NUCLEOSYNTHESIS REACTIONS WITH THE HIGH-INTENSITY SARAF-LiLiT NEUTRON SOURCE

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Neutron-induced reactions remain at the forefront of experimental investigations for the understanding of stellar nucleosynthesis and chemical evolution of the Galaxy. We report on recent experiments performed with the Liquid-Lithium Target (LiLiT) and the mA-proton beam at 1.92 MeV (2-3 kW) from the Soreq Applied Research Accelerator Facility (SARAF), yielding high-intensity 30-keV quasi-Maxwellian neutrons ($3\text{-}5\times10^{10}$ n/s). First experiments were dedicated to benchmark the experimental system by measuring the Maxwellian Averaged Cross Section (MACS) of several targets. The MACS of ^{94}Zr and ^{96}Zr, important isotopes for understanding the *s*-process evolution, were determined as 28.0 ± 0.6 mb and 12.4 ± 0.5 mb, respectively, based on activation measurements and detailed analysis, in good agreement with previous measurements and with lower uncertainties. Using α–, β–, γ–spectrometry and atom-counting techniques (accelerator mass spectrometry, atom-trap trace analysis), we are extending our experimental studies to several targets of astrophysical interest: the ^{36,38}Ar(n,γ) reactions are investigated for the first time with 30-keV neutrons as well as neutron capture reactions on important nuclides ^{nat}Ga, ^{nat}Se, ^{nat}Kr and ^{nat}Xe, ^{nat}Ce in the weak and main *s*-process regimes, respectively, and ^{209}Bi at the end of the *s*-process path. The high neutron intensity enables MACS measurements of low-abundance or radioactive targets. Neutron-induced reactions on ^{7}Be and neutron capture reactions on *s*-process branching points ^{147}Pm, ^{171}Tm are investigated. The status of these experiments and preliminary results will be presented. This work was supported by Pazi Foundation (Israel), Israel Science Foundation and the US Department of Energy, Office of Nuclear Physics, under Contract NoDE-AC02-06CH11357.