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Measurements of the neutron-induced reactions on 7Be with CRIB by the Trojan Horse method

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It has been known that the prediction of the primordial ^{7}Li abundance by the standard Big-Bang Nucleosynthesis (BBN) model is about 3 times larger than the observation, so called the cosmological ^{7}Li problem. The ^{7}Li abundance strongly depends on the ^{7}Be production. The ^{7}Be$(n,p)^7$Li reaction is considered as the main process to destroy ^{7}Be during the BBN. Although its resonance structure has been well investigated, the contribution of the transition to the first excited state of ^{7}Li at the BBN energies ($\sim$25 keV–1 MeV) has never been discussed. The ^{7}Be$(n,\alpha)^4$He reaction might be the second important ^{7}Be destroyer, but its experimental reaction rate has not been investigated until the recent studies, which yet involve uncertainty in the BBN energy region.

We performed indirect measurements of these reactions simultaneously by the Trojan Horse Method (THM) at Center for Nuclear Study Radioactive Ion Beam (CRIB) separator. This study is one of the first attempts to apply the THM to RI+n reactions together with a recent collaborating study led by L. Lamia and the INFN-LNS nuclear astrophysics group.

The experimental setup consisted of two parallel-plate avalanche counters to track the ^{7}Be RI beam, a CD_2 target, and six ΔE-E position-sensitive silicon telescopes to observe the ^{7}Be$(d,^7$Li$p)^1$H and ^{7}Be$(d,\alpha\alpha)^1$H reactions in inverse kinematics, which allows us to approach the ^{7}Be$(n,p)^7$Li and ^{7}Be$(n,\alpha)^4$He reactions in quasi-free kinematics, respectively. We aimed to resolve both the ground and the first excited states of ^{7}Li by Q-value spectrum of the 3-body reactions for the first time. We observed several thousands of valid events in quasi-free kinematics. Some results including the Q-value spectrum, the momentum distribution of the spectator, and the preliminary cross sections of the ^{7}Be$(n,p)^7$Li and the ^{7}Be$(n,\alpha)^4$He reactions will be presented.

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