

The LUNA neutron detector array for the direct measurement of the $^{13}\text{C}(\alpha, n)^{16}\text{O}$ reaction in its Gamow window

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The $^{13}\text{C}(\alpha, n)^{16}\text{O}$ reaction is very important in the astrophysical context. This reaction is the dominant neutron source for the synthesis of the main s-process component of heavy elements, taking place in thermally pulsing, low-mass asymptotic giant branch stars. The aim of the current LUNA campaign is the determination of the reaction cross section towards the Gamow window with an accuracy of about 10%. At these low energies (< 250 keV) the cross section is of the order of picobarn. Because of this the measurement is taking place in the LNGS Underground Laboratory thanks to the reduction of the neutron background by 3 orders of magnitude compared to the flux on the surface. The experimental setup is composed of 18 low-activity ^3He counters embedded in a polyethylene moderator with a geometry optimised for maximal detection efficiency. The target setup includes a high capacity cooling system and allows for quick target changes as well as the possibility to regularly check the target degradation in situ. The poster describes the main features of the experimental setup, the environmental and ion induced backgrounds and presents the determination of the detection efficiency using charged particle induced nuclear reactions, radioactive sources and Geant4 simulations.