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Cross section measurements of the 7Be(n,p)7Li and the 7Be(n,α)4He reactions covering the Big-Bang nucleosynthesis energy range by the Trojan Horse method at CRIB

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It is still an open question that the prediction of the primordial 7Li abundance by the standard Big-Bang Nucleosynthesis (BBN) model is about 3 times larger than the observation, the so-called cosmological 7Li problem. Since the 7Li abundance strongly depends on the 7Be production and destruction rate, those of the main destruction processes 7Be(n,p)7Li and 7Be(n,α)4He need to be determined in the BBN energy range. In spite of the several recent experimental progresses, there are still some uncertainties and ambiguities at the most relevant energies; the 7Be(n,p1)7Li* channel, the transition to the first excited state of 7Li has never been taken into account; several new studies on the 7Be(n,α)4He yet lack in data directly reaching the BBN energies.
We have performed indirect measurements of both of these reactions by the Trojan Horse Method (THM). The experiments were performed at the INFN-LNL in collaboration with the INFN-LNS nuclear astrophysics group, and at the Center-for-Nuclear-Study Radioactive Ion Beam (CRIB) separator located at RIKEN. We will present the results of the latter experiment.
The experimental setup consisted of two parallel-plate avalanche counters to track the 7Be RI beam bombarding a CD2 target, and 6 sets of ΔE-E position-sensitive silicon telescopes to observe the 7Be(d,7Lip)1H and 7Be(d,αα)1H reactions in inverse kinematics, which allowed us to approach the 7Be(n,p)7Li and 7Be(n,α)4He reactions in quasi-free kinematics, respectively. The contributions of the 7Be(n, p0)7Li and the 7Be(n,p1)7Li* reactions were extracted by Gaussian fitting to the 3-body Q-value spectrum for Ec.m.~0–2 MeV. We will discuss the consistency of the present data with the previous ones taking into account resonance structures, also showing new information around the BBN energies including possible 7Be(n,p1)7Li* contributions with reliable error evaluations.

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