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Study on astrophysical reactions using low-energy RI beams

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In recent years, low-energy RI beams can be produced in a good intensity and they have been used for studying many astrophysical reactions. One of the facilities producing low-energy RI beams is CRIB (CNS Radio-Isotope Beam separator) [1,2], an RI-beam separator of Center for Nuclear Study, University of Tokyo. Taking CRIB as an example, recent improvements on the RI-beam production and experimental results on astrophysical studies are presented. Several experimental approaches have been taken for the studies on astrophysical reactions. The feature of each method are discussed based on real measurements performed at CRIB. One is the direct method, applied for measurements of reactions such as (α, p) [3]. Another is the measurement of proton/alpha resonance scattering using the thick target method in inverse kinematics, by which we can obtain information on the resonances relevant in astrophysical reactions [4,5]. A recent fruitful result was from a measurement of proton resonance scattering using a ^7Be beam [5]. The energy level structure of ^8B , revealed by the experiment, is especially of interest as it is related with the $^7\text{Be}(p, \gamma)^8\text{B}$ reaction, responsible for the production of ^8B neutrinos in the sun. We successfully determined parameters of resonances in ^8B below 6.7 MeV, which may affect the $^7\text{Be}(p, \gamma)^8\text{B}$ reaction rate at the solar temperature. Indirect methods, such as ANC and the Trojan Horse Method, were also used in some of the measurements.

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