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Lifetime measurements in 44Sc excited states using LaBr3 :(Ce) detectors coupled with the AFRODITE array

The progressive development of the scintillator detectors has made it possible to do perform direct determination of electronic lifetimes. 2" x 2" LaBr₃ :(Ce) detectors provide a combination of excellent time resolution and good energy resolution. With these detectors it is possible to undertake direct lifetime measurements of excited nuclear states down down to hundreds of picoseconds. Six 2" x 2" LaBr₃ :(Ce) detectors were coupled to the AFRODITE array as their first in-beam experiment. AFRODITE consisted of eight HPGe clover detectors as well two 3.5" x 8" LaBr₃:(Ce) detectors. A particle telescope was used to select the desired reaction channel. The reaction of interest ⁴⁵Sc(p,d) ⁴⁴Sc was carried out at a beam energy of 27 MeV. Through this reaction, excited states that have lifetimes which are apt for the characterization of the 2" x 2" LaBr₃ :(Ce) detectors were populated. One of the nuclei of interest in these studies, ⁴⁴Sc, has states with a wide range of lifetimes at low to moderate energies. Various techniques such as the slope method and the centroid shift method have been employed to extract the lifetimes of the excited states. All these endeavours will seek to unveil the quadrupole moment of nuclei and their intrinsic behavior.

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