Winter school on Physics with Trapped Charged Particles

Report of Abstracts

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Characterization of the nuclear clock isomer ^{229m}Th and search for the optical excitation

Content

The thorium-229 nucleus possesses a unique first excited state at an energy of only about 7.8 eV, coupled to the ground state by a transition with a natural linewidth in the mHz range. This transition can be used as a reference for an optical clock that is highly immune to field-induced frequency shifts and as a sensitive probe of temporal variations of fundamental constants [1]. Despite many experimental efforts, fundamental properties of the isomer were still unknown.
We recently performed the first measurement of the nuclear magnetic dipole and electric quadrupole moments and the mean square charge radius of the isomer [2]. This was achieved via high-resolution laser spectroscopy of the hyperfine structure of trapped $^{229}Th^{2+}$ ions.
We also plan to investigate the excitation of the nuclear isomer via electronic bridge and NEET processes [3,4], using two-photon laser excitation of high-lying electronic levels in Th^{+} and Th^{2+}.
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[1] E. Peik, Chr. Tamm, Europhys. Lett. 61, 181 (2003).

J. Thielking et al., arXiv preprint arXiv:1709.05325 (2017).

S. G. Porsev et al., Phys. Rev. Lett. 105, 182501 (2010).

F.F. Karpeshin, et al., Nucl. Phys. A, 654, 579 (1999).

Summary

Primary author(s) : Mr. THIELKING, Johannes (Physikalisch-Technische Bundesanstalt)

Co-author(s) : Dr. OKHAPKIN, Maksim V. (Physikalisch-Technische Bundesanstalt); Dr. GLOWACKI, Przemyslaw (Physikalisch-Technische Bundesanstalt); Mr. MEIER, David-Marcel (Physikalisch-Technische Bundesanstalt); Dr. VON DER WENSE, Lars (Ludwig-Maximilians-Universität München); Mr. SEIFERLE, Benedict (Ludwig-Maximilians-Universität München); Prof. DÜLLMANN, Christoph (GSI); THIROLF, Peter (Ludwig-Maximilians-Univ. Muenchen (DE)); Dr. PEIK, Ekkehard (PTB)

Presenter(s) : Mr. THIELKING, Johannes (Physikalisch-Technische Bundesanstalt)

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