

Challenges of the neutron-capture measurement on radioactive ^{204}Tl with the DANCE detector

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Radiative neutron capture is one of the main reaction channels responsible for production of heavy elements in stars. The so-called slow neutron capture or s-process involves a chain of neutron captures followed by beta decays. ^{204}Tl is a branching point in the reaction chain and therefore its neutron-capture cross section is of crucial importance for astrophysical calculations.

A measurement of neutron capture on ^{204}Tl was carried out with Detector for Advanced Neutron Capture Experiments (DANCE) at Los Alamos Neutron Science Center (LANSCE). This highly efficient and highly segmented detector array is designed for detection of total γ -ray energy and individual γ rays emitted after the neutron capture. However, this was a very challenging measurement due to the large amount of background, as ^{204}Tl undergoes beta decay with 3.8-year half-life.

This talk will present experimental data from this measurement and describe complications related to the analysis, which include high count rates, very small abundance of ^{204}Tl in the sample and significant background contribution. Despite these difficulties, new resonances - identified as ^{204}Tl - are observed in the experimental data.