CRC 1227
Designed Quantum States of Matter

GUEST LECTURE

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(Guest of Prof. P.O. Schmidt and Prof. Dr. K. Hammerer)

Leibniz Universität Hannover
DQ-mat Colloquium
Thursday, 04 April 2024, 4.00 pm
Vieweg-Building Room 133
Physikalisch-Technische Bundesanstalt,
Bundesallee 100, 38116 Braunschweig

"Laser Excitation of the Thorium-229 Nucleus"

The Th-229 nucleus is known for its unique low-energy isomeric state with an excitation energy of about 8.3 eV that places this nuclear transition in the vacuum-ultraviolet (VUV) spectral range and makes it accessible for experiments with tabletop laser systems and the tools of optical frequency metrology. Several proposals have been made based on these properties, including a nuclear optical clock of high accuracy and high sensitivity in tests of fundamental physics. Reflecting the inherent robustness of nuclear transitions to external fields and chemical environments, even a solid-state version of such a clock has been proposed. We have now achieved laser excitation of the Th-229 nuclear resonance in Th-doped calciumfluoride crystals grown at TU Wien, using a VUV laser system developed at PTB. A laser-induced VUV fluorescence signal is observed from two crystals with different Th-229 concentrations, while it is absent in a test experiment with a Th-232 doped crystal. The energy and lifetime of the isomer are measured with strongly improved accuracy. The results open the perspective for Th-229 nuclear laser spectroscopy in solids and trapped ions.

All DQ-mat members and all interested are cordially invited to attend.