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Underground Nuclear Astrophysics: present and Future of the LUNA experiment

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The evolution of all the celestial bodies is regulated by gravitation and thermonuclear reaction rates, while the Big Bang nucleosynthesis is the result of nuclear processes in a rapidly expanding Universe. The LUNA Collaboration has shown that, by exploiting the ultra low background achievable deep underground, it is possible to study the relevant nuclear processes down to the nucleosynthesis energy inside stars and during the first minutes of Universe. In this talk the main results obtained by LUNA are overviewed, as well as the scientific program of LUNA with the forthcoming 3.5 MV underground accelerator. In particular I will discuss the recent study of the $d(p,\gamma)^3\text{He}$ reaction, whose cross section has been measured inside the Big Bang Nucleosynthesis energy region. The importance of this measurement in Cosmology, particle physics and theoretical nuclear physics is also discussed.

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