_{7/2}-n^4D_{5/2}^0$	5	2133.90	0	46847.7	$a^6D_{3/2}-20_{3/2}^0$
5	2849.086	4	35088.69	$b^4D_{5/2}-35^0$	5	2132.91	8N	46869.5	46869.5
6	2815.994	5h V	35501.02	$a^2P_{3/2}-21_{5/2}^0$	5	2132.03	3	46888.8	$a^6D_{1/2}-20_{3/2}^0$
4	2788.16	2 V	35855.41	$a^2D_{5/2}-r^2F_{5/2}^0$	5	2127.17	5d?	46995.9	$a^4F_{3/2}-s^2F_{5/2}^0?$
4	2785.52	8 IV	35889.37	$a^2D_{3/2}-r^2F_{5/2}^0$	5	2126.74	5	47005.4	$a^4F_{5/2}-s^2F_{7/2}^0$
4	2777.70	8h IV	35990.41	$a^2D_{5/2}-r^2F_{7/2}^0$	5	2125.84	20	47025.3	$a^4F_{7/2}-7_{7/2}^0$
1	2742.250	2	36455.64	$a^2G_{7/2}-7_{7/2}^0$	5	2124.15	12	47062.7	$a^4F_{9/2}-8_{7/2}^0$
1	2711.874	1	36863.96	$a^4P_{3/2}-5_{5/2}^0$	5	2117.48	20§§	47210.9	$a^4F_{5/2}-7_{7/2}^0$
1	2710.471	2	36883.04	$a^4P_{5/2}-6_{3/2}^0$	5	2114.82	0	47270.3	$a^4F_{9/2}-q^4G_{7/2}^0$
1	2708.224	2	36913.64	$a^2G_{9/2}-q^4G_{9/2}^0$	5	2113.52	0	47299.4	$a^4D_{5/2}-35^0$
1	2696.760*	(6) IV	37070.55	$a^4P_{3/2}-6_{3/2}^0$	5	2111.38	5N	47347.3	47347.3
1	2690.065	2	37162.80	$a^4P_{1/2}-6_{3/2}^0$	5	2110.51	1§§	47366.8	$a^4F_{7/2}-q^4G_{5/2}^0$
1	2645.343	5	37791.04	$a^4P_{5/2}-8_{7/2}^0$	5	2108.97	8	47401.4	$a^4D_{3/2}-35^0$
1	2640.684	(6) III**	37857.71	$a^4P_{5/2}-9^0$	5	2106.33	15	47460.8	$a^4F_{9/2}-q^4G_{9/2}^0$
1	2629.094	5	38024.59	$a^4D_{3/2}-5_{5/2}^0$	5	2104.84	20	47494.4	$a^4F_{9/2}-14_{7/2}^0$
8	2614.90	2 III	38230.98	$a^4D_{3/2}-6_{3/2}^0$	5	2104.57	15	47500.5	$a^4F_{7/2}-q^4G_{7/2}^0$
1	2613.85	2?	38246.34	$a^4P_{5/2}-15_{5/2}^0$	5	2104.07	3	47511.8	47511.8
8	2602.7	1 III	38410.17	$a^2G_{7/2}-21_{5/2}^0$					

* Blend.

** Temperature class = that of blend.

§§ May be blend with VII.

TABLE III.—Continued.

REF.	$\lambda(\text{AIR})A$	I(ARC) AND TEMP. CLASS	WAVE NO. VAC CM ⁻¹	MULTIPLIET DESIGNATION	REF.	$\lambda(\text{AIR})A$	I(ARC) AND TEMP. CLASS	WAVE NO. VAC CM ⁻¹	MULTIPLIET DESIGNATION
5	2103.04	8	47535.1	$a^6D_{3/2}-l^2D_{5/2}^{0?}$	5	2048.99	<i>tr</i>	48788.8	$a^4F_{9/2}-22^0$
5	2102.58	15	47545.5	$a^4F_{5/2}-9^0$	5	2044.26	2 <i>NN</i> §§	48901.7	$a^6D_{7/2}-m^4D_{5/2}^{0?}$
5	2102.23	15	47553.4	$a^4F_{5/2}-g^4G_{5/2}^{0?}$	5	2043.13	20	48928.7	
5	2101.51	<i>tr</i>	47569.7	$a^6D_{3/2}-l^2D_{3/2}^{0?}$	5	2041.74	10 <i>N</i>	48962.0	
5	2100.77†	25	47586.4	$a^4F_{9/2}-o^4F_{7/2}^{0?}$	5	2041.24	<i>tr</i>	48974.0	$\{a^6D_{9/2}-m^4D_{7/2}^{0?}$
5	2100.51†	25	47592.3	$a^4F_{7/2}-o^4F_{5/2}^{0?}$	5	2041.00	60	48979.8	$a^6D_{5/2}-31^0$
5	2099.55	3	47614.1		5	2039.81	5 <i>N</i>	49008.4	$a^4F_{7/2}-21_{5/2}^{0?}$
5	2098.50	40	47637.9	$a^4F_{9/2}-g^4G_{11/2}^{0?}$	5	2039.39	<i>tr</i>	49018.4	$a^4F_{7/2}-22^0$
5	2097.36†	30	47663.8	$a^4F_{5/2}-o^4F_{3/2}^{0?}$	5	2038.85	90	49031.4	$a^4F_{9/2}-n^4D_{7/2}^{0?}$
5	2097.00	8§§	47672.0	$a^4F_{5/2}-10_{5/2}^{0?}$	5	2038.45	0 VII?	49041.0	$a^6D_{3/2}-31^0$
5	2096.72	15	47678.3	$a^4F_{7/2}-12^0$	5	2035.30	80	49116.9	$a^4F_{7/2}-n^4D_{5/2}^{0?}$
5	2096.54	<i>tr</i>	47682.4	$a^4F_{3/2}-9^0$	5	2034.06	90	49146.9	$a^4F_{5/2}-n^4D_{3/2}^{0?}$
5	2096.37	20§§	47686.3	$a^4F_{5/2}-g^4G_{7/2}^{0?}$	5	2033.28	8	49165.7	$a^4F_{5/2}-21_{5/2}^{0?}$
5	2096.19	20	47690.4	$\{a^4F_{3/2}-g^4G_{5/2}^{0?}$	5	2032.27	60	49190.2	$a^4F_{3/2}-n^4D_{1/2}^{0?}$
5	2095.77	25	47699.9	$a^4F_{7/2}-13_{7/2}^{0?}$	5	2032.10	5 <i>N</i>	49194.3	
5	2095.29	2	47710.9		5	2029.36	50	49260.7	$a^4F_{7/2}-n^4D_{7/2}^{0?}$
5	2095.11	2	47715.0		5	2028.42	40	49283.5	$a^4F_{3/2}-n^4D_{3/2}^{0?}$
5	2094.71	40	47724.1	$a^4F_{7/2}-14_{7/2}^{0?}$	5	2027.62	40	49303.0	$a^4F_{5/2}-n^4D_{5/2}^{0?}$
5	2094.15	8	47736.8	$a^4F_{9/2}-17^0$	5	2025.04	3	49365.8	$a^4F_{7/2}-l^2D_{5/2}^{0?}$
5	2093.70	1	47747.1	$a^4F_{7/2}-15_{5/2}^{0?}$	5	2021.98	1	49440.5	$a^4F_{3/2}-n^4D_{5/2}^{0?}$
1	2092.44†	60 <i>r</i>	47775.8	$a^4F_{9/2}-o^4F_{5/2}^{0?}$	5	2021.72	0	49446.8	$a^4F_{5/2}-n^4D_{7/2}^{0?}$
1	2092.30†	10 <i>r</i>	47779.0	$\{a^6D_{7/2}-23^0$	5	2020.30	2	49481.6	
5	2091.91	4	47787.9	$a^4F_{5/2}-o^4F_{5/2}^{0?}$	5	2018.04	<i>tr</i>	49537.0	$a^4F_{9/2}-23^0$
1	2091.29†	20 <i>r</i>	47802.1	$a^4F_{3/2}-o^4F_{3/2}^{0?}$	5	2015.41	4	49601.6	$a^4F_{9/2}-25^0$
5	2090.96	10	47809.7	$a^4F_{3/2}-10_{5/2}^{0?}$	5	2015.04	0 <i>N</i> V II?	49610.7	$a^6D_{5/2}-32_{3/2}^{0?}$
5	2090.68†	30	47816.1	$a^4F_{7/2}-o^4F_{7/2}^{0?}$	5	2013.09	3 <i>N</i>	49658.8	
5	2090.54	5	47819.3	$a^6D_{7/2}-24_{5/2}^{0?}$	5	2012.35	20	49677.0	$a^6D_{3/2}-32_{3/2}^{0?}$
5	2089.94†	20	47833.0		5	2011.83	3	49689.9	$a^4F_{3/2}-l^2D_{5/2}^{0?}$
5	2089.13	2	47851.5		5	2011.54	15	49697.0	$a^6D_{7/2}-33^0$
5	2088.56	40	47864.6	$a^4F_{5/2}-12^0$	5	2011.33	4 <i>N</i>	49702.2	
5	2087.97	1	47878.1	$a^4F_{7/2}-16^0$	5	2010.66	2 Fe II?	49718.8	$a^6D_{1/2}-32_{3/2}^{0?}$
5	2087.62	10	47886.1	$a^4F_{5/2}-13_{7/2}^{0?}$	5	2010.48	20	49723.2	$a^4F_{3/2}-l^2D_{3/2}^{0?}$
5	2087.47	8	47889.6		5	2009.54	8	49746.5	
5	2086.57	15 <i>n</i> to <i>r</i>	47910.2	$\{a^6D_{5/2}-24_{5/2}^{0?}$	5	2008.70	10	49767.3	$a^4F_{7/2}-23^0$
5	2086.33†	20	47915.7	$a^4F_{5/2}-14_{7/2}^{0?}$	5	2007.86	1	49788.1	$a^6D_{5/2}-33^0$
5	2085.91	20	47925.4	$a^4F_{3/2}-o^4F_{5/2}^{0?}$	5	2006.12	9	49831.3	$a^4F_{7/2}-25^0$
5	2085.56	10	47933.4	$a^4F_{3/2}-11_{5/2}^{0?}$	5	2004.31	4	49876.3	
5	2084.12	10 <i>n</i> to <i>v</i>	47966.5	$a^4F_{5/2}-15_{5/2}^{0?}$	5	2003.04	8	49907.9	
5	2083.65	<i>tr</i>	47977.4	$a^4F_{7/2}-17^0$	5	2000.56	0	49986.0	$a^4F_{9/2}-r^2F_{7/2}^{0?}$
5	2082.84	12 <i>NN</i>	47996.0	$a^6D_{3/2}-24_{5/2}^{0?}$	5	1995.43	0	50114.6	$a^4F_{7/2}-28^0$
5	2082.52†	30 <i>r</i> ?	48003.4	$\{a^4F_{5/2}-o^4F_{7/2}^{0?}$	5	1994.34	20 <i>N</i>	50141.9	
5	2081.70	0	48022.3	$a^4F_{7/2}-o^4F_{9/2}^{0?}$	5	1992.46	0	50189.2	$a^4F_{9/2}-p^4G_{9/2}^{0?}$
5	2081.35	2 <i>N</i>	48030.4	$a^6D_{7/2}-26^0$	5	1991.75	2	50207.1	$a^4F_{7/2}-29_{7/2}^{0?}$
5	2080.86	2 <i>N</i>	48041.7		5	1991.31	<i>tr</i>	50218.2	$a^4F_{5/2}-27_{3/2}^{0?}$
5	2080.70	2 <i>N</i>	48045.4		5	1989.82	12††	50255.8	$a^4F_{7/2}-p^4G_{7/2}^{0?}$
5	2080.46	2 <i>N</i>	48050.9		5	1989.17	0	50272.2	$a^4F_{7/2}-30_{7/2}^{0?}$
5	2079.87	1 <i>N</i>	48064.5	$a^4F_{5/2}-16^0$	5	1988.97	8	50277.3	
5	2079.56	15 <i>d</i> ? <i>r</i> ?	48071.7		5	1987.25	10 <i>NN</i> §§	50320.8	
5	2078.12	0 <i>N</i>	48105.0	$a^6D_{9/2}-29_{7/2}^{0?}$	5	1984.91	50	50380.1	$a^4F_{9/2}-p^4G_{11/2}^{0?}$
5	2077.75	<i>tr</i>	48113.6	$a^6D_{5/2}-26^0$	5	1984.43	6 <i>N</i>	50392.3	$a^4F_{5/2}-29_{7/2}^{0?}$
5	2077.16	15	48127.2	$a^6D_{7/2}-28^0$	5	1983.37	50	50419.2	$a^4F_{7/2}-p^4G_{9/2}^{0?}$
5	2077.00	5	48131.0		5	1982.45	40	50442.6	$a^4F_{5/2}-p^4G_{7/2}^{0?}$
5	2076.78	0?	48136.0	$a^6D_{5/2}-27_{3/2}^{0?}$	5	1982.06	40	50452.6	$a^4F_{3/2}-p^4G_{5/2}^{0?}$
5	2076.41	8 <i>N</i>	48144.6		5	1981.85	1	50457.9	$a^4F_{5/2}-30_{7/2}^{0?}$
5	2073.89	1	48203.1	$a^6D_{3/2}-27_{3/2}^{0?}$	5	1975.42	10	50622.2	$a^4F_{9/2}-n^4F_{7/2}^{0?}$
5	2073.58	2 <i>N</i>	48210.3		5	1973.55	5 <i>N</i>	50670.1	
5	2073.23	2	48218.5	$\{a^6D_{5/2}-28^0$	5	1972.48	15	50697.6	$a^4F_{7/2}-n^4F_{5/2}^{0?}$
5	2072.75	10	48229.6	$a^6D_{7/2}-29_{7/2}^{0?}$	5	1969.57	15	50772.5	$a^4F_{5/2}-n^4F_{3/2}^{0?}$
5	2072.30	6	48240.1		5	1967.98	80 <i>r</i> ?	50813.5	$a^4F_{9/2}-n^4F_{9/2}^{0?}$
5	2072.16	0	48243.4	$a^6D_{1/2}-27_{3/2}^{0?}$	5	1966.76	60	50845.1	$a^4F_{9/2}-m^4D_{7/2}^{0?}$
5	2068.81	5 <i>N</i> to <i>r</i> §	48321.5		5	1966.52	60	50851.3	$a^4F_{7/2}-n^4F_{7/2}^{0?}$
5	2062.78	3	48462.7		5	1965.26	60	50883.9	$a^4F_{5/2}-n^4F_{5/2}^{0?}$
5	2056.11	2	48619.9		5	1965.07	60	50888.8	$a^4F_{7/2}-m^4D_{5/2}^{0?}$
					5	1964.27	60	50909.5	$a^4F_{3/2}-n^4F_{3/2}^{0?}$
					5	1963.47	70	50930.2	$a^4F_{5/2}-m^4D_{3/2}^{0?}$
					5	1961.69	60	50976.5	$a^4F_{3/2}-m^4D_{1/2}^{0?}$

† Designation previously published.

§§ May be blend with V II.

‡ Multiplet designation previously assigned to this line very doubtful.

§ V II present.

†† Blend with Cu II.

TABLE III.—Continued.

REF.	λ (VAC)	I(ARC) AND TEMP. CLASS	WAVE No. VAC CM ⁻¹	MULTIPL* DESIGNATION	REF.	λ (VAC)	I(ARC) AND TEMP. CLASS	WAVE No. VAC CM ⁻¹	MULTIPL* DESIGNATION
5	1959.97	40	51021.2	$a^4F_{3/2}-n^4F_{5/2}^0$	5	1900.00	6	52631.6	
5	1959.36	30	51037.1	$a^4F_{5/2}-n^4F_{7/2}^0$	5	1898.78	5	52665.4	
5	1959.12	30	51043.3	$a^4F_{7/2}-n^4F_{9/2}^0$	5	1897.90	2	52689.8	
5	1958.60	<i>tr</i>	51056.9	$a^4F_{5/2}-31^0$	5	1897.49	5 <i>N</i>	52701.2	
5	1958.18	12	51067.8	$a^4F_{3/2}-m^4D_{3/2}^0$	5	1894.47	8 <i>N</i>	52785.2	
5	1957.90	50	51075.1	$\left\{ \begin{array}{l} a^4F_{7/2}-m^4D_{7/2}^0 \\ a^4F_{5/2}-m^4D_{5/2}^0 \end{array} \right.$	5	1890.82	3 <i>N</i>	52887.1	
5	1947.37	4 <i>N</i>	51351.3		5	1890.50	4 <i>N</i>	52896.1	
					5	1872.66	5 <i>N</i>	53400.0	

and all new unclassified lines of intensity greater than 1. From 3915A to 2196A the stronger lines were included in the previously published paper¹ but were unclassified. In column one the numbers refer to the observers, and the key to the numerals is the same as in the older list. Similarly, the other columns contain, respectively, wave-length, arc intensity, temperature class, wave number and multiplet designation. An asterisk following the wave-length denotes that a designation has been published for the line and it is, therefore, a blend. A dagger indicates that the multiplet designation is taken from the earlier list. In the overlapping region of the two lists a few intensities have been revised. These are in italics when the earlier measurements have been retained. Furnace intensities are in brackets. For lines of known temperature class, King's intensities are given unless the intensity is in parentheses, in which case it is that of the observer in column one.

All but four of the classified lines in the newly-measured region arise from the two lowest terms of the atom, a^4F and a^6D . Almost all of the

stronger lines have been classified, but it has not been possible to fit all of them into multiplets. Consequently, the reality of some of the numerous miscellaneous levels may be questionable.

There are enough combinations with higher terms to indicate that there is no systematic error in the ultraviolet measurements. Owing to the lack of standards in the ultraviolet, and to the scarcity of combinations in the visible region based on well measured lines, the present wave-lengths are not sufficiently accurate to provide standards, although they suffice to check the reality of nearly all of the new terms.

This paper is an outcome of work on the analysis of V II by W. F. Meggers and the writer. Observations of the spark spectrum in the ultraviolet were urgently needed. Dr. Meggers kindly lent electrodes of pure vanadium and Dr. A. G. Shenstone secured excellent photographs of both arc and spark spectra at the Palmer Laboratory. The writer greatly appreciates this assistance as well as that of Dr. Henry Norris Russell, who suggested this note and has taken a very keen interest in it.

Time Changes in Emission from Oxide-Coated Cathodes

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(Received February 1, 1939)

The decay of electron emission which sets in when emission-limited current is drawn from an oxide cathode has been studied as a function of anode voltage, anode current, cathode temperature, and tube temperature. It is concluded that the decay is due to a transport of barium or oxygen by electrolysis and diffusion. A value is deduced for the heat of the diffusion process. Other time variations in emission have been observed and are discussed.

WHEN an emission-limited current is drawn from an oxide-coated cathode, the emission current decays rapidly at first, then more slowly, finally reaching a more or less constant