High spin states in neutron-rich Tantalum nuclei

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The neutron-rich region of deformed nuclei around A=180-190 is challenging to access via fusion–evaporation reactions. Recent progress in studying these nuclei has been achieved through other population methods such as deep-inelastic, fragmentation and particle transfer reactions [1–3].

One of the major interests in nuclei in this region is the presence of the metastable states, isomers, in particular those that are related to non-conservation of the K–quantum number, where K is the projection of the angular momentum on to the nuclear symmetry axis [4]. Identification and characterisation of these isomers can provide information on the intrinsic single–particle orbitals lying close to the Fermi-surface and hence indirect data on the nuclear deformation and shape.

The present measurements used an 840 MeV ^{136}Xe beam from the ATLAS facility at Argonne National Laboratory, incident on a ^{186}W target with a gold backing sufficiently thick to stop the recoiling reaction products. The Gammasphere array was used to detect the emitted γ–rays. A range of neutron–rich nuclei were populated in the reactions, including ^{183}Ta and ^{185}Ta. It is also expected that other tantalum nuclei between A=182 and A=187 will be populated.

Other than the decay of the 17 ms isomer in ^{185}Ta [5, 6], there is little or no γ–ray decay data available for excited states in tantalum nuclei heavier than ^{183}Ta [7]. From the current work, new structures and isomers have been observed in a range of neutron–rich tantalum isotopes. The focus of this presentation will be on extensions to previously published structures in ^{183}Ta [8] and a possible new level scheme for ^{184}Ta. The spins and parities are investigated in terms of both the available spectroscopic information as well as self–consistent Lipkin–Nogami pairing calculations. Proposed configurations for the observed structures will be discussed.

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