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Zero-Field and High-Field Precision Measurements of Muonium Hyperfine Structure at J-PARC

Monday, 17 October 2022 15:00 (30 minutes)

The muonium atom is a bound state of a positive muon and an electron, and is one of the hydrogen-like atoms which consists purely of leptons. By measuring the muonium hyperfine structure, the muon mass and the magnetic moment ratio of the proton to the muon can be determined. These values are used to determine the experimental value of muon $g-2$, for which a discrepancy of 4.2σ between the theoretical and experimental values in the Standard Model has been reported [1], and the importance of these measurements is increasing. We plan to measure the hyperfine structure of muonium with ten times higher precision than the previous experiment [2] by using high-intensity muon beam at J-PARC [3]. For zero-field measurements, a new analytical method named Rabi-oscillation spectroscopy has been developed [4], the gas pressure shift dependence has been improved using mixed gas of krypton and helium. Also for high-field experiments, we are developing probes that precisely measure the magnetic field of in an ellipsoidal spherical region. In this talk, we will report on these developments and preparations.

[1] T. Albahri *et al.*, (The Muon g 2 Collaboration) Phys. Rev. A **103**, 042208
[2] W. Liu *et al.*, Phys. Rev. Lett. **82**, 711-714.
[3] S. Kanda *et al.*, Phys. Lett. B **815** 136154.
[4] S. Nishimura *et al.*, Phys Rev. A **104**, L020801.

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