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Isomeric decay spectroscopy at RISING

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Decay spectroscopy following projectile fragmentation constitutes one of the most sensitive methods of studying exotic nuclei. It enables nuclear structure investigations for species produced with very low yields (few nuclei an hour).

Exotic nuclei were synthesised using relativistic projectile fragmentation. The fragments were separated and unambiguously identified event-by-event using the GSI FRagment Separator. The final reaction products were stopped either in a passive stopper or a stack of double-sided Si strip detectors at the final focal point of the FRS and viewed by the high-efficiency, high granularity Stopped RISING gamma-ray spectrometer, consisting of 15 Euroball cluster Ge-detectors. Time-correlated gamma decays from individually identified nuclear species have been measured, allowing the clean identification of isomeric decays in a wide range of exotic nuclei both at the proton drip-line and in heavy, neutron-rich systems.

Highlights of the experimental programme include:
(i) the first observation of excited states in the N=126 closed-shell nuclei 205Au, 204Pt and 203Ir following the internal gamma-ray decay from isomeric states.
(ii) internal conversion electron spectroscopy in 205Au from a long-lived (seconds) isomeric state.
(iii) isomeric decay in the probably oblate nucleus 198Os.
(iv) decays from the previously reported isomeric I=27 and I=(49/2) states in 148Tb and 147Gd, respectively. These isomeric decays represent the highest discrete spin states observed to date following a projectile fragmentation reaction, and opens up the possibility of doing high-spin physics using this technique.
(v) internal isomer decay in the r-process waiting point nucleus 130Cd [1]
(vi) studies of medium-mass N~Z nuclei from both internal [2] and beta-delayed gamma-ray decay.

The experimental setup as well as selected highlights of the experimental results, together with theoretical interpretations, from these highly successful experiments will be presented.

[1] A. Jungclaus et al., Phys. Rev. Lett. 99(2007) 132501.
[2] A.B. Garnsworthy et al, Phys. Lett. B660 (2008) 326.

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