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SHELL MODEL FAR FROM STABILITY: ISLANDS OF INVERSION MERGERS

Wednesday, 3 July 2019 09:00 (35 minutes)

In this presentation, I will expose some of the last developments in microscopic nuclear structure calculations for exotic nuclei far from stability in the vicinity of ^{78}Ni, in a key region needed for understanding nucleosynthesis paths of gold and some of the most heavy elements.

In a first part, I will expose recent study on the development of collectivity in neutron-rich nuclei around N=40, where recent experimental evidence suggest a rapid change from the spherical to rotational regime, in analogy to the island of inversion known at N=20 [1,2] and extension of the island of collectivity towards N=50 [3].
In a second part, our recent algebraic Nilsson SU3 self-consistent model [6] will be used to describe the intruder relative evolution in the vicinity of ^{78}Ni. The spectroscopy of the exotic nucleus ^{78} performed at the RIKEN-RIF laboratory in Japan has been recently published in Nature [1]. The results support the doubly magic character N=50, Z=28, of the heaviest nickel isotope, that is spherical in its ground state. In addition they have detected the presence at very low energy (2.5 MeV) of another facet of the same nucleus which is radically different, characterized by its spheroidal shape. This atypical phenomenon of coexistence, more germane to molecular systems, was predicted by the Configuration-Interaction (LSSM) calculations of the Strasbourg-Madrid collaboration in 2016 [6].
The model predicts as well the vanishing of the magic closure at N=50 for the
more exotic isotones of Chromium and Iron which should be deformed in
their ground states, leading to the idea of merging islands of collectivity from N=40 to N=50, as already observed from N=20 to N=28 [3]. Core excitations and their impact on moments in Cu and Zn isotopic chains will be discussed.
Finally, discussion of the underlying mecanism in terms of Spin-Tensor components will be exposed and compared to other neutron-rich regions of the nuclear chart.

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[3] C. Santamaria et al., Phys. Rev. Lett. C 115, 192501 (2015)
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[5] R. Tanushui et al., Nature 569, 53-58 (2019)
[6] F. Nowacki, A. Poves, Phys. Rev. Lett. {\bf 117}, 272501 (2016)

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