PARTIAL SYMMETRIES IN NUCLEAR MODELS

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Partial symmetries can be defined as symmetries of some parts of a physical system which, in principle can determine global behavior of this system independently of the fact that this physical system, as a whole object, can have different symmetry or can have no symmetry at all.

In case of nuclei the main interesting object which can be investigated to find its partial symmetries is the nuclear Hamiltonian (shape of nuclei also belongs to this category). It can be decompose into partial Hamiltonians which have a well determined symmetry though the corresponding Hamiltonian can have no symmetry at all.

This method leads to decomposition of nuclear spectra not into traditional bands constructed by hands, using as the main criterion the strongest E2 transitions, but to a decomposition in respect to symmetries: each band correspond to a given symmetry with all consequences caused by the corresponding selection rules and similar relations like level degenerations correlated to dimensions of irreducible representations, some specific rules due to Wigner-Eckart theorem etc.

This idea probably allows to get a new classification of nuclear levels, which because of similarities due to structure induced by the appropriate partial symmetry groups will have a weak model dependent predictive power which should allow e.g. for searching of missing, i.e. not seen in a given experiment nuclear levels. This method gives also a hope to construct a general structure of nuclear interactions as composed of partial Hamiltonians (or corresponding invariants in nuclear space) representing specific excitations of nuclei.

The poster presented by A. Pędrak under the same title as above is presented. The main subject of this poster is to illustrate the methods described during the seminar.

REFERENCES

[1] A. Pędrak, A. Góźdź, Intrinsic Hamiltonian symmetry group structure analysis for orthogonal partial symmetry decomposition, Phys. Scr. 89 (2014) 054024, doi:10.1088/0031-8949/89/5/054024.
[2] A. Pędrak and A. Góźdź: Symmetry properties of eigenproblems in intrinsic frames, Phys. Scripta (2015), in print.