Contribution ID: **28** Type: **not specified**

Isomers and intrinsic excitations at high spin in ^{200,201}Tl and ^{202}Pb

Nuclei just below the doubly magic 208Pb (Z=82, N=126) are near-spherical and isomers are realized due to the hindered decays from states with predominantly high-j contributions to those with relatively lower-j values. The high-j orbitals in this region are $h_{11/2}$ for protons and $i_{13/2}$ for neutrons. Tl (Z=81) isotopes correspond to one proton hole and a few neutron holes with respect to ^{208}Pb and the coupling of the odd proton to different neutron configurations can be explored. Tl isotopes with A ≥ 200 are characterized by weakly-deformed oblate to near-spherical shapes and are expected to exhibit the presence of isomers. With increase in neutron number approaching the closed shell at N=126, intrinsic excitations arising from the coupling of a few to several valence neutrons in the unique-parity $i_{13/2}$ subshell and a proton in the $h_{11/2}$ orbital dominate the yrast line. In a few cases, contributions from some low-j orbitals are also evident. The isotopes of specific interest are ^{200,201}Tl which are odd-odd and odd-even respectively, in terms of nucleon numbers. They allow the opportunity to explore intrinsic states embedded along with weakly collective, oblate deformed levels. The study of these contrasting excitation mechanisms up to high spin can provide considerable nuclear structure insights.

The present work encompasses the analysis of data from two experiments, one with the Gammasphere detector array at Argonne National Laboratory, USA, and the other with INGA (Indian National Gamma Array) at the Inter-University Accelerator Centre, New Delhi. High-fold coincidence data were analyzed and a number of histograms were created, up to three dimensions, involving energy and time parameters for verifying the placement of known transitions, identifying new ones and their location in the level scheme, and exploring the data for the presence of high-spin isomers. The analysis was performed primarily using the Radware suite of programs. The decay scheme of ^{201}Tl was extended up to spin I ≈ 25 $\hbar$ and an excitation energy Ex $\approx$ 8.5 MeV with the inclusion of many newly identified transitions. A total of four isomeric states (three of them being newly identified along with confirmation of one which was previously established) with half-lives ranging from a few nanoseconds to the sub-microsecond region were established using the centroid-shift method or by fitting exponential decay. At high spin, intrinsic configurations with dominant contributions from high-j orbitals are found to be favored. An isomeric state at high spin in ^{200}Tl is newly identified and is attributed to a possible 4-quasiparticle configuration involving high-j nucleons. Additionally, half-lives of a few previously established isomeric states in ^{202}Pb, an isotone of ^{201}Tl, were also revisited.

A number of calculations have been performed to understand the experimental results. Single-particle energies were calculated using a Woods-Saxon potential with universal parameters. Empirical calculations were also performed using experimental data for 1-quasiparticle states and residual interactions obtained from isomers in neighboring nuclei. Further, shell model calculations using the Oxbash code with the KHH7B interaction have also been performed. Detailed results will be presented at the conference.

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