NMR OF SHORT-LIVED BETA EMITTER ^{12}N IN WATER AND ITS NEW APPLICABILITY

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So far, β-NMR technique has been adopted to measure electromagnetic moments in mostly crystalline solid materials. We have successfully observed β-NMR in water for the first time by using a β-ray emitter ^{12}N ($I^{\pi} = 1^{+}$, $T_{1/2}$ = 11ms) as a high energy beam. We measured the temperature variation of the longitudinal relaxation time T_1 and the chemical shift. The chemical shift of ^{12}N in H_2O at 295K was determined to be $(1.1 \pm 1.3) \times 10^2$ ppm relative to the reference compound NH_4Cl powder.

The experiment was performed at NIRS-HIMAC. A high energy spin polarized ^{12}N beam was produced through p(^{12}C, ^{12}N)n reaction using a 70A-MeV ^{12}C beam. The ^{12}N secondary beam was implanted into an enclosed distilled water sample.

The present work implies the following new possibilities. Liquid may be good material to maintain polarization. If we could find a liquid that can maintain polarization for any unstable nuclei, it would be a powerful tool to measure the magnetic moment which is one of important properties for studying unstable nuclei. In addition, we can approach the property of water itself which is still the hot topic in physics. Moreover, nitrogen is one of the most familiar elements for our life, thus the β-NMR of ^{12}N in liquid can be applied to biology or chemistry.