Zeeman splitting of the ground and excited states of boron-like argon

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Recent high-precision measurements of the bound-electron g factor in hydrogen-like carbon and oxygen ions together with corresponding theoretical studies have lead to the most accurate value of the electron mass [1]. Recently, the g factors of H-like [2] and Li-like [3] silicon have been measured with an accuracy of 10^{-10} and 10^{-9}, respectively. Experimental and theoretical investigations of the g factor of heavy few-electron ions will provide stringent tests of bound-state QED in strong nuclear field. Moreover, the studies of heavy boron-like ions will serve for an independent determination of the fine structure constant [4].

The ARTEMIS project aims at the measurement of the Zeeman splittings of both ground state $^2P_{1/2}$ and first excited state $^2P_{3/2}$ in boron-like argon with ppb accuracy [5]. We present the most accurate up-to-date theoretical predictions, including the g factors and the coefficients of the non-linear in magnetic field effects. The interelectronic-interaction, QED and recoil corrections are evaluated. For the g-factor values the accuracy of about 10^{-6} is achieved. The effects of second and third order in magnetic field are found to be important under the proposed experimental conditions.

References:
[1] P. J. Mohr, B. N. Taylor, and D. B. Newell, Rev. Mod. Phys. **84**, 1527 (2012).
[2] S. Sturm *et al.*, Phys. Rev. Lett. **107**, 023002 (2011).
[3] A. Wagner *et al.*, Phys. Rev. Lett. **110**, 033003 (2013).
[4] V. M. Shabaev *et al.*, Phys. Rev. Lett. **96**, 253002 (2006).
[5] D. von Lindenfels *et al.*, Phys. Rev. A. **87**, 023412 (2013).
[6] D. A. Glazov *et al.*, Phys. Scr., in press.