

NUCLEAR SEMINAR SERIES

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4:00 pm - Rm 184 NSH

Direct low-energy measurement of the $^{13}\text{C}(a,n)^{16}\text{O}$ cross section at LUNA

The reaction $^{13}\text{C}(a,n)^{16}\text{O}$ is the main neutron source for the s process, which is responsible for the production of about half of the heavy elements in the Universe. The stellar site of the main s process is thermally pulsing AGB stars, and the temperature of ~ 90 MK in this environment translates to an effective energy window (Gamow peak) for the reaction between ~ 140 and 230 keV. At these low energies the cross section is of the order of picobarns and below, making a direct measurement extremely challenging. To solve this issue an experiment deep underground at the LUNA facility at the Gran Sasso National Laboratory (LNGS) has been carried out between 2017 and 2019, with data taking having recently been completed. The natural neutron background at the LNGS is suppressed by over 3 orders of magnitude compared to at the surface, greatly increasing the sensitivity of the measurement. In addition, as at such low external background rates the radioactivity of the detector material itself becomes a significant background source, ultra-clean He-3 detectors have been used to construct the neutron detector. Exploiting these advantages we have managed to measure direct data for the first time at energies inside the Gamow peak.

I will present the setup and measurement approach and show preliminary results of the campaign together with a brief outlook into future related projects at the LNGS.



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