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7Be(n,p) cross section measurement for the Cosmological Lithium Problem at the n_TOF facility at CERN

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Big Bang Nucleosynthesis (BBN) theory predicts the abundances of the light elements D, 3He, 4He and 7Li produced in the early universe. The primordial abundances of D, 3He and 4He inferred from observational data are in good agreement with predictions, however, the BBN theory overestimates the primordial 7Li abundance by about a factor of three with respect to the observations in metal poor halo stars [1]. This discrepancy is known as "Cosmological Lithium Problem"(CLiP). Since primordial 7Li is produced mainly by the decay of 7Be, reducing the amount of 7Be surviving the BBN phase, reduces the primordial 7Li. The two principal reactions responsible of the destruction of 7Be via neutron reactions are: the 7Be(n,p)7Li, providing 97% destruction of 7Be and the 7Be(n,a)4He, responsible of 2.5%. The (n,a) reaction has already been studied at the n_TOF facility at CERN, where its cross section has been found too low to solve the CliP[2]. Various measurements have excluded also a significant effect on the CLiP of charged particle induced reactions on 7Be, so the only possibility left to find a Nuclear physics solution to the problem is the (n,p) reaction. Despite the importance of this reaction in BBN, there is a lack of cross section data. Taking advantage of the innovative features of the second experimental area at n_TOF facility at CERN[3][4], e.g. the very high instantaneous flux, the wide energy range and the low background conditions, an accurate measurement of 7Be(n,p)7Li cross section has been recently performed at n_TOF with a pure 7Be target produced by implantation of a 7Be beam at ISOLDE. The experimental procedure, the set-up used in the measurement and the results will be presented in this talk.

References

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[2] M. Barbagallo et al., Phys. Rev. Lett. {117} (2016).
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