included at the trap depths obtained by assuming a frequency-factor for trap-emptying of 10^{10} sec^{-1}. Energy levels for the impurity-associated excitation and emission processes of ZnS:Mn phosphors are included below the band diagrams for the other ZnS phosphors, because of the uncertainty of the nature or even the existence of a real energy level for the Mn in the forbidden gap.

The next logical extension of these measurements is the determination of the variation in electronic transitions with temperature.

The author wishes to express his thanks to Dr. R. E. Shrader for his assistance in obtaining measurements of absorption, to Dr. H. B. DeVore for his assistance in obtaining measurements of excitation, and to Dr. A. Rose for helpful discussions.

PHYSICAL REVIEW VOLUME 90, NUMBER 1 APRIL 1, 1953

The Zeeman Effect in the Spectra of Tellurium

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(Received December 3, 1952)

Over one hundred lines of tellurium have been investigated in fields of approximately 36 000 gauss; g values have been established for Te I, Te II, Te III, and from one line of Te IV. Classifications already published for many of these lines are in general agreement with the Zeeman patterns given in this report. Some previously indefinite assignments of j values are established.

THE experimental data on which this paper is based were taken during the summer of 1936 on the 21-foot concave grating spectrograph which was then in existence at the Mendenhall Laboratory of Physics.

The method of excitation of the tellurium was the same as that described for the excitation of the spectra of arsenic.[1,2]

TELLURIUM I

The first classification of the arc spectrum of tellurium was given by McLennan[3] and his co-workers and was later extended by Bartelt,[4] but no Zeeman effects have ever been published.

TABLE I. Zeeman effect for tellurium I.

Wave-length	Classification	Zeeman pattern	g_1	g_2
2383.27	$p^4\,{}^3P_0-6s({}^4S)\,{}^3S_1$	(0) 1.90	⋯	1.90
2385.78	${}^3P_1-\quad{}^3S_1$	(0.40) 1.49 1.90	1.49	1.90
2530.73	${}^3P_1-\quad{}^5S_2$	(0) (0.47) 1.96 2.47	1.49	1.98
2769.65	${}^1D_2-\quad{}^3S_1$	0 0.94	?	?
2858.28		(0) 1.10		
3175.13	${}^1S_0-5d({}^4S)\,{}^3D_1$	(0) 1.39	⋯	1.39

Six lines of this spectrum were observed, five classified and one unclassified. Table I gives the results, together with the g values garnered therefrom. The classifications are those of Bartelt.[4] The line λ2770 is a fuzzy triplet, and if we omit the usual designation for polarization (there is no information on polarization), the pattern is consistent with the g value, 1.03, calculated for the ${}^1D_2$ level on the basis of the structure of the p^4 configuration. The pattern of λ2858 yields no clue to its classification. In view of the g value for the $j=1$ level of λ3175, it seems inappropriate to assign LS classification to this level.

TABLE II. g values for tellurium II.

Even terms				Odd terms			
Level j	g value	Accuracy	Mack	Level j	g value	Accuracy	Mack
71 5/2	1.60	*c*	1.70	93°1/2	0.79	*a*	⋯
74 3/2	1.67	*b*	1.78	96°3/2	1.33	*a*	1.3
76 1/2	2.62_5	*a*	2.71	99°3/2	1.25_5	*a*	1.30
78 1/2	2.25	*a*	2.4	100°5/2	1.36_5	*b*	1.39
81 3/2	1.08	*a*	1.12	101°3/2	1.30	*a*	1.30
82 3/2	1.44	*a*	1.42	101°1/2	2.33_5	*a*	2.29
83 1/2	1.02	*b*	1.07	102°5/2	1.35	*b*	1.33
85 5/2	{1.35 or 0.95	*c*	⋯	103°7/2	1.34	*c*	1.36
85 3/2	0.86	*b*	0.8	103°3/2	1.72	*a*	1.74
85′5/2	1.47	*b*	1.49	105°3/2	1.20	*b*	1.18
86 3/2	0.93	*a*	0.99	105°5/2	1.27_5	*a*	1.29
87 5/2	1.13	*b*	⋯	106°1/2	0.81	*c*	⋯
88 3/2	1.12	*c*	1.14	107°5/2	1.15	*d*	⋯
117 3/2	1.62	*c*	⋯	112°3/2	1.10	*c*	1.12
120 5/2	1.57	*c*	⋯	112°5/2	1.33	*c*	⋯
124 5/2	1.27	*c*	1.27				
121′3/2	0.89	*c*	1.24				
123 7/2	1.28	*d*	1.24				

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1 J. B. Green and W. M. Barrows, Jr., Phys. Rev. **47**, 131 (1935).
2 A word of caution should be inserted here. Tellurium, after it comes in contact with the skin, is readily absorbed by the body. It is then eliminated very slowly by means of perspiration which gets on the clothing of the unfortunate victim, or by means of expiration. The result is an aura of concentrated garlic which seems to persist for several months after only one short exposure.
3 J. C. McLennan *et al.*, Phil. Mag. 4, 486 (1927).
4 O. Bartelt, Z. Physik **88**, 522 (1934).

TABLE III. Zeeman effect for Te II.[a]

Wavelength	Pattern	Classification	g_1	g_2	Remarks
2711.61	(0) 0.97				
2858.29	(0) 1.10				
2868.86	(0) 0.98				
2895.49	(0) 1.10				
3017.51	(0) 1.50				
3047.00	(0) 1.21				
3073.43	(0) 0.85				
3256.81	(0) 1.12				
3329.25	(0) 1.90	$71_{5/2}-101°_{3/2}$	1.65	(1.30)	
3362.83	(0) 1.01				
3406.77	(0) 1.13				
3442.22	(0) 1.70	$74_{3/2}-103°_{3/2}$	1.70	1.70	
3456.84	(0.42) 1.47	$71_{5/2}-100°_{5/2}$	1.56	1.38	
3497.93	(0) 1.10				
3521.07	(0) 1.94	$71_{5/2}-99°_{3/2}$	1.65	(1.26)	
3617.55	(0.45) **1.29** 2.15	$76_{1/2}-103°_{3/2}$	2.61	1.73	
3654.36	(0) 0.84				
3797.18	(···) (**0.57**) 1.10 **1.48** 1.88	$74_{3/2}-101°_{3/2}$	1.67	1.29	
3918.50	(0.23) 0.99	$86_{3/2}-112°_{3/2}$	0.91	1.07	
3936.21	(0.39) 1.88	1/2→1/2	1.49	2.27	
3947.93	(0.47) ···	$\Delta j=0$			
3975.90	(0.46) 1.23	$87_{5/2}-112°_{5/2}$	1.13	1.33	
4006.50	looks like 5/2→3/2	$(71_{5/2}-96°_{3/2})$?	1.77	1.62?	Inconsistent pattern
4011.68	(0.66) ··· **1.96**	$76_{1/2}-101°_{3/2}$	2.64	1.32	
4048.89	(···) (0.67) 1.48 1.89	$74_{3/2}-99°_{3/2}$	1.69	1.26	
4169.77	(0) 0.93				
4261.08	(0) 1.12	$93°_{1/2}-117_{3/2}$			Inconsistent pattern
4364.02	(0.45) very fuzzy	$85_{5/2}-107°_{5/2}$	{1.35 0.95	(1.15)	
4434.96	(0) 0.93	$83_{1/2}-106°_{1/2}$	(1.02)	0.84	
4478.33	(0) 1.31	$102°_{5/2}-124_{5/2}$	(1.35)	1.27	
4557.84	(0.54) 1.09	$99°_{3/2}-121'_{3/2}$	1.29	0.89	
4602.57	(0) 0.92				
4641.19	(0.34) **1.40** 2.00 looks like 1/2→3/2	$(103°_{7/2}-124_{5/2})$?	2.36	1.72	Improper classification?
4654.38	(0) 1.11				
4664.34	(0) 1.26				
4686.95	(0) 1.19	$102°_{5/2}-123_{7/2}$	(1.35)	1.28	
4706.53	(0) 1.27				
4729.83	(0.63) 1.74	$78_{1/2}-99°_{3/2}$	2.22	1.26	
4738.67	(0) 1.02				
4769.73	(0) 0.89	$85_{3/2}-106°_{1/2}$	(0.86)	0.80	
4784.85	(···) (**0.47**) ··· **1.13** 1.42	3/2→3/2	1.27	0.99	
4831.30	(0) 1.09				
4842.88	(0) 1.39				
4864.10	(0) 1.14	$87_{5/2}-107°_{5/2}$	[1.13]	1.15	
4866.22	(0) 1.14	$118'-97°_{1/2}$			
4875.53	(0) 1.14	$100°_{5/2}-120_{5/2}$			Inconsistent pattern
4885.22	(0) 1.07				
4893.58	(0) 1.47	$81_{3/2}-102°_{5/2}$			(0) 1.55 calc
4894.94	(**0.21**) (0.63) ··· 1.09 1.48 **1.89**	$85_{3/2}-105°_{5/2}$	0.86	1.27	
5000.87	(0.47) 1.37	$85'_{5/2}-105°_{5/2}$	1.47	1.27	
5037.97	(0.66) 1.92	$76_{1/2}-96°_{3/2}$	2.65	1.33	
5130.99	(0.14) **0.82** ···	3/2→1/2	0.97	1.25	
5133.23	[0.56]	$81_{3/2}-101°_{1/2}$			Mixed polarization
5149.90	(0) 1.20				
5164.00	(0) 0.97	$86_{3/2}-106°_{1/2}$	(0.93)	0.78	
5172.99	(0.27) 1.20	$81_{3/2}-101°_{3/2}$	1.10	1.29	
5238.07	(0.45) ··· **2.15**	$74_{3/2}-93°_{1/2}$	1.70	0.80	
5256.36	(0) 1.25				
5300.67	(0) 1.05				
5304.99	(0.69) 1.45	3/2→3/2	1.69	1.20	
5311.07	(**0.18**) (0.54) ··· 1.13 1.47 **1.80**	$86_{3/2}-105°_{5/2}$	0.93	1.28	
5366.91	(0.45) **0.99** 1.87	$82_{3/2}-101°_{1/2}$	1.44	2.34	
5410.41	(0.19) 1.38	$82_{3/2}-101°_{3/2}$	1.44	1.31	
5449.82	(**0.16**) (0.40) **1.08** 1.32 ··· ···	$85'_{5/2}-103°_{3/2}$	1.47	1.73	
5465.17	(0.45) (1.47)	$102°_{5/2}-120_{5/2}$	1.37	1.57	
5479.13	(···) **0.41** (0.77) **1.07** 1.345	$86_{3/2}-105°_{3/2}$	0.93	1.20	

TABLE III.—(*Continued*).

Wavelength	Pattern	Classification	g_1	g_2	Remarks
5488.07	**(0.15)** (0.44) 1.25 1.51 **1.80**	$81_{3/2}-100°_{5/2}$	1.07	1.36	
5576.40	(0) 1.07				
5618.47	(0.64) 1.69	$83_{1/2}-101°_{1/2}$	1.05	2.33	
5630.66	(0.52) 1.43	$99°_{3/2}-117_{3/2}$	1.24	1.62	
5649.30	(0.45) **0.87** 1.80	$78_{1/2}-96°_{3/2}$	2.24	1.33	
5651.51	(0.18) 1.17	$81_{3/2}-99°_{3/2}$	1.10	1.24	
5655.15	(0.92) 1.70	$76_{1/2}-93°_{1/2}$	2.62	0.79	
5666.26	(0.16) 1.17 **1.45**	$83_{1/2}-101°_{3/2}$	0.99	1.29	
5708.07	(0) 1.19	$85'_{5/2}-103°_{7/2}$	(1.45_5)	1.34	
5741.66	(0) 1.41				
5755.87	(0) 1.36	$82_{3/2}-100°_{5/2}$			(0) 1.31 calc
5765.25	(0) 1.12				
5851.09	(0.14) 1.21	$3/2\rightarrow3/2$	1.16	1.26	
5936.21	(0.27) 1.34	$82_{3/2}-99°_{3/2}$	1.44	1.24	
5972.64	(0) 1.44				
5974.70	(0.33) 1.40	$85'_{5/2}-102°_{5/2}$	1.47	1.33	
5993.94	(0.42) 0.88	$120_{5/2}-103°_{3/2}$			
6014.64	(0) 1.41				
6230.80	(0) 1.16	$88_{3/2}-105°_{3/2}$	1.12	(1.20)	
6245.61	(0) 1.34	$83_{1/2}-99°_{3/2}$			(0) 1.315 calc
6437.06	(0.75) 1.53	$78_{1/2}-93°_{1/2}$	2.28	0.79	

[a] Boldface numbers denote the strongest components.

TELLURIUM II

Wavelengths of tellurium II lines have been published by Bloch and Bloch,[5] and a classification has been presented by Rao and Sastry,[6] but the classifications given for several lines are not consistent with the Zeeman effect data given in this paper. More recently, Mack and his co-workers[7] have given a more complete classification which fits the observed Zeeman patterns in most cases. While most of the g values in Table II are in general agreement with those given by Mack, there are some significant differences and some additions. The j values of 93° and 112°3/2, 5/2 are definitely established as 1/2 and 5/2, respectively.

Table III is a summary of those lines attributed by Bloch and Bloch[5] to Te II whose Zeeman patterns were measured. Classifications are those of Mack.[7] Table II is a summary of the g values derived from Table III.

TABLE IV. Zeeman effect for tellurium III.

Wave-length	Classification	Zeeman pattern	g_1	g_2
5537.87	$6s\,^1P_1 - 6p\,^3P_0$	(0) 1.00	1.00	···
5326.80	$5d\,^3D_3 - 6p\,^3P_2$	(0) 1.28	1.35	(1.43)
4876.63	$5d\,^3P_1 - 6p\,^3S_1$	(0) 1.14	(1.26)	1.02
4783.30	$6s\,^3P_1 - 6p\,^1P_1$	[0.69] 1.37	1.37	(0.76)
4725.69	$6s\,^3P_0 - 6p\,^1P_1$	(0) 0.76	···	0.76
4355.70	$5d\,^3P_2 - 6p\,^3P_2$	(0.14) 1.39	1.35	1.43
4302.12	$5d\,^3P_2 - 6p\,^3D_3$	(0) 1.22	(1.34)	1.28
4122.80	$6s\,^3P_2 - 6p\,^3P_2$	(0) 1.36	1.28	(1.43)
4074.88	$6s\,^3P_2 - 6p\,^3D_3$	(0) 1.28	1.29	(1.28)
4062.01	$6s\,^3P_1 - 6p\,^3D_2$	(0) 1.05	(1.37)	1.16
4054.89	$6s\,^3P_0 - 6p\,^3D_1$	(0) 1.24	···	1.24
3984.42	$5d\,^3P_2 - 6p\,^3P_1$	(0) (0.42) **0.91** 1.34	1.34	1.76
3968.42	$5d\,^3P_1 - 6p\,^1D_2$	(0) 1.08	1.26	(1.14)
3841.60	$5d\,^3F_3 - 6p\,^3D_2$	(0) 0.97	1.07	(1.16)
3550.64	$5p^3\,^1D_2 - 6p\,^1P_1$	(0) (0.54) ··· ··· **1.67**	1.13	0.59
3474.67	$6s\,^1P_1 - 6p\,^1D_2$	(0) 1.21	(1.00)	1.14
3455.59	$6p\,^3P_0 - 6d\,^3P_1$	(0) 1.43	···	1.43

TELLURIUM III

Seventeen lines of Te III, classified by Krishnamurty and Rao[8] and Rao,[9] were measured. These are listed in Table IV. The classification given by Krishnamurty[10] for the line λ3984 is favored by the Zeeman effect. The classification given for λ4876 is questionable. The pattern should probably have been resolvable with the calculated g values. Parentheses indicate g values assumed from measurements of other lines.

TELLURIUM IV

Only one line classified by Rao[9] as belonging to Te IV was found on our plates. This line is λ3585.27, $^2S_{\frac{1}{2}}\rightarrow{}^2P_{\frac{1}{2}}$, (0.68) 1.34. The classification is in agreement with the Zeeman pattern.

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[10] S. G. Krishnamurty, Proc. Roy. Soc. (London) **A151**, 178 (1935).