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The Interaction of Neutrons With ^{7}Be: Lack of Standard Nuclear Physics Solution to the "Primordial ^{7}Li Problem"

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The accurate measurement of the baryon density by WMAP renders Big Bang Nucleosynthesis (BBN) a parameter free theory with only inputs from measurements of the relevant (12 canonical) nuclear reactions. BBN predicts with high accuracy the measured abundance of deuterium, helion and helium relative to hydrogen, but it over-predicts the abundance of 7Li relative to hydrogen by a factor of approximately three and more than three sigma difference from the observed value. This discrepancy was observed early on (more than thirty years ago) and is known as the "Primordial 7Li Problem". Several attempts to reconcile this discrepancy by destroying 7Be with deuterons and helions or a conjectured d + 7Be resonance were ruled out as solutions of the 7Li problem. But the interaction of 7Be with neutrons that are also prevailing during the epoch of BBN, was not directly measured thus far in the BBN window. Also a hitherto unknown n + 7Be narrow resonance in 8Be at energies relevant for the BBN window was not yet ruled out. A worldwide effort for measuring the interaction of neutrons with 7Be is currently underway. We will discuss a measurement in the new neutron facility at the Soreq Applied Research Accelerator Facility (SARAF)
in Israel, that covers the "BBN energy window"with T = 0.5 - 0.8 GK and kT = 43 - 72 keV. We measured a significantly small upper limit on the 7Be(n,a) reaction and the first measurement of the 7Be(n,g1)8Be*(3.03 MeV) reaction (Ea = 1.5 MeV). Our measurement allow us to re-evaluate the so designated "7Be(n,a) reaction rate" first derived by Wagoner in 1969 and still used in BBN calculations. Our evaluated new rate demonstrates that the last possible avenue (of the n + 7Be interaction) for a standard nuclear physics solution of the 7Li problem does not solve the problem. We conclude on lack of standard nuclear physics solution to the "Primordial 7Li problem".

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