Isomers in Exotic Nuclei

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Studying exotic nuclei is of primary interest in today's nuclear physics. It attracts more and more attention with increasing improvements of the population and detection capacities of the existing experimental facilities.

From the physics point of view, it is of great importance to examine the possible presence of certain specific symmetries manifested by certain states in exotic nuclei. The significance of this kind of analysis comes from the fact that symmetries (certain so-called molecular point-group symmetries) strongly hinder the decay properties. It follows that the excited states with such symmetries are expected to become isomers with lifetimes possibly much longer than the lifetimes of the corresponding ground states. This offers a very attractive possibility of focussing the exotic nuclei studies on the new areas of the Periodic Table in which the ground states live too shortly to be detectable with the present-day instrumentation.

We will present perspectives of what we refer to as "a new era of nuclear spectroscopy" related to the nuclear states with tetrahedral and / or octahedral symmetries. Such nuclei are predicted to produce neither quadrupole nor dipole moments, thus neither E2 not E1 transitions, the latter usually dominating the decay schemes of the so-called rotational nuclei. As a consequence, such states once populated may decay via E3-transitions or via beta-decay processes, which are several orders of magnitude slower. Thus the corresponding states become isomeric.

In the recent article [1] the first experimental evidence of the nuclear tetrahedral and octahedral symmetries has been presented and the spectroscopic criteria of identification of these new symmetries have been elaborated. This, as we believe, opens the totally new perspectives for both exotic nuclei and exotic symmetry studies, where from the term "new era in nuclear spectroscopy".

Bibliography

[1] J. Dudek *et al*., Phys. Rev. C **97**, 021302(R) (2018)