Sixteenth Marcel Grossmann Meeting



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Precision isotope-shift spectroscopy in neutral Yb and joint Yb/Yb⁺ King-plot analysis

Monday, 5 July 2021 16:30 (30 minutes)

The isotope shifts (IS) in the frequency of an atomic transition are approximately linearly correlated with the shifts in another transition. This linearity is reflected in the so-called King-plot analysis. It has been suggested to search for deviations from linearity as a way to probe beyond-Standard-Model interactions mediated by light bosons [1]. These searches require availability of precision IS data in a chain of isotopes of a given element. In a recent report on precision spectroscopy in a pair of Yb⁺ transitions [2], a large nonlinearity was observed in the King-plot, that primarily arises due to the quadratic field shift [2], or the influence of the nuclear deformation on the field shift [3]. Further availability of precision IS data in the same element is crucial to check modeling of the cause of the nonlinearity [3], and potentially separate within Standard-Model effects from possible new physics contributions to the nonlinearity [4].

We will discuss an experiment involving precision spectroscopy of the ${}^{1}S_{0} - {}^{1}D_{2}$ optical transition in neutral Yb, in order to determine the IS in the naturally abundant, nuclear-spin zero Yb isotopes. We will present our preliminary experimental results, and show a joint King-plot of our data combined with those on Yb⁺, that reveals an order of magnitude larger nonlinearity, compared to that of the Yb⁺ work.

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[3] Saleh O. Allehabi, V. A. Dzuba, V. V. Flambaum, and A. V. Afanasjev. Phys. Rev. A 103, L030801 (2021).

[4] J. C. Berengut, C. Delaunay, A. Geddes, and Y. Soreq, Phys. Rev. Research 2, 043444 (2020)

Primary authors: Dr ANTYPAS, Dionysios (Johannes Gutenberg-Universität Mainz, Helmholtz-Institut Mainz, Mainz 55128, Germany); Mr FIGUEROA, Nathaniel (Johannes Gutenberg-Universität Mainz, Helmholtz-Institut Mainz, Mainz 55128, Germany); BERENGUT, Julian (University of New South Wales, School of Physics, Sydney 2052, Australia); DZUBA, Vladimir (University of New South Wales, School of Physics, Sydney 2052, Australia); Prof. FLAMBAUM, Victor (University of New South Wales, School of Physics, Sydney 2052, Australia); Prof. BUDKER, Dmitry (Johannes Gutenberg-Universität Mainz, Helmholtz-Institut Mainz, BUDKER, Dmitry (Johannes Gutenberg-Universität Mainz, Helmholtz-Institut Mainz, Mainz 55128, Germany)

Presenter: Dr ANTYPAS, Dionysios (Johannes Gutenberg-Universität Mainz, Helmholtz-Institut Mainz, Mainz 55128, Germany)

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