Seminarium

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Complex landscape of nuclear deformation at zero spin in Ni nuclei – search for shape isomers

The phenomenon of shape isomerism, being the best example of shape coexistence in nuclei, is related to the existence of a high barrier in the nuclear potential energy surface (PES), separating the primary energy minimum (the ground state) from secondary energy minima at large deformation. Shape isomers at spin zero have clearly been observed, so far, only in actinide nuclei - they decay mainly by fission, although in two cases, ^{236}U and ^{238}U, gamma-ray branches with very hindered transitions are known [1].

Inspired by various mean-field theoretical approaches [2] as well as by the state-of-the-art Monte Carlo Shell Model (MCSM) calculations, we have recently identified a shape-isomer-like structure at spin zero in a light nucleus ^{66}Ni by using gamma-ray spectroscopy technique [3].

Being guided by the MCSM calculations, we have extended our studies to other Ni isotopes [4]. For example, by combining a number of experimental techniques, we have unveiled an unexpectedly complex landscape of nuclear deformation at zero spin in stable ^{64}Ni. This includes the first identification, in Ni isotopes, of a 2^+ excitation in the prolate minimum. The new results provide, for the first time, a complete picture of the mechanisms underlying the appearance of deformation and shape coexistence in the Ni isotopes. They highlight the impact of the monopole tensor interaction in driving deformation at zero spin, even in ^{64}Ni, a nucleus located within the valley of stability.

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