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Normal and intruder configurations in neutron-rich Co isotopes: competition between spherical and deformed shapes

Neutron-rich isotopes are a continuous source of new information on the behavior of the nucleus and sometimes of unexpected phenomena, from the discovery of halo-nuclei to the disappearance of the well-established magic numbers. Responsible for these changes could be both the developments of a diffuse neutron surface that could fade the spin-orbit interaction as well as the proton-neutron monopole interaction that could reorder the single-particle orbits. While the experimental information obtained for nuclear systems has been limited for decades to nuclei close to the stability line, the continuous experimental developments allow nowadays the study of exotic nuclei far from stability.
A neutron-rich region, where new magic numbers may appear and others disappear, is the one bounded by N = 28-40 and Z = 20-28. As a matter of fact, it has been shown that a new sub-shell closure is present at N = 32 but only for Z = 20 [1]. The appearance of this new shell gap has been explained [2] in terms of a strong spin-flip 1f7/2 – 1f5/2 proton-neutron monopole interaction. More recently new experimental data has shown that near the sub-shell closure at N=40 a new region of nuclear deformation sets in, leading to the disappearance of the sub-shell closure at N=40 for Z < 28 [3, 4]. This has been explained by large-scale shell model calculation using the new effective interaction LNPS [5]. In the present contribution new experimental results on neutron rich Co isotopes which display shape coexistence will be shown and discussed in terms of the same shell-model calculation.

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Primary author: RECCHIA, Francesco (University and INFN Padova)

Co-authors: Prof. LUNARDI, Santo (University and INFN Padova); Prof. LENZI, Silvia Monica (University and INFN Padova)

Presenter: RECCHIA, Francesco (University and INFN Padova)