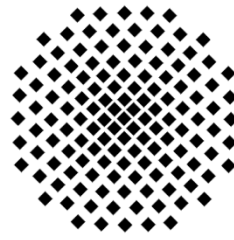


Stuttgarter Physikalisches Kolloquium

Fachbereich Physik, Universität Stuttgart
Max-Planck-Institut für Festkörperforschung
Max-Planck-Institut für Intelligente Systeme

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Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart-Vaihingen

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Laser Excitation of the Th-229 Nucleus

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Abstract

The low-energy nuclear isomer state in Th-229 is resonantly excited in Th-doped calciumfluoride crystals using a tabletop tunable laser system at 148 nm wavelength based on four-wave mixing in xenon. A resonance fluorescence signal is observed in two crystals with different Th-229 dopant concentrations, while it is absent in a control experiment using a crystal doped with Th-232.

The nuclear resonance frequency for the Th⁴⁺ ions in Th:CaF₂ is measured with an uncertainty of 7 GHz. The fluorescence lifetime in the crystal is 630(15) s, corresponding to an isomer half-life of 1740(50) s for a nucleus isolated in vacuum. These results pave the way towards applications like laser Mössbauer spectroscopy and a nuclear clock with high sensitivity in tests of fundamental physics.