Symmetries of Quadrupole-Collective Vibrational Motion in Transitional Even-Even $^{124-134}$Xenon Nuclei

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Vibrational proton-neutron mixed-symmetry states (MSSs) of heavy nuclei are sensitive to the residual proton-neutron quadrupole-quadrupole interaction and have recently been identified in various experimental approaches (see [1] for a review). The technique of projectile-Coulomb excitation is particularly suited for the study of one-phonon and multi-phonon quadrupole excitations in the proton-neutron symmetric and the mixed-symmetry sector. After having demonstrated this approach at the ATLAS facility at ANL on the N=80 nucleus $^{138}$Ce [2] we have studied projectile-Coulomb excitation of Xe isotopes at ANL using the Gammasphere array for the detection of $\gamma$-rays. The one-quadrupole phonon 2$^+$ MSS has been traced in the stable N=80 isotones down to $^{134}$Xe [3]. First, the data on absolute E2 and M1 transition rates quantify the amount of F-spin symmetry in these nuclei and provide a new local measure for the pn-QQ interaction. Second, the evolution of the one-phonon 2$^+$ MSS has been studied along the sequence of stable even-even $^{124-134}$Xe isotopes [4] that are believed to form a shape transition path from vibrational nuclei with U(5) symmetry near N=82 to $\gamma$-softly deformed shapes with almost O(6) symmetry. Third, our data [4,5] on more than 40 absolute E2 transition rates between off-yrast low-spin states of $^{124,126}$Xe enable us to quantitatively test O(6) symmetry in these nuclei. As a result we find that O(6) symmetry is more strongly broken in the A=130 mass region than previously thought. The data will be discussed.

[4] L. Coquard et al., to be submitted for publication.

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