



Allgemeines Physikalisches Kolloquium

Donnerstag, 23.01.2025 - 16 Uhr c.t.



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Precision Tests of the Standard Model at low energies using stored exotic ions in Penning traps

The four fundamental interactions and their symmetries, the fundamental constants as well as the properties of elementary particles like masses and moments, determine the basic structure of the universe and are the basis for our so well tested Standard Model (SM) of physics. Performing stringent tests on these interactions and symmetries in extreme conditions at lowest energies and with highest precision by comparing, e.g., the properties of particles and their counterpart, the antiparticles, will allow us to search for physics beyond the SM. Any improvement of these tests beyond their present limits requires novel experimental techniques. An overview is given on recent mass and g-factor measurements with extreme precision on single or few cooled ions stored in Penning traps. Among others the most stringent test of bound-state quantum electrodynamics could be performed. Here, the development of a novel technique, based upon the coupling of two ions as an ion crystal, enabled the most precise determination of a g-factor difference to date. This difference, determined for the isotopes $^{20,22}\text{Ne}^{9+}$ with a relative precision of 5.6×10^{-13} with respect to the g factor, improved the precision for isotopic shifts of g factors by about two orders of magnitude. Our latest results on precision measurements with exotic ions in Penning traps will be presented.





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Short description:

Klaus Blaum studied physics at the Johannes Gutenberg University Mainz. After completing his doctorate in Mainz, he moved to the European Nuclear Research Centre CERN in Geneva as a postdoctoral researcher at the GSI Helmholtz Centre for Heavy Ion Research Darmstadt. From 2004 to 2007, he headed a Helmholtz research group in Mainz, where he habilitated in 2006. In 2007 he was appointed director of the department "Stored and Cooled Ions" at the Max Planck Institute for Nuclear Physics in Heidelberg. At the same time, he is a professor and member of the Faculty of Physics and Astronomy at the Ruprecht Karls University in Heidelberg.

Klaus Blaum has received a number of prizes for his groundbreaking work, including the Gustav Hertz Prize 2004 of the German Physical Society, the Mattauch Herzog Prize 2005 of the German Society for Mass Spectrometry, the Helmholtz Prize for Precision Measurement in 2012, the G.N. Flerov Prize in 2013, the Lise Meitner Prize for Nuclear Physics of the European Physical Society in 2020, and the Otto Hahn Prize of the City of Frankfurt am Main, the German Chemical Society and the German Physical Society in 2021. He has been a Fellow of the American Physical Society since 2008, a member of the Royal Swedish Academy of Sciences since 2019, and a member of the German National Academy of Sciences Leopoldina since 2024. From July 2020 till June 2023 Klaus Blaum was the Scientific Vice President for the Chemical-Physical-Technical Section of the MPG.