FIRST NUCLEAR-ASTROPHYSICS EXPERIMENTS WITH HIGH-INTENSITY NEUTRONS FROM THE LIQUID-LITHIUM TARGET LiLiT

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A high-intensity neutron source based on a Liquid-Lithium Target (LiLiT) [1] and the ^{7}Li(*p*,*n*) reaction was developed at SARAF (Soreq Applied Research Accelerator Facility, Israel) and is used for nuclear astrophysics experiments. The LiLiT device consists of a forced-flown (> 2 m/s) film of liquid lithium (~200 ^{o}C) whose free surface is bombarded by the proton beam. The lithium film acts both as the neutron-producing target and as a power beam dump. The setup was commissioned with a 1.2 mA proton beam at 1.91 MeV, producing a neutron yield (peaked at ~25 keV) of ~ 2×10^{10} n/s, more than one order of magnitude larger than conventional ^{7}Li(*p*,*n*)-based neutron sources. The target dissipates a peak power areal density of 2.5 kW/cm^{2} and a peak volume density of 0.5 MW/cm^{3} with no temperature or vacuum elevation in the target chamber. We will describe the methodology used for extracting experimental cross sections from activation measurements using Au as neutron monitor under the particular conditions imposed by our setup and will present preliminary results on neutron-capture Maxwellian-averaged cross sections of Zr stable isotopes and further planned experiments.

[1] S. Halfon et al., Rev. Sci. Inst. 84, 123507 (2013)