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# Towards testing physics beyond the Standard Model with the $g$ factor of bound electrons

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We demonstrate the relevance of the $g$ factor of bound electrons in few-electron ions to the search for physics beyond the Standard Model (SM). The contribution to the $g$ factor from hypothetical forces beyond the SM can be calculated and, when compared to existing and potential experimental data, used to derive competitive bounds on the parameters of these forces.

A first method to implement this program consists in comparing the best available theoretical and experimental results, including data on the weighted difference of $g$ factors of different electronic levels [V.A. Yerokhin et al., Phys. Rev. Lett. 116, 100801 (2016)]. Stringent bounds can be obtained in the future with this method, through the ongoing advancement of bound-state QED calculations at the two-loop level.

Another method makes use of the isotope shift. Inspired by a recent proposal concerning optical frequencies in ions [J.C. Berengut \textit{et al., Phys. Rev. Lett. 120, 091801 (2018)], we propose to use precision spectroscopy of the isotope shifts in the $g$ factor of few-electron ions, to obtain bounds on a hypothetical fifth fundamental force. This method is based on experimental King plots, which are built from isotope shift data. By carefully considering subleading nuclear corrections to the $g$ factor, our treatment allows for the precise interpretation of King plots. Plans to measure isotope shifts in $g$ factors of highly charged ions with very-high precision [S. Sturm et al., Eur. Phys. J. Special Topics 227, 1425 (2019).] make our investigation especially timely.

**Authors:** DEBIERRE, Vincent (Max Planck Institut für Kernphysik, Heidelberg, Germany); Prof. KEITEL, Christoph H. (Max Planck Institut für Kernphysik, Heidelberg, Germany); HARMAN, Zoltan

**Presenter:** DEBIERRE, Vincent (Max Planck Institut für Kernphysik, Heidelberg, Germany)

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