HK 32: Hauptvorträge III

Zeit: Mittwoch 11:30–12:40 Raum: Plenarsaal

Hauptvortrag HK 32.1 Mi 11:30 Plenarsaal

Where nuclear physics meets quantum optics — •Adriana Pálffy — Max-Planck-Institut für Kernphysik, Heidelberg

Nuclear physics studies atomic nuclei and their constituents and interactions. While not particularly spectacular from nuclear physics point of view, the photo-excitation of low-lying nuclear states opens the new field of nuclear quantum optics and may bring substantial progress in the field of metrology. These developments aim to exploit the fact that nuclei are very clean quantum systems, well isolated from the environment and benefiting from long coherence times. The lecture will follow these perspectives at the borderline between nuclear and atomic physics on the one hand side and metrology and quantum optics on the other hand side. First, the present status of the efforts to use the ^{229}Th isomer at approx. 8 eV for a nuclear frequency standard will be discussed.

Second, the prospects of mutual control between nuclear transitions and x-rays will be discussed in the light of novel coherent x-ray sources such as the x-ray free electron laser. Combining the advantages of x-rays and nuclei, a prominent incentive is to use nuclei to exploit x-rays as the future quantum information carriers or for novel probing technologies based on quantum effects. Turning the tables, the control of nuclear transitions with strong x-ray sources would open the possibility to use long-lived nuclear excited states as a compact and clean energy storage solution. The lecture will follow the developments on the emerging field of x-ray quantum optics and focus on the mutual control of coherent x-ray radiation and nuclear transitions.

Hauptvortrag HK 32.2 Mi 12:05 Plenarsaal

COLLAPS: revealing nuclear structures of short lived isotopes by collinear laser spectroscopy at CERN-ISOLDE — •Simon Kaufmann for the COLLAPS-Collaboration — Institut für Kernphysik, TU Darmstadt

High-resolution laser spectroscopy is a proven tool to investigate the structure, size and shape of a variety of nuclei by probing the distortions in the energy schemes of the electrons caused by the nucleus. Collinear laser spectroscopy (CLS) allows the investigation of short-lived isotopes far away from stability down to lifetimes in the millisecond range. Established in the 1980s at the RIB facility CERN-ISOLDE, the COLLAPS experiment evolved throughout the years by various upgrades and developments, but in its core principle it is still in operation today [1, 2]. During these years, also the radioactive ion beam production at ISOLDE was upgraded constantly, enabling CLS on isotopes even further away from stability.

In this talk recent highlights of work at COLLAPS will be presented including measurements in the nickel region ($Z = 28$) and in the much heavier tin region ($Z = 50$). The development of the charge radius along with Z and N is hereby of special interest and the outcome of these measurements serve as an important benchmark for nuclear theories in both mass regions.

[1] R Neugart, 1981, Nucl. Instrum. Methods Phys. Res. 186 165
[2] R Neugart et al, 2017, J. Phys. G: Nucl. Part. Phys. 44 064002