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Ultra-Sensitive γ-Ray Spectroscopy Set-Up for Investigating Primordial Lithium Problem.

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To precisely determine BBN 6Li production, the cross section of the nuclear reaction $^{2}H(\alpha,\gamma)^{6}Li$ must be directly measured within the astrophysical energy range of 30-400 keV.
Since the cross section is of the order of nanobarn, the expected counting rate is very low indeed, therefore this measurement requires an ultra-low γ-ray background in the experimental set-up.

We have realized the conditions matching these very strict requirements at LUNA, the deep underground accelerator laboratory active in the INFN Gran Sasso National Laboratory (LNGS), Italy, exploiting 1400 m of rock as a powerful passive shield from cosmic ray. This leads to a reduction of the muon flux, the most penetrating component of the cosmic-rays, by a factor 106 compared to the surface. At LUNA is running an electrostatic continuous beam 400 kV accelerator that provides an α beam of 0.3 mA of average luminosity.

The nuclear reactions are induced in a windowless differentially pumped gas target filled
with up to 0.3 mbar high purity deuterium gas, with on-line feed back control of gas pressure.

We present and discuss the γ-ray background reduction reached in the HPGe spectrometer.

Collaboration

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