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REGULARITIES IN THE STARK PARAMETERS OF SPECTRAL LINES OF SINGLY IONIZED ALUMINUM

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In a series of experimental and theoretical papers (Konjević and Wiese, 1976; Konjević *et al.*, 1984; Konjević and Wiese 1990) the Stark parameters of spectral lines of singly ionized aluminum were studied. Experimental data for some lines obtained by different authors differ considerably from each other. Determination of regularities in the behaviour of the Stark parameters of spectral lines is one of the ways to estimate the reliability of experimental and theoretical data.

In this paper based on the approach we proposed for finding these regularities (Sarandaev *et al.*, 1991; Salakhov *et al.*, 1991), the dependencies allowing one to analyze experimental and theoretical data for Al II and to estimate Stark widths and shifts of the Al II lines, which are neither calculated theoretically nor measured experimentally, are obtained.

The main point of the proposed approach is based on determining regularities for energy levels rather than for lines assuming that the following relations hold with the accuracy to the interference terms :

$$w = dE(q_2) - dE(q_1) \tag{1}$$

$$d = dd(q_2) - dd(q_1), \tag{2}$$

where w and d are the line width and shift, respectively, $dE(q_2)$, $dE(q_1)$, $dd(q_2)$ and $dd(q_1)$ are the widths and shifts of the upper and lower levels, respectively, in frequency units. These dependencies were approximated as follows :

$$\lg(dE) = a \cdot \lg(n) + \lg(A) \tag{3}$$

$$\lg(dd) = b \cdot \lg(n) + \lg(B) \tag{4}$$

where n is the effective principal quantum number of the level. A, a, B and b are constants independent of n.

These dependencies as well as those established for other atoms and ions are obtained based on semiclassical calculations of (Griem, 1974), where the widths and

shifts of 15 Al II spectral lines are given. The dependence obtained for the widths of levels was approximated by the relation :

$$\lg(dE) = 4.68 \cdot \lg(n) + 9.11 \tag{5}$$

The values of the widths of levels are well described by a straight line : the correlation coefficient is not less than 0.99. The comparison of the line widths obtained using (1) and (5) with the values of the initial semiclassical calculations (Griem, 1974) shows that the discrepancy does not exceed 30%.

We have also compared our estimates with the literature experimental data on the Al II line widths. For example, for three lines Al II 390 nm, Al II 263.1 nm and Al II 559.3 nm our estimates agree with experiment (Colon *et al.*, 1993). For other lines the experimental values are 2-3 times higher than our estimates. We give possible reason for this discrepancy.

The dependence obtained for the shifts of levels was approximated by the relation :

$$\lg(dd) = 4.13 \cdot \lg(n) + 9.53 \tag{6}$$

The values of the shifts of levels are well described by a straight line : $R = 0.986$. The comparison of the line shifts obtained using (2) and (6) with the values of the initial semiclassical calculations (Griem, 1974) shows that the discrepancy does not exceed 25%.

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