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Muonium 1S-2S spectroscopy with improved statistics

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Our purpose is precision measurement of the 1S-2S energy interval in Muonium, which is an exotic hydrogen-like atom consists of a positive muon and an electron. This purely leptonic system enables a precise calculation of the energy interval with the Standard Model without any concerns of the uncertainty from the charge radius of the nucleus, unlike the hydrogenatom. This advantage motivates us to measure the precise 1S-2S energy interval in Muonium with technology of laser spectroscopy and to determine the muon mass with the highest accuracy of 10 ppb. The improvement of muon mass accuracy has an impact on verification of the Standard Model, muon g-2/EDM experiment, for example. In addition, our technique of Muonium laser ionization is related to muon accelerator or muon microscope.

The energy interval accuracy has been statistically limited since 1999[1]. However, more powerful muon beam is available now at J-PARC in Japan and we are developing new UV laser system.

We will report a recent result of Muonium 1S-2S energy interval measurement at J-PARC. The event rate in our experiment is 50 times higher than the previous experiment. This dramatic improvement gives promising prospect for higher accuracy of 1S-2S energy interval and the muon mass accuracy in the future.
[1]V. Meyer et al, Phys. Rev. Lett 84, 1136(2000)

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