Stark effect in two-electron atoms by high-resolution diode-laser spectroscopy

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The Stark effect is very important for understanding the atomic structure and the interaction between the atom and external electric field and is, however, less studied up to now. We report studies of the Stark effect in two-electron atoms of Ba and Yb using high-resolution diode-laser spectroscopy. Measurements were performed for two transitions of $6s^2 1S_0 \rightarrow 6s6p \, ^3P_1$ at 791.1 nm and $6s5d \, ^3D_1 \rightarrow 5d6p \, ^3F_2$ at 767.2 nm in Ba I and two transitions of $4f^{14}6s^2 1S_0 \rightarrow 4f^{14}6s6p \, ^1P_1$ at 398.8 nm and $4f^{14}6s6p \, ^3P_2 \rightarrow 4f^{14}6s7s \, ^3S_1$ at 769.9 nm in Yb I; the 767.2 nm and 769.9 nm transitions are from the metastable states, related to the high-lying levels.

Figure 1 shows observed Stark spectra of the $4f^{14}6s6p \, ^3P_2 \rightarrow 4f^{14}6s7s \, ^3S_1$ transition in Yb I at the electric field 78.4 kV/cm as well as at a zero field. Not only Stark shifts but also splittings can be found from the figure for the even mass number isotopes. From detailed measurements at different electric fields, scalar and tensor polarizabilities, the fundamental spectroscopic data, were determined for the studied transitions. Comparison and discussion about polarizabilities in ground and high-lying levels of two-electron atoms of Ba and Yb are presented.

![Stark Spectra](image.png)

Fig. 1. Observed Stark spectra of the $4f^{14}6s6p \, ^3P_2 \rightarrow 4f^{14}6s7s \, ^3S_1$ transition in Yb I at the electric field 78.4 kV/cm as well as at a zero field.