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7Be(n,a) and 7Be(n,p) cross-section measurement for the cosmological Lithium problem at the n_TOF facility at CERN

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Summary

One of the most important unresolved problems in Nuclear Astrophysics is the so-called "Cosmological Lithium problem"(CLiP). It refers to the large discrepancy (factor 3-5) between the abundance of primordial 7Li predicted by the standard theory of Big Bang Nucleosynthesis (BBN) and the value inferred from the so-called "Spite plateau"in halo stars.
In the framework of Standard Model, a possible explanation for this longstanding puzzle is related to the incorrect estimation of the destruction rate of 7Be. Indeed in the standard theory of BBN, 95% of primordial 7Li is produced by the decay of 7Be (t1/2=53.2 days), relatively late after the Big Bang, when lower temperature of Universe allows electrons and nuclei to combine into atoms. Therefore, the abundance of 7Li is essentially determined by the production and destruction of 7Be.
While charged-particle induced reactions responsible for the destruction of 7Be have mostly been ruled out by recent measurements, data on the 7Be(n,a) and 7Be(n,p) reactions were so far scarce or completely missing, mainly due to experimental difficulties arising from 7Be specific activity.
Recently, (n,a) reaction cross-section has been measured at n_TOF (CERN) while (n,p) reaction cross-section measurement is in progress, taking advantage of state-of-art techniques for the production of high-purity radioactive samples at ISOLDE, of high performance detection systems and, especially, of the innovative features of the new measuring station (EAR2) particularly suited for challenging measurements on short-lived radioisotopes. The two measurements, performed with two different silicon detection systems, provide for the first time nuclear data on 7Be(n,a) and 7Be(n,p) cross-section in a wide neutron energy range, namely in the energy range of interest for Nuclear Astrophysics.
The experimental setups and the results of the measurements will be here presented, together with the implications of the measurements in standard BBN theory.

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