Contribution ID: **266** Type: **Poster**

Attempt at laser spectroscopy of pionic helium atoms at PSI

Metastable pionic helium atoms $\pi\mathrm{He}^+$ are heretofore hypothetical three-body Coulomb systems composed of a helium nucleus, an electron occupying the 1s ground state, and a π^- occupying a Rydberg state, with principal and orbital angular momentum quantum numbers of around $n \sim \ell + 1 = 16$ [1-2]. The atom has been conjectured to explain the apparent metastability of π^- observed in liquid helium bubble chambers in the 1960's [3-6]. The atoms are believed to retain nanosecond-scale lifetimes against π^- absorption in the helium nucleus. The new PiHe collaboration of Paul Scherrer Institute attempts to carry out laser spectroscopy of this atom. By measuring the transition frequencies of this atom, and comparing the results with three-body QED calculations, the π^- mass can in principle be determined to high precision [7], as was done recently for antiprotonic helium atoms [8]. In this poster, we describe the status of the experimental setup and laser systems that will be used in this experiment. The method for resolving the laser resonance transition relies on detecting the nuclear fragments that emerge from the experimental target when the laser is in resonance with the atom.

[1] G.T. Condo, Phys. Lett. 9, 65 (1964).

[2] J.E. Russell, Phys. Rev. Lett. 23, 63 (1969).

[3] J.G. Fetkovich and E.G. Pewitt, Phys. Rev. Lett. 11, 290 (1963).

[4] M.M. Block et al., Phys. Rev. Lett. 11, 301 (1963).

[5] O.A. Zaimidoroga et al., Sov. Phys. JETP 25, 63 (1967).

[6] S.N. Nakamura et al., Phys. Rev. A 45, 6202 (1992).

[7] M. Hori, A. Sótér, and V.I. Korobov, submitted to Physical Review A

[8] M. Hori et al., Nature 475, 484 (2011).

Primary author: HORI, Masaki (Max Planck Institute of Quantum Optics)

Co-authors: DAX, Andreas Josef (Paul Scherrer Institute); SÓTÉR, Anna (Max Planck Institute of Quantum Optics); BARNA, Dani (CERN and University of Tokyo); YAMADA, Hiroyuki (University of Tokyo); AGHAI-KHOZANI, Hossein (Max-Planck Institute of Quantum Optics); TODOROKI, Koichi (University of Tokyo); Prof. HAYANO, Ryugo (University of Tokyo); MURAKAMI, Yohei (University of Tokyo)

Presenter: HORI, Masaki (Max Planck Institute of Quantum Optics)

Track Classification: Experiments: 2a) Experiments & Upgrades