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Intermediate-energy Coulomb-excitation of neutron-rich isotopes at Z<38, N>50

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The evolution of collectivity, mirrored in B(E2) excitation strength, along the N=52 isotonic line is of special interest toward the Z=28 shell closure. The degree of collectivity depends on the possibility of cross-shell excitations, and on the evolution of shell structure in general. The energies of 21+ states in the N=52 isotones minimize at Z=32 (Ge), only four protons above the Z=28 magic proton shell. This has previously been attributed to a continuous weakening of the N=50 closure when moving to lower-Z isotones [1], where also the effect of the down-sloping 3s1/2 neutron orbital was highlighted, opening the possibility of a N=58 sub-shell at low Z. B(E2) values are available and show a rise down to 84Ge (Z=32), however, the recent value for 84Ge [2] has large uncertainties, not allowing for a conclusive structural interpretation. Shell model predictions are supportive of enhanced collectivity in the first 2+ state of 84Ge, but the calculated B(E2) value would not be significantly larger than the known value in 86Se. The continuation of the trend toward doubly-magic 78Ni, i.e., in 82Zn, is lacking to date. In order to shed light on the onset of collectivity in this region, in which also triaxial features (e.g., in 84Ge and 86Ge) have been suggested [3,4], B(E2) measurements in intermediate-energy Coulomb-excitation are proposed. In two settings of the BigRIPS separator, the important B(E2) values of 84Ge and 82Zn could be obtained simultaneously, as well as B(E2) values of 86Ge and 88Se, probing the evolution toward N=56. With the availability of a high-resolution γ array, not only the B(E2) strength of the first-excited, but also those of the second-excited 2+ states could be obtained. In addition, from the recent proton-knockout work [4,7] candidates for octupole-excited states are known in the Ge isotopes, which would be accessible in through Coulomb excitation. This would result in another key observable for the γ-degree of freedom, besides the energy ratio R2/2=E(22+)/E(21+), namely the ratio B2/2 = B(E2;22+⟶01+) /B(E2;21+⟶01+) [5,6]. The evolution of B(E2) strengths could even be followed up to N=60 in the Se isotopes, cutting deeper into the shell and covering the region of transition to deformed nuclei.

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