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Tetrahedral Symmetry in the Actinides: the ELMA Project

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During the last few years the TetraNuc collaboration has launched a series of experiments in the Rare-Earth region to possibly demonstrate the existence of high-rank symmetries in subatomic physics focused on the tetrahedral symmetry [1]. Meanwhile an important progress has been made on the theory side. Some suggestions strongly indicate that the Actinides region may be of particular interest because of the role of the octahedral symmetry. Our analysis clearly points out that some light uranium isotopes are among the most interesting experimental candidates [2].
The studies of high-rank symmetries will focus in the future on the measurement of the gamma decay branching ratio of the candidate states but also on the B(E2) and B(E1) transition probabilities. One has to remind that in the exact static limit of the tetrahedral symmetry, both the static quadrupole moment and the dipole moment must vanish and hence both transition probabilities are expected to be small. In the uranium isotopes strong experimental hints comes from the excited negative parity bands that are reported in the literature with no or extremely weak E2 in-band transitions; this fact might sign weak B(E2) but also large B(E1). To go further experimentally, we need to measure the candidate states-lifetimes in the uranium isotopes of interest. Unfortunately, it is far from being an easy task for these nuclei because of the limited existing production possibilities: most of them preclude the lifetime measurements to be performed based on the available Doppler methods. This motivates us to develop the ELMA project (Electron for Lifetime Measurements in the Actinides).
In this talk I will present a brief overview of the current experimental knowledge and develop the ideas on how to search for the symmetries in the Actinide region as well. The results* of an early ELMA test experiment run at IPN-Orsay with the ORGAM array and a 232Th target from the IPNO target laboratory will also be presented.
* Analysis by G. Lehaut (IPN-Lyon) and L. Sengelé (IPHC-Strasbourg)
[1] D. Curien et al. J.of Phys. CS 205, 012034 (2010)
[2] D. Curien et al. Int. J. of Mod. Phys. E 20, 219 (2011)

Primary author: CURIEN, Dominique (IPHC-DRS, Strasbourg)

Co-author: TETRANUC, collaboration (.)

Presenter: CURIEN, Dominique (IPHC-DRS, Strasbourg)

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