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Towards high precision measurements of nuclear g-factors for Be isotopes

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We have worked on the development of an online trap system including prototype SLOWRI for the highly energetic Be isotope ions provided by the RIKEN projectile fragment separator RIPS. The direct measurements of the hyperfine structure constants of the atomic ground states for 7Be+ and 11Be+ ions were performed with high precisions of 500 ppb and 30 ppb, respectively [1]. In order to study the magnetization distribution of 11Be through its Bohr-Weisskopf effect, which the one halo neutron bears the primary responsibility for, the nuclear g-factor is also required to be determined with a higher precision than an order of 10 ppm. We propose the measurements of the nuclear g-factors of utilizing laser-microwave double resonance and laser-microwave-rf triple resonance methods for laser-cooled and trapped radioactive Be isotope ions. Beryllium isotope ions will be produced at BigRIPS, decelerated at SLOWRI [2], and then online-trapped into a linear rf trap. From the measurement of both of the electron spin flip and the nuclear spin flip transitions in the Zeeman splitting under a strong magnetic field of around 0.5 T, the nuclear g-factor and the hyperfine constant will be determined simultaneously with a high precision as already demonstrated for 9Be ions [3]. With this mehotd, the nuclear g-factor of 11Be is expected to be determined with an enough precision to deduce its hyperfine anomaly. This is also essential to determine the nuclear g-factor of 7Be which cannot be accessible by the beta-NMR method. The detailed experimental setup and procedure will be presented.

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[3] T. Nakamura et al., Opt. Commun. 205, 329 (2002).

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