PARITY-TRANSFER REACTION FOR STUDY OF SPIN-DIPOLE 0\(^+\) MODE

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The spin-dipole (SD) 0\(^+\) excitation characterized by \(\Delta L=1, \Delta S=1,\) and \(\Delta\pi=0\(^+\),\) attracts recent theoretical attention due to its strong relevances to the tensor correlations in nuclei. For example, self-consistent HF+RPA calculations in Ref. [1] predict that the tensor correlations produce a strong hardening (shifting toward higher excitation energy) effect on the 0\(^+\) resonance. It is also predicted that the effect is sensitive to the magnitude of the tensor strength. Thus experimental data of the SD 0\(^+\) distribution enable us to quantitatively examine the tensor correlation effects. Despite this importance, experimental information on 0\(^+\) states is limited because of the lack of the experimental tools that are suitable for the 0\(^+\) studies.

We propose a new probe, the parity-transfer \((^{16}\text{O},^{16}\text{F}(0\,\text{g.s.}))\) reaction, for the 0\(^+\) studies [2]. The parity-transfer reaction selectively excites unnatural-parity states for a 0\(^+\) target nucleus, which is an advantage over the other reactions used so far. In order to establish the parity-transfer reaction as a new tool for the 0\(^+\) studies, we performed the measurement of the \(^{12}\text{C}(^{16}\text{O},^{16}\text{F}(0\,\text{g.s.}))^{12}\text{B}\) reaction. We demonstrate the effectiveness of this reaction by identifying the known 0\(^+\) state at \(E_x=9.3\) MeV in \(^{12}\text{B}\).

The experiment was performed at the RIKEN RI Beam Factory (RIBF) by using the SHARAQ spectrometer and the high-resolution beam line [3]. A primary \(^{16}\text{O}\) beam at 250MeV/nucleon was used. The outgoing \(^{15}\text{O} + p\) produced by the decay of \(^{16}\text{F}\) were measured in coincidence.

We obtained the relative energy \(E_{\text{rel}}\) between the \(^{15}\text{O}\) and the proton, and the 0\(^+\) g.s. of \(^{16}\text{F}\) was clearly separated from other excited states owing to the high resolution. In order to identify \(^{12}\text{B}(0\,\text{g.s.})\) state, the data analysis for obtaining the \(^{12}\text{C}(^{16}\text{O},^{16}\text{F}(0\,\text{g.s.}))\) spectrum and its angular distributions is in progress. In this presentation, we will report the details of the experiment and the results.

REFERENCES