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Systematic measurement of nucleon removal cross sections in the vicinity of doubly magic 78Ni

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Nucleon removal reactions from atomic nuclei are connected both with the nuclear structures and the reaction mechanisms. Systematic studies in the vicinity of magic numbers are of importance to test our understandings of the nuclear structure as such reactions involve not only the valence nucleons but also the nucleons across the shell gap. In a recent study, an anomalously small inclusive cross section of 79Cu for a one-proton knockout reaction at intermediate energy compared with the other isotones, 80Zn and 81Ga. It has been interpreted as most of the contribution of the cross sections feeds to the unbound states due to the large shell gap across the Z=28 proton shell.

To assess the lack of the cross sections systematically and with reduced uncertainties, an experiment aiming to measure nucleon removal cross sections in the vicinity of the doubly magic isotope 78Ni at the RIKEN RI Beam Factory has been conducted. Secondary beams in the vicinity of 78Ni at 250 MeV per nucleon were produced by in-flight fission of 238U primary beam at the energy of 345 MeV per nucleon with a 9Be production target. The cocktail beams were separated and identified event-by-event by BigRIPS and bombarded on another 9Be reaction target with a thickness of 6.8 mm. Reaction residues were analyzed by the ZeroDegree Spectrometer.

The figure shows a summary of the experimentally obtained one-proton removal cross sections (σ-1p) compared with empirical theoretical calculations. These results behave even-odd staggering, which is assumed to be affected by neutron separation energies in the ablation process. The calculation with INCL+Abla07 reproduced the trends of experimental results very well, except for σ-1p(79Cu). The experimental σ-1p(79Cu) was much smaller than the calculation value.

In this contribution, we will report the experimental results and discussions.

Topic

Experiment

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