Due to the shape driving effect of the highly aligned $N = 5\ h_{11/2}$ intruder orbitals, a shell gap occurs in the Nilsson scheme at proton and neutron numbers $Z, N \approx 44$ leading to a predicted island of superdeformed (SD) prolate spheroids with $\beta_2 \approx 0.55$. Baktash et al. [1] reported the first observation of a discrete SD band in this mass region, which was tentatively assigned to $^{83}$Sr. Jin et al. [2] have identified a SD band in $^{84}$Zr and determined its quadrupole moment $(5.2(8)\ eb; \ \beta_2 \approx 0.53)$, thus providing direct evidence for the SD shell gap. Interestingly, the band in $^{84}$Zr was populated with 4% via the $2pn$ reaction channel, but only $2\%$ via the $α2p$ channel in two different GAMMASPHERE experiments. Usually, the relative intensities of the SD bands in the $A \approx 80$ region amount to some $1.5\%$. Subsequently, multiple SD bands have been reported for $^{81}$Sr, $^{82}$Sr, and $^{82}$Y. All these bands reveal population and depopulation patterns and large dynamic moments of inertia $J^{(2)}$ typical for SD bands. The observed moments of inertia are generally in agreement with predictions of cranked shell model calculations suggesting two to four aligned particles in $h_{11/2}$ orbitals. However, discrete linking transitions between SD and normal-deformed (ND) states are yet to be observed in this mass region.

High-spin states in $^{83}$Zr were studied using the GAMMASPHERE array and the MICROBALL charged-particle detector system. Two superdeformed bands extending over nine to eleven transitions were identified in $^{83}$Zr. The quadrupole moment of one band was determined by the Residual Doppler Shift Method and is consistent with a quadrupole deformation of $\beta_2 \approx 0.5$. Both bands feed mainly ($\approx 85\%$) into the positive-parity yrast band around spin $I = 31/2$ though this band carries only $\approx 50\%$ of the total $γ$-ray flux towards the ground state. Near the bottom, the more intense SD1 band ($\approx 5\%$) branches out in a manner which suggests that it interacts with ND states. Fixing the excitation energy of SD1 by assuming it crosses the yrast ND band at a point where their side-feeding intensities are nearly equal (Fig. 1) creates the unusual situation where the SD1 band reapproaches ND states at low spins (Fig. 2). A similar situation is observed in the decay of SD1 in $^{81}$Sr [3].

**Fig. 1:** Intensities (full symbols) and side feedings (open symbols) of the two SD bands, the positive-parity yrast band, and all known ND bands in $^{83}$Zr.

**Fig. 2:** Routhians for SD1 and SD2 and the positive-parity yrast band in $^{83}$Zr.

