Direct measurement of the $^{17}$O(p,α)$^{14}$N reaction at energies of astrophysical interest at LUNA

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The $^{17}$O(p,α)$^{14}$N reaction plays a key role in several astrophysical scenarios, including classical novae and AGB stars. In classical novae $^{17}$O(p,α)$^{14}$N influences the production of $^{18}$F, unstable to $\beta^+$-decay. Gamma rays generated by the annihilation of the positrons, if observed by space telescopes, would help constrain theoretical models and simulations [1]. In AGB stars $^{17}$O(p,α)$^{14}$N depletes $^{17}$O, which is used as a tracer for extra-mixing processes such as the Cool Bottom Process (CBP) [2]. A better knowledge of the abundance of $^{17}$O would improve our understanding of the nature of CBP. At relevant temperatures ($T=0.03-0.4$ GK), the cross-section of $^{17}$O(p,α)$^{14}$N is dominated by two narrow and isolated resonances at $E_p=70$ and 193 keV in the laboratory frame. The latter resonance is reasonably well-known [3-4], but the picture painted in the literature [5-6] for the 70 keV resonance is incomplete because of the resonance’s extreme weakness. The precise measurement of the strengths for both the 70 and the 193 keV resonances is the final objective of an ongoing experimental campaign at the underground LUNA-400kV accelerator in Gran Sasso Laboratory, Italy. Measurements were carried out using the thick-target yield direct technique. Protons were accelerated onto a solid Ta$_2$O$_5$ target, 95% enriched in $^{17}$O, and outgoing alpha particles were detected using an array of silicon detectors. Results for the 193 keV resonance strength have been obtained and will be presented. Preliminary results will be presented for the 70 keV resonance as well.