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Development of an ultra-thin-walled gas target for spectroscopy of deeply bound pionic atoms in inverse kinematics

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We plan to perform missing-mass spectroscopy of deeply bound pionic Xe atoms using an inverse kinematics reaction. So far, the (d, ^{3}He) reaction in normal kinematics has been employed to measure excitation-energy spectra of pionic states in Sn and Pb isotopes [1–5]. In the new experiment, we adopt, for the first time, the inverse-kinematics (^{136}Xe, ^{3}He) reaction for the spectroscopy of pionic atoms. This method has the potentials to overcome the limitation of the spectral resolution in the normal kinematics and to enlarge the region of the pionic atoms in the nuclear chart, leading to experimental evaluation of density dependence of quark condensate at finite nuclear density.

One of the key components of this new experiment is a deuterium gas target. The target is required to have a pressure of ~1 bar and a length of a few centimeters to ensure sufficient reaction yield. At the same time, the window thickness must be as thin as a few times 100 μg/cm^2 (~ μm) to minimize energy straggling of the emitted low-energy ^{3}He particles. We have constructed prototype gas targets equipped with ultra-thin windows made of materials such as silicon nitride and graphenic carbon, and are currently evaluating their stability and radiation tolerance under heavy-ion irradiation.

In this contribution, we will discuss the current status of the R&D and the outlook for this new experiment, including recent test results and simulation studies.

[1] T. Yamazaki et al., Z. Phys. A 355, 219 (1996).
[2] H. Gilg et al., Phys. Rev. C 62, 025201 (2000); K. Itahashi et al., Phys. Rev. C 62, 025202 (2000).
[3] K. Suzuki et al., Phys. Rev. Lett. 92, 072302 (2004).
[4] T. Nishi et al., Phys. Rev. Lett. 120, 152505 (2018).
[5] T. Nishi et al., Nature Phys. 19, 788 (2023).

Collaboration

Primary author: TANAKA, Yoshiki (RIKEN)

Co-authors: NAKAHARA, S.; ITAHASHI, K.; BANNO, Y.; FUJIOKA, H.; HABA, H.; HAETTNER, E.; MATSUMOTO, S. Y.; MIYAKE, Y.; NISHI, T.; PURUSHOTHAMAN, S.; SAKAUE, A.; SATO, H.; SCHEIDENBERGER, C.; SEKIYA, R.; TAKEDA, H.

Presenter: TANAKA, Yoshiki (RIKEN)

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