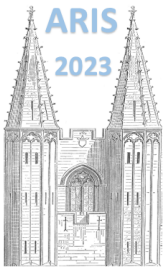

ID de Contribution: **364** Type: **oral contribution**

High-precision collinear laser spectroscopy - An all-optical nuclear charge radius of ^{12}C

jeudi 8 juin 2023 11:45 (15 minutes)

The size of an atomic nucleus is a fundamental observable and can be used to benchmark nuclear structure theory and therefore test our fundamental knowledge of matter. In contrast to matter and neutron radii, the nuclear charge radius can be probed through the well-known electromagnetic interaction. Typically, charge radii of stable nuclei are extracted from elastic electron scattering or muonic atom spectroscopy, and collinear laser spectroscopy resonance ionization spectroscopy are used to measure differential charge radii of radioactive isotopes relative to a stable reference nucleus. In a few cases, the uncertainty of the charge radius of the stable isotope limits the uncertainties of the radioactive species. To overcome this limit in light mass nuclei like ^{10,11}B, an all-optical approach for the charge radius determination purely from laser spectroscopy measurements and non-relativistic QED calculations [1] was tested with the well-known nucleus of ^{12}C. Thereby, helium-like $^{12}C^{4+}$ was laser excited from the metastable $1s2s\ ^3S_1$ state with a lifetime of 21 ms to the $1s2p\ ^3P_J$ states and the respective transition frequencies were determined with less than 2 MHz uncertainty. The high-precision collinear laser spectroscopy was performed at the Collinear Apparatus for Laser Spectroscopy and Applied Science (COALA), situated at the Institute for Nuclear Physics at the TU Darmstadt.
This contribution will present the first high-precision laser spectroscopy in the isotopic chain of carbon and the first all-optical nuclear charge radius determination of ^{12}C. This project is supported by the German Research Foundation (Project-ID 279384907 –SFB1245).
[1] V.A. Yerokhin et al., Phys. Rev. A 106, 022815 (2022)

Author: IMGRAM, Phillip (Institute for Nuclear Physics, Technical University Darmstadt)

Co-auteurs: Dr MAASS, Bernhard (Technische Universität Darmstadt); KÖNIG, Kristian (TU Darmstadt, HFHF Darmstadt); M. MÜLLER, Patrick (Institut für Kernphysik, Technische Universität Darmstadt); NÖRTERSHÄUSER, Wilfried (TU Darmstadt)

Orateur: IMGRAM, Phillip (Institute for Nuclear Physics, Technical University Darmstadt)

Classification de Session: parallel session

Classification de thématique: ground-state properties