HK 13: Focus Session I: New Results on Nuclear Structure at Shell Closures

Time: Tuesday 14:00–15:30 Location: HBR 14: HS 1

Invited Talk HK 13.1 Tue 14:00 HBR 14: HS 1
First laser spectroscopy measurements of ^{53}Ca and the prospects for measuring ^{54}Ca — •Tim Lellinger for the COLLAPS-Collaboration — EP-SME-IS, CERN — TU-Darmstadt

Over a decade ago, the first experimental evidence for the N=32 sub shell closure in the calcium isotopic chain emerged [1,2]. Subsequent experimental and theoretical investigations have confirmed this finding. However, in laser spectroscopy measurements extending up to ^{52}Ca (N=32), no indications of this shell gap were apparent [3]. Crossing the shell gap with laser spectroscopy setups has proved difficult due to the simultaneous requirement of a sensitivity of approximately 10 ions/s and a measurement uncertainty on the order of MHz.

This contribution presents the first laser spectroscopy measurements of ^{53}Ca, facilitated by an extension of the collinear laser spectroscopy technique employed at the COLLAPS setup at ISOLDE/CERN. This technique, termed as *radioactive detection after optical pumping and state selective charge exchange* (ROC), combines the high sensitivity of a particle detection scheme with the high resolution of low-power, continuous wave lasers utilized in a collinear geometry. The methodology of this technique will be explained, followed by the presentation and discussion of preliminary values for the charge radius and magnetic dipole moment of ^{53}Ca in the context of the robustness of the N=32 sub shell closure, as well as the prospects to measure ^{54}Ca.

[1] Wienholtz, F. et al. Nature vol. 498, 346-349 (2013)
[2] Steppenbeck, D. et al. Nature vol. 502, 207-210 (2013)
[3] R.F. Garcia Ruiz et al, Nature Physics vol. 12, 594-598 (2016)

Invited Talk HK 13.2 Tue 14:30 HBR 14: HS 1
High-precision mass measurements near Sn-100 challenge nuclear theory — •Lukas Nies for the ISOLTRAP-Collaboration — CERN, 1211 Geneva, Switzerland — Universität Greifswald, Germany

Nuclear binding energies arise from various effects that govern nuclear properties. Different nucleon configurations within nuclear isomers lead to modified binding energies, often resulting in mass differences of tens to hundreds of kilo-electronvolts. These isomeric excitation energies can be directly accessed by measuring the difference in atomic masses of ground and isomeric states. In this contribution, high-precision mass measurements of ground and isomeric states in tin, indium, and cadmium isotopes near tin-100 using the multi-reflection time-of-flight technique will be presented and compared to nuclear theory.

Invited Talk HK 13.3 Tue 15:00 HBR 14: HS 1
Ab initio advances for medium-heavy nuclei and electroweak properties — •Takayuki Miyagi — Technische Universität Darmstadt, Department of Physics, 64289 Darmstadt, Germany — ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany

A reliable prediction of electroweak processes involving a nucleus is required to further understand nuclear structure and other related topics, such as nucleosynthesis and particle physics. In the past two decades, the range of applicability of nuclear ab initio calculations has been rapidly extending and reaching mass number of 200 systems. With controlled uncertainty estimations, an ab initio calculation can provide a meaningful prediction where performing experiments is difficult or impossible. Nuclear radii and moments are complementary information to the energies and can be useful tools to test the quality of the calculations. In this presentation, I will discuss our recent results for charge radii, magnetic and quadrupole moments of medium-heavy nuclei computed with the combination of chiral effective-field theory and valence-space in-medium similarity renormalization group approach.

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