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Determination of Resonance Spin via Low-Energy Gamma-Ray Spectroscopy in Neutron Capture Reactions

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A large enhancement of parity-violation via the weak interaction has been observed in nuclear reactions for several nuclei [1]. The enhancement is explained by the mixing of parity-unfavored partial amplitudes in the entrance channel of the compound nuclear states, s-p mixing [2]. The s-p mixing occurs between resonances with the same spin. Therefore, the spin of resonances is an important parameter for understanding the enhancement mechanism.
It has been proposed that the spin of resonances can be determined by measuring the low-energy gamma-ray emitted from compound states formed via neutron capture [3]. This approach utilizes the effect that the intensity of gamma rays emitted from low-lying excited states after multiple cascade transitions varies depending on the resonance spin. Although this concept can be understood qualitatively, no studies have clearly verified whether the observed differences are truly due to spin.
In this study, we aim to verify this by comparing two methods: measuring the intensity ratios of low-energy gamma rays and measuring the polarized neutron transmission through a polarized nuclear target. In this presentation, we report primarily on the measurement and analysis results of low-energy gamma rays and discuss future prospects for measurements using polarized nuclei.

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