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Laser spectroscopy of ground-state hyperfine splitting energy of muonic hydrogen KATSUHIKO ISHIDA, MASAHARU SATO, MASAHIKO IWASAKI, YUE MA, TEIICHIRO MATSUZAKI, YU OISHI, SHINJI OKADA, RIKEN Nishina Center, SATOSHI WADA, NORIHITO SAITO, KATSUMI MIDORIKAWA, RIKEN Center for Advanced Photonics, YASUYUKI MATSUDA, KAZUO TANAKA, SOTARO KANDA, University of Tokyo — We propose a new measurement of the ground-state hyperfine splitting of muonic hydrogen by laser spectroscopy with the accuracy of $\sim$2 ppm. The hyperfine splitting energy is connected to the Zemach radius [1], which is a convolution of the spatial distribution of the charge and the magnetic moment within the proton. This can provide new insights on "Proton radius puzzle" [2]. When the laser with the resonance frequency of the hyperfine splitting energy is irradiated, the spin-flip transition is induced from the spin-singlet to the spin-triplet hyperfine sub-levels. Since the muon spin in the spin-triplet state can be polarized by a circularly-polarized laser, we can search for the resonance frequency with the muon decay asymmetry by the decay-electron detection. The transition energy is about 0.182 eV, which corresponds to the laser wavelength of 6.7 μm. The experiment becomes feasible by a narrow-bandwidth tunable mid-infrared laser recently developed in RIKEN. In this contribution, we present the physics motivation, the experimental principle and its feasibility.

[1] A. Dupays et al., Phys. Rev. A68, 052503 (2003).
[2] R. Pohl et al., Nature 466, 213 (2010).

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