



NUSTAR Seminar

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“K-Isomers as Stepping Stones in Studies of Exotic Nuclei”

The domain of nuclear isomerism is governed by phenomena strongly related to nuclear geometry. As it turns out, the shape isomers – as the name indicates – occur as a result of the nuclear shape competition, whereas the K-isomers exist thanks to the axial symmetry leading to the conservation of the K quantum number and related hindrance properties. On the theory side this encourages strongly employing the nuclear mean-field methods as one of the most powerful tools in this domain of physics. Indeed, thanks to short range of nuclear forces the nuclear densities drop to zero in a relatively narrow zone what allows to introduce the notion of the nuclear surface and nuclear shapes. On the other hand one shows that the spatial distributions of the nuclear mean field potentials follow closely that of the densities.

We are employing the so-called universal realisation of the nuclear mean-field approach capable of describing realistically several classes of nuclear phenomena ranging from the nuclear K-, and shape isomerism to the high spin and temperature effects, including shape transitions, exotic symmetries etc. The term ‘universal’ refers to the fact all these effects are described with the help of 12 adjustable constants fixed once for all for all over 3 000 nuclei throughout the Periodic Table. Nevertheless, the contemporary results of many authors show that it is very important to examine and control the uncertainties of the theory predictions to provide reliable bridge with the experimental evolution – this aspect of our efforts will also be shortly discussed.

We will present briefly the leading lines of the above evolution as well as a few selected illustrations focussing on the K-isomers. This is a very attractive element of the present day studies in particular of exotic nuclei since it is expected that certain isomeric states in many nuclei may live longer or much longer than the corresponding ground-states. This field of research is expected to open new era in the studies of such nuclei.