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Fast neutron inelastic scattering from 7Li

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The inelastic scattering of fast neutrons from ^{7}Li nuclei was investigated at the nELBE neutron-time-of-flight facility.
This process has technological implications in fusion and fission reactors. In the former it could create an intense γ-ray field causing heating and radiation damage, in the latter it could strongly influence the neutron energy spectrum and therefore the neutronics of e.g. novel reactor concepts like the molten salt reactor. Furthermore the γ-ray production cross section of ^{7}Li is a very good case to be used as an alternative for neutron fluence determination to enable relative measurements of neutron-induced reactions. Inelastic neutron scattering on ^{7}Li leads to the production of a 478 keV γ-ray from the first excited state of ^{7}Li. The next higher lying state in this nucleus at 4630 keV already undergoes break up into an α-particle and a triton. The angular distribution of the γ-rays after inelastic neutron scattering is isotropic and has negligible internal conversion. The threshold energy is low enough to be able to cover a large range of neutron energy and the cross section of about 0.2 barn is reasonably high to enable good statistics within a feasible measurement time.
At nELBE the photon production cross section was determined by irradiated a disc of LiF with neutrons of energies ranging from 100 keV to about 10 MeV. The target position was surrounded by a setup of 7 $LaBr_3$ scintillation detectors and 4 high-purity germanium detectors to detect the 478 keV de-excitation γ-rays. A ^{235}U fission chamber was used to determine the incoming neutron flux. All details of the experiment and the data analysis will be explained. The final results will be compared to previous measurements.

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