

論文題目要旨

学位申請者：坂梨 公亮

論文題目：Measurement of the γ -decay Probability of the Hoyle State Using the Combination of Si Detector and ROSPHERE
(Si 検出器と ROSPHERE を組み合わせたホイル状態からのガンマ崩壊確率の測定)

論文要旨：

In this thesis, the γ -decay probability of the Hoyle state has been measured using the $\alpha + {}^{12}\text{C} + \gamma$ triple-coincidence measurement. The aim of this research was to solve the discrepancy in the γ -decay probabilities of the Hoyle state between the recently reported value of $\Gamma_\gamma/\Gamma = 6.2(6) \times 10^{-4}$ and previous literature value of $\Gamma_\gamma/\Gamma = 4.09(10) \times 10^{-4}$. We populated the Hoyle state in ${}^{12}\text{C}$ by the $\alpha + {}^{12}\text{C}$ scattering using an α particle beam at $E_{\text{beam}} = 25$ MeV at the tandem accelerator facility of IFIN-HH, Romania. Emitted charged particles were detected by a double-sided Si detector (DSSD) and, γ rays were by the ROSPHERE LaBr_3 detector array. The charged particle detection with a large solid-angle DSSD and particle identification using the pulse-shape discrimination method increased the experimental yield. Furthermore, γ -ray detection with ROSPHERE suppressed significant background from α particles originating due to accidental coincidence with 3α decay, achieving an excellent signal-to-noise ratio. This method enabled high yields and low background levels, and successfully determined the γ -decay probability of the Hoyle state as $\Gamma_\gamma/\Gamma = 4.05(24) \times 10^{-4}$, which is consistent with the previous literature value. Therefore, we concluded that the puzzle on the γ -decay probability of the Hoyle state is now finally solved, and the previous literature value can be reliably used in the study of nucleosynthesis in the universe.