Recent Progress and Prospects in Research of Discrete Symmetries in Nuclei

Jerzy DUDEK
University of Strasbourg and IN_2P_3/CNRS, Strasbourg, France

Abstract. During recent years the geometrical symmetries in nuclei have received quite some interest manifested by about a hundred of articles which appeared in various journals. This interest followed the first predictions by the TetraNuc collaboration that nuclear tetrahedral and/or octahedral symmetries may be present in atomic nuclei. From the mathematical point of view these symmetries are quite appealing since, when their presence is confirmed experimentally, they would encourage using the non-trivial methods of group-theory representations to discover the new and no-trivial transition probability rules and branching rations allowing to identify new forms of nuclear structure.

The first slightly naive arguments were based on the purely static considerations: A tetrahedral-symmetric nucleus (at the static tetrahedral energy minimum) produces strictly speaking no dipole nor quadrupole moments and it has been deduced that the rotational bands should exist which possibly very weak E2-transitions. This argumentation and its very limited validity will be explained and discussed.

The new evolution based on the dynamics of nuclear vibrations in the competing spaces of the tetrahedral- and pear-shape configurations lead to totally new expectations. They are based on the calculations of the nuclear deformation-dependent inertia-parameters (mass tensor) rather than on the static-minimum considerations. The dynamical effects will be treated with the help of the direct information about the properties of the macroscopic calculations of the mass tensor as well as of the solutions of the corresponding collective Schrödinger equations in multi-dimensional spaces.

The present status of the most advanced experimental results will be discussed.