Spectroscopy of iridium nuclei beyond the proton dripline

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With recent developments in detection mechanisms and experimental techniques both in-beam and decay spectroscopic studies can now be realised beyond the proton dripline. The University of Jyväskylä presently hosts the JUROGAM array and the GREAT spectrometer at the target and focal plane of the gas-filled separator RITU, respectively. This combination now allows in-beam γ-ray spectroscopy to be performed down to a cross section limit of tens of nanobarns when the RDT technique is employed.

The nuclei $^{166-169}Ir_{89-93}$, which lie beyond the proton dripline in an area between the N=104 mid-shell and the N=82 closed shell will be disucssed . The most neutron deficient iridium nucleus for which there is a published level scheme is ^{171}Ir[1]. Still, this is only for the bands built above the $\pi h_{11/2}$ isomeric state, which are interpreted as having large shape asymmetries. In contrast, the proton emitting nuclei $^{166-167}$Ir decay rates have been interpreted in terms of a single proton tunnelling through a Coulomb plus centrifugal barrier using the WKB or DWBA approximation and the Becchetti and Greenlees optical potential, and the spectroscopic factors are derived from low-seniority spherical shell-model calculations or BCS theory[2,3]. For doubly-odd nuclei this does not give the full picture. It is thought that the residual interaction between the odd proton and neutron will allow j-components other than that of the proton to contribute to the decay process. Due to this fact it is difficult to predict the underlying single-particle structure of the decaying state; thus experimental data from in-beam and isomeric γ-ray spectroscopic studies are required to understand the structure of these nuclei.

Proton and alpha-decay RDT have been performed for ^{166}Ir and ^{167}Ir and alpha-decay tagging has been performed for ^{169}Ir. These data provide a systematic study of shape evolution moving from the collective midshell to the single-particle closed shell. The excited states built upon the ground state and isomeric state of these nuclei will be shown, giving an insight into the configurations upon which they are built.

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