# Estimates of the bound-state QED contributions to the $g$-factor of valence $ns$ elecrons in alkali metal atoms

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**Abstract**

The bound-state QED corrections to $g$-factors are partly calculated and partly estimated for the $ns$ valence elecrons in the atoms K, Rb, Cs, $Ba^+$ and Fr. It is shown that these corrections should be taken into account in the comparison with experimental data.

The electron $g$ factors for a number of $ns^1$ heavy atomic systems and in particular for alkali metals have been accurately measured, showing a clear deviation from the free-electron value $g$=2.002 319 304 386(20) [1]. A large number of theoretical calculation of $\delta g = g^{bound} - g^{free}$ also exist for alkali metals (see [2] for the references). The reasons behind the deviation $\delta g$ are, however, different in light and heavy atoms. For light atoms the main contribution is the relativistic, kinetic correction $\delta g_{rel}$, first introduced by Breit [3]. For the recent status of this correction see [4]. In heavy atoms the core-valence correlation correction $\delta g_{corr}$ dominates [5]–[9]. The Breit interaction between the valence and core electrons also gives an observable contribution $\delta g_{Breit}$ [6]–[9].

In all the theoretical studies for the alkali metals it was assumed that the QED correction $\delta g_{QED}$ is the same as for the free electron [1], *i.e.* the bound-state QED corrections were not considered. Howeover the recent calculations for the highly charged H-like ions show that the deviation of the bound-state QED correction $\delta g_{QED}^{bound}$ from the free-electron value $\delta g_{QED}^{free}$ can be as large as 50% for high $Z$ values [10]–[11] ($Z$ is the charge of the nucleus).

Therefore in this work we present partly direct calculations and partly estimates for $\delta g_{QED}^{bound}$ for the heavier alkali metals and show that this correction is comparable with $\delta g_{Breit}$ and should be taken into account in comparisons with experimental data.

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