HIGH SPIN STATES IN ^{114}Xe: BUILDING A BRIDGE BETWEEN THE MASS 110 AND 130 REGIONS*

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Superdeformed (SD) nuclei in the mass 130 region were initially believed to be driven solely by the occupation of $\nu i_{13/2}$ intruder orbitals from the N_{osc}=6 shell [1]. This was consistent with the original observation of a strongly populated (5%) SD band in ^{132}Ce (N=74) [2], while only recently have SD bands been found for $N \leq 72$ [3]; this work did however show that the presence of holes in the $\pi g_{9/2}$ orbital, which originates below the Z=50 spherical shell gap, are just as important in forming SD shapes in $Z \sim 58$ nuclei; superdeformation still persists as the neutron Fermi surface falls well below the $\nu i_{13/2}$ intruder orbitals [4]. The $\pi g_{9/2}$ holes are also a crucial ingredient of smoothly terminating bands seen in $A \approx 110$ nuclei with $Z \approx 50$ [5].

New results have been obtained for $^{114}_{54}$Xe, populated with the 230-MeV ^{58}Ni(^{58}Ni,2p) reaction at Argonne National Laboratory. GAMMASPHERE was used in conjunction with the MICROBALL charged-particle detector in order to select evaporation residues of interest. The yrast band of this nucleus has been greatly extended by fourteen transitions to a spin of 52$\hbar$ and shows high-spin features consistent with smooth band termination. This band represents the first firm evidence for a core-excited (6-particle, 2-hole) proton configuration above Z=53 involving two $\pi g_{9/2}$ holes. Results of cranked Nilsson-Strutinsky calculations predict a deformation of $\varepsilon_2 \approx 0.30$ for the band, much larger than the ground-state deformation of ^{114}Xe. This demonstrates the shape-driving aspect of holes occupying a strongly upsloping ($\partial E/\partial \varepsilon_2 > 0$) orbital and explains the connection between mass 110 terminating bands and mass 130 SD bands ($\varepsilon_2 \approx 0.35$). The SD bands, with a larger valence space, can accommodate more spin before termination is reached; for instance, the yrast SD band in ^{132}Ce is expected to terminate at I^{π}=78$^+$, 22$\hbar$ higher than that predicted (56$^+$) for the new band in ^{114}Xe. The present results for Z=54 advances the bridge between these two structural features in the two mass regions.

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