The Structure of Neutron-Rich N∼126 Nuclei

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An experiment was performed at GSI Helmholtzzentrum für Schwerionenforschung using a high-intensity ^{208}Pb primary beam at 1 GeV/u incident on a ^{9}Be target to populate neutron-rich fragmentation products near the N = 126 shell closure. Nuclei in this region are of particular interest for testing shell-model predictions and constraining the astrophysical r-process path toward heavy nuclei.

Reaction products from the GSI Fragment Separator were implanted into two 1 mm thick AIDA active silicon stoppers (24 × 8 cm^2), surrounded by two scintillating β-plastic detectors. Gamma-ray spectroscopy was performed using an array of eight newly developed DEGAS detectors and two EUROBALL high-purity germanium detectors.

The primary aim of the experiment was to investigate the structure of neutron-rich N = 126 nuclei through the observation of isomeric transitions. The Fragment Separator was centred on ^{203}Ir and ^{202}Os for approximately one day and three days, respectively. In total, 62 neutron-rich nuclei were populated, with γ-ray spectroscopy carried out for 40 nuclei. Experimental level schemes and transition strengths for N = 125 and N = 126 nuclei were established where possible and compared with predictions from three shell-model parameterisations.

Key results include a revised level scheme and improved isomeric lifetime for ^{203}Ir, a tentative partial level scheme for the most neutron-rich N = 126 nucleus ^{202}Os, and the first spectroscopic information on ^{197}Re and the newly observed ^{200}Re. The properties of ^{197}Re indicate a prolate–oblate shape transition between A = 196 and 197.