A Note on the Intersystem Combination Lines in A III

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Intersystem combination lines of the third spectrum of argon have been discovered in the extreme ultraviolet. The lines are listed and the singlet term values previously published are revised to conform to the same basis as that of the triplet terms. Wave-lengths of the "forbidden" lines of this stage of ionization of argon have been calculated. One of them is in close agreement with a nebular line at λ7135.6.

IN a term table for A III already published[1] the singlet terms have been listed on the assumption, following Bowen,[2] that the $s^2p^4\ {}^1D_2$ term lies at 14,000 cm^{-1} above the lowest ($s^2p^4\ {}^3P_2$) term of the atom. In a note appended at proof mention was made of additional triplet terms discovered by de Bruin[3] and the term table was amended to include them. Of these the $(^2D)3d\ {}^3F^0$ term gives no combinations with the ground triplet but has since been discovered to give intersystem combinations with the low $s^2p^4\ {}^1D_2$ term. Following this clue other intersystem lines have been found so that now the values of the singlet terms can be given on the same basis as that of the triplet terms. Tables I and II list these intersystem lines and the revised values which they give for the singlet terms previously published. These tables should be taken as supplementing and correcting Tables IV and V of the earlier article.[1] While the values of the suggested $(^2D)3d\ {}^1F_3^0$ and $(^2D)4s\ {}^1D_2^0$ terms have been shifted to conform to the new scale, the reality of these terms remains open to considerable question.

TABLE I. *Intersystem combination lines in A III.*

λ	INT.	ν	CLASSIFICATION
1205.95	1	82,922.5	$s^2p^4\ {}^1S_0 - sp^5\ {}^3P_1^0$
1002.095	3−	99,790.9	$s^2p^4\ {}^1D_2 - sp^5\ {}^3P_2^0$
699.72	1−	142,907	$s^2p^4\ {}^1D_2 - (^4S)3d\ {}^3D_3^0$
623.767	5	160,316	$s^2p^4\ {}^3P_0 - sp^5\ {}^1P_1^0$
579.212	3	172,648	$s^2p^4\ {}^1D_2 - (^2D)3d\ {}^3F_2^0$
578.386	4	172,895	$s^2p^4\ {}^1D_2 - (^2D)3d\ {}^3F_2^0$

TABLE II. *A III singlet term values.*

$(3s)^2$	$(3p)^4$	$^3P_2$	0
$(3s)^2$	$(3p)^4$	$^1D_2$	14,010
$(3s)^2$	$(3p)^4$	$^1S_0$	31,873
$3s$	$(3p)^5$	$^1P_1^0$	161,886
(^2D)	$3d$	$^1F_3^0$	179,531 ?
(^2D)	$4s$	$^1D_2^0$	200,318 ?

These term values permit the more exact calculation of the wave-lengths of the "forbidden" lines due to A III and locate them as follows:

$$^3P_2 - {}^1D_2\ \lambda 7135.7, \quad {}^3P_1 - {}^1D_2\ \lambda 7751.0,$$
$$^1D_2 - {}^1S_0\ \lambda 5596.6, \quad {}^3P_1 - {}^1S_0\ \lambda 3250.$$

The first of these predictions agrees very closely with the line observed by Merrill at λ7135.6[4] in NGC 6572 and NGC 7027. This line has been so identified by Bowen[2, 5] upon the basis of interpolation along an isoelectronic sequence. Bowen's suggestion for λ7135.6 is considerably strengthened by the present results, but a final decision in the interpretation of the nebular line must await observations to detect its companion line at λ7751. This line lies further into the infrared than nebular observations have yet been extended. λ5597 and λ3250 would be expected to be observed only in such celestial objects as favor the excitation of the "auroral" type of "forbidden" line,[6] namely, certain stages of novae and a few nebulae such as NGC II 4997.[7] Observations in the proper spectral ranges are unfortunately scarce.

Opportunity is taken to correct a misprint in Table V of the earlier article.[1] The value of the $(^2P)3d\ {}^3P_2^0$ term should be 213,945.

[1] J. C. Boyce, Phys. Rev. **48**, 396 (1935).
[2] I. S. Bowen, Phys. Rev. **46**, 791 (1934).
[3] T. L. de Bruin, *Pieter Zeeman Jubilee Volume* (Martinus Nijhoff, The Hague, 1935), p. 413.
[4] P. W. Merrill, Publ. Astron. Soc. Pacific. **40**, 254 (1928).
[5] I. S. Bowen, Astrophys. J. **81**, 1 (1935).
[6] J. C. Boyce, D. H. Menzel and C. H. Payne, Proc. Nat. Acad. Sci. **19**, 581 (1933).
[7] R. H. Stoy, Publ. Astronom. Soc. Pacific **46**, 297 (1934).