THE SPECTRUM OF HIGHLY IONISED IODINE—I VI

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ABSTRACT. Using the regular and irregular doublet laws, appropriate lines possibly belonging to the spectrum of iodine VI have been picked up from the far ultraviolet data of highly ionised iodine due to Blochs and Felici, and a scheme set up The important intervals $5p$ $(^3P_0-{}^3P_1)$ and $5p$ $(^3P_1-{}^3P_2)$ have been found to be 3593 cm^{-1} and 10,424 cm^{-1} respectively.

Our knowledge of the spectrum of highly ionised iodine is as yet very meagre. In a previous publication, one of the authors (Krishnamurty, 1936) reported a regularity in the spectrum of trebly ionised iodine and set up a scheme consisting of the $6s$, $6p$, and $5d$ terms. Since then Blochs and collaborator (1937) published a long list of lines of highly excited iodine from λ200 to λ1,000. They showed that the excitation obtained in their experiments was very high, by picking up from the list, two lines belonging to I VIII.

However, they did not classify their data into the lines belonging to I VII, VI, V, etc., but only into seven groups denominated 2−, 2, 2+, 3−, 3, 3+, and 4 in increasing order of excitation. They point out that all lines attributed to I II are contained in their group 2. Group 3, they think, contains "about all" the lines due to I III but as no reliable analysis of I III lines is as yet made, they do not feel sure of this conclusion. Group 4 contains, according to them, lines due to iodine IV, V, VI, VII and VIII.

Starting from the clue afforded in the last sentence, we made an attempt in the present paper, to pick out from the data given by the Blochs, lines of I VI, which are expected to result from the allowed combinations of the terms listed in Table I.

TABLE I

Terms of I VI

Term prefix	Terms		
$5s^2$	^1s		
$5p$	^3p	^1p	
$5d$	^3D	^1D	
$5p^2$	^3p	^1p	^1p
$6s$	^3s	^1s	

The main procedure adopted is the application of the law of variation of the frequencies of corresponding lines in iso-electronic spectra as shown in Table II.

TABLE II

Corresponding lines in Cd I—like spectra

Spectrum.	$5p\,^3P_2 - 5d\,^3D_3$	$5p\,^3P_1 - 5d\,^3D_2$	$5p\,^3P_0 - 5d\,^3D_1$
In II	56479	58825	59812
	26128	27503	17957
Sn III	82607	86328	87769
	24652	26234	36708
Sb IV	107259	112562	114477
	23853	25552	29626
Te V	131112	138114	144103
	22943	25162	22049
I VI	154055	163276	166152

Spectrum	$5p\,^3P_2 - 5p^2\,^3P_2$	$5p\,^3P_1 - 5p^2\,^3P_1$	$5p\,^3P_2 - 5s^2\,^1S_0$
In II	59735	59898	63036
	15599	15023	16872
Sn III	75334	74921	79908
	15623	14761	16044
Sb IV	90957	89682	95952
	15638	14714	15755
Te V	106595	104396	111707
	15702	14819	15468
I VI	122297	119215	127175

TABLE III

Screening Constants.

Z	Spectrum	$5p(^3P_1 - ^3P_2)$	S	ΔS	$\Delta^2 S$
48	Cd I	1171	33.03		
				2.09	
49	In II	2478	30.94		.75
				1.34	
50	Sn III	4034	29.6		.34
				1.0	
51	Sb IV	5860	28.6		.21
				.79	
52	Te V	7974	27.81		.12
				.67	
53	I VI	10423	27.14		

As far as possible, only group 4 lines of the Blochs were selected in this process, which yielded the scheme presented in Table IV. Further confirmation for the selection was obtained from the law of variation of screeing constants shown in Table III.

The numbers printed above the frequencies in Table IV represent the group to which the selected lines are assigned in the list of the Blochs. It will be seen that some group 3 lines are also selected for the scheme. It is hoped that, in view of the want of absolute certainty in the assignment of the lines to the various known stages of excitation, these lines will fit ultimately into the I VI scheme, when further work on I III, I IV etc., which is in progress, is completed. The behaviour of intervals and intensities is throughout normal. One line, ν 154055 (20) looks quite of an abnormal intensity, but in addition to representing the present combination, which should be about the brightest line (compare intensities of the $5d^3D$—$5p^3P$ multiplet with other multiplet lines) it (alone) is found to represent another combination in I VII too.

TABLE IV
Multiplet Scheme of I VI

	$5p^3P_0$	(3595)	$^3P_1$	(10424)	$^3P_2$
$5s^2\ ^1S_0$			3 127175 (8)		
$5p^2\ ^3P_0$			3 110945 (0)		
$^3P_1$	4 122805 (3)		3 119215 (2)		4 108781 (7)
$^3P_2$			3+ 132723 (2)		4 122297 (3)
$^1D_2$			4 120172 (3)		4 109749 (3)
$5d^3D_1$	4 166152 (5)		4 162557 (4)		
$^3D_2$			4 163276 (6)		4 152854 (4)
$^3D_3$					4 154055 (20)
$^1D_2$			4 166653 (1)		3 156223 (2)
$6s^3S_1$			4 207005 (3)		

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