Investigation into behavior of weakly-bound proton via B(GT) measurement for the β decay of ^{24}Si

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We performed B(GT) measurement for the β decay of ^{24}Si in order to investigate behavior of a weakly-bound s-wave proton. The behavior of a weakly-bound proton in a proton-rich nucleus is one of the interesting topics to explore exotic nuclear structures, in association with proton halo [1]. Mirror asymmetry on nuclear structure helps us to close up a characteristic behavior of such a weakly-bound proton in a proton-rich nucleus. One of the example is the Thomas-Ehrman (TE) shift [2] that is lowering of the Coulomb energy due to the spatially spreading of a s-wave proton. The TE shift is important for the spectra of nuclei near the proton-drip line. We should take into account another effect, that is the change of configuration in the wave function due to lowering of the single-particle energy of the $s_{1/2}$ orbit. ^{24}Si is a nucleus near the proton-drip line and β-decays to ^{24}Al. Since ^{24}Al has 5 valence protons in the *sd* shell, a state dominated by s-wave protons is expected to appear in an excited states fed by the β decay. Indeed there is found a TE-type mirror asymmetry of energy level on the second 1^+ states between ^{24}Al and ^{24}Na [3,4,5]. However the change of configuration also may be related to the asymmetry. Since B(GT) is a sensitive observable to the configuration of wave function, we can extract the contribution related to the change of configuration using mirror asymmetry of B(GT).

The experiment was carried out at the RIPS facility in RIKEN. It included the measurements for the β-delayed γ rays which had not been measured so far, and for the β-delayed protons of ^{24}Si. In this presentation, we will report the experimental results of the B(GT) measurement. Discussion on the comparison with theoretical calculations which takes into account the Coulomb force and the TE shift is also given in order to clarify the effect of the weakly-bound proton on the nuclear structure.

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