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The Luna experiment

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The thermo-nuclear reactions responsible for the luminosity and for the chemical evolution of stars take place in a narrow energy window: the Gamow peak. The extremely low value of the cross section inside the Gamow peak has always prevented its direct measurement in a laboratory at the surface of the Earth, where the signal to background ratio is too small mainly because of cosmic ray interactions. In order to explore this new domain of astrophysics LUNA (Laboratory for Underground Nuclear Astrophysics) started its activity in 1991 by installing a 50 kV electrostatic accelerator deep underground inside the Gran Sasso Laboratory, followed in the year 2000 by a 400 kV one.

In the talk I will first describe the background suppression achievable deep underground, then I will give an overview of the main contributions provided by LUNA to the study of hydrogen burning in stars, from the Sun to classical Novae. In particular, I will discuss the new results of the experiment performed to study $^{22}\text{Ne}(p,\gamma)^{23}\text{Na}$, the most uncertain reaction of neon-sodium cycle. Finally, I will outline the scientific motivations of the LUNA program with the new underground accelerator of 3.5 MV. This accelerator will start running underground in 2018 and it will be devoted to the study of the key reactions responsible for the helium and carbon burning in stars.

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