PROBING BIG BANG NUCLEOSYNTHESIS DEEP UNDERGROUND

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The Big Bang Nucleosynthesis (BBN) theory allows to compute the primordial abundance of isotopes (e.g. deuterium) created in the early universe. Interestingly, the primordial abundance of deuterium deduced from observations of pristine gas at high redshifts is more accurate with respect to the computed value, mainly because the BBN calculation is affected by the paucity of data for the deuterium-burning reaction $D(p,\gamma)^3He$ cross section. In fact, only a single dataset is currently available in the BBN energy range, in which the authors state systematic error of 9%. The concern for the $D(p,\gamma)^3He$ cross section error is made worse by the fact that the theoretical and experimental values do not agree at the level of 20%. A new measurement is presently in progress at the LUNA (Laboratory for Underground Nuclear astrophysics) accelerator, operating deep underground at the Gran Sasso Laboratory, Italy. The main goal is the study of the $D(p,\gamma)^3He$ cross section in the BBN energy range with accuracy at the 3% level. The LUNA measurement is described and preliminary results are discussed and compared with ab-initio calculations. The impact of this measurement in cosmology and particle physics is also highlighted. In particular, a precision measurement allows to derive the universal baryon density Ω_b with accuracy comparable to the one obtained by the PLANCK experiment. Finally, the accurate knowledge of the $D(p,\gamma)^3He$ cross section increases the sensitivity to probe the existence of relativistic particles (e.g. sterile neutrinos, hot axions etc.) beyond the standard model.