Cross section measurements of the ^{7}Be(n, p)^{7}Li and the ^{7}Be(n, α)^{4}He 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 ^{7}Li abundance by the standard Big-Bang Nucleosynthesis (BBN) model is about 3 times larger than the observation, the so-called cosmological ^{7}Li problem. Since the ^{7}Li abundance strongly depends on the ^{7}Be production and destruction rate, those of the main destruction processes ^{7}Be(n, p)^{7}Li and ^{7}Be(n, α)^{4}He 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 ^{7}Be(n, p_1)^{7}Li* channel, the transition to the first excited state of ^{7}Li has never been taken into account; several new studies on the ^{7}Be(n, α)^{4}He 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 ^{7}Be RI beam bombarding a CD_2 target, and 6 sets of ΔE-E position-sensitive silicon telescopes to observe the ^{7}Be(d, ^{7}Lip)^{1}H and ^{7}Be(d, $\alpha\alpha$)^{1}H reactions in inverse kinematics, which allowed us to approach the ^{7}Be(n, p)^{7}Li and ^{7}Be(n, α)^{4}He reactions in quasi-free kinematics, respectively. The contributions of the ^{7}Be(n, p_0)^{7}Li and the ^{7}Be(n, p_1)^{7}Li* reactions were extracted by Gaussian fitting to the 3-body Q-value spectrum for $E_{\text{c.m.}} \sim$ 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 ^{7}Be(n, p_1)^{7}Li* contributions with reliable error evaluations.