Deep inelastic reactions and isomers in neutron-rich nuclei across the perimeter of the A = 180-190 deformed region

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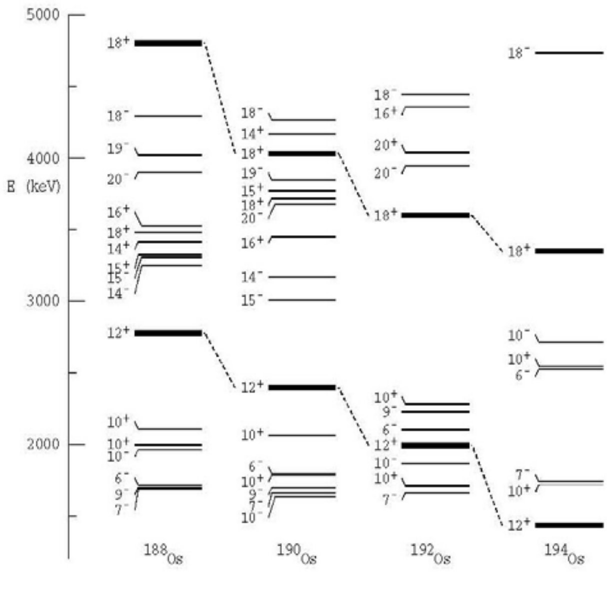
The region of deformed nuclei near Z = 72 and N = 104 is prolific in multi-quasiparticle high-K isomers, formed by combining high-Ω orbitals near the proton and neutron Fermi surfaces. Many more are predicted to occur in stable and neutron-rich isotopes but few of these are accessible by conventional fusion-evaporation reactions. As reviewed recently [1], multi-nucleon transfer or “deep-inelastic” reactions with heavy energetic beams offer an alternative, although non-selective, means of production, complementing the broader reach of fragmentation reactions.

We report here on a series of deep-inelastic studies that now extend into the transitional region of neutron-rich W, Ir, Os and Au isotopes . Measurements were made using 6 MeV per nucleon, pulsed and chopped Xe-136 beams provided by the ATLAS facility at Argonne National Laboratory, incident on a range of enriched targets. Gamma-rays were detected with Gammasphere.



As well as some of the technical aspects of discovery, assignment and characterization, newly identified level schemes and isomers in several Os, Ir and Au isotopes [2,3] will be discussed in the context of the tri-axial structures predicted by configuration-constrained potential energy-surface calculations, and also of dynamical effects such as oblate alignment [4] . An emerging issue is that very low-lying states ($K^{\pi} = 12^{+}$ and 18^{+}) associated with the $i_{13/2}$ two-neutron-hole configuration are predicted. These could result in, as yet undiscovered, long-lived β-decaying isomers. Prospects for their identification could include new storage-ring mass techniques [5].

Figure 1: *Predicted multi-quasiparticle intrinsic states from configuration-constrained potential-energy-surface calculations. Note that each state has been independently minimized.*

[1] G. D. Dracoulis, Nobel Symposium 152, Proceedings, Physica Scripta T, in press.
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