Frontiers in Gamma Ray Spectroscopy FIG18

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Nuclear structure studies in the vicinity of shell closure

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Content :

The nuclei approaching the neutron and proton major shell closure at N=Z=50 provide a unique opportunity to study interplay between the single particle and collective degree of freedom and the influence of the valence orbitals on deformation. Theoretical interpretation of band structures observed in the nuclei approaching major shell closures at N=Z=50 have revealed diversity in the deformation-generating mechanisms. The proton particle-hole excitations across major shell gap are energetically possible due to the strong proton-pair correlations and proton-neutron interaction between the spin-orbit partner orbitals. As one approaches , N =54 the h11=2 subshell intruder orbital is likely to be occupied. The Neutron Fermi level lie at the bottom in the h11=2 sub shell or the low-h11=2 orbitals are accesible at low excitation energies, the shape is driven to prolate deformation. The active intruder orbitals lie near the top in the high-g9=2orbitals which drives shapes towards oblate deformation. The delicate interplay of strongly shape-driving g9=2 and h11=2 orbitals result in the soft (triaxial) shapes with modest deformation. Intriguing relevant phenomena such as magnetic rotation and degenerate twin bands have been reported in this mass region. The limited number of valence particles (holes) in the nuclei in this mass region, are able to break the spherical symmetry and induce, albeit small, nuclear deformation. Because the small (prolate) deformation requires high angular velocity to generate collective angular momentum, specifi c noncollective \aligned" states with the nuclear spin made up completely from single particle angular momentum contributions, are able to compete energetically with the weakly deformed collective structures. In the nuclides in the A100 region, there is existence of isomers due to the presence of low energy states based on the p1=2 and g9=2 orbitals, with widely di erent angular momentum where the γ-decay is slow. The identi cation of isomers has been a difficult task, considerable eff ort has been devoted to the study of isomers in nuclides. For the even -Z and odd -A nuclei in this mass region, the presence of nearby h11=2, g7=2, d5=2 neutron orbitals usually give rise to di erent one-quasiparticle band structures, and further rearrangements of neutrons and protons is expected to add richness to the structure.

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