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Probing core polarization around ^{78}Ni: intermediate energy Coulomb excitation of ^{74}Ni

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The study of the evolution of nuclear shells far from stability provides fundamental information about the shape and symmetry of the nuclear mean field. Nuclei with large neutron/proton ratio allow to probe the density dependence of the effective interaction. Indeed, it was recently shown that tensor and three-body forces play an important role in breaking and creating magic numbers [1]. Of particular interest is the region of ^{78}Ni where the large neutron excess coincides with a double shell closure. At this N/Z ratio one could expect an increase of the proton-neutron interaction strength that would modify the relative energies of the single particle states, thus reducing the $Z = 28$ energy gap [2]. In such a scenario, particle-hole excitations are expected to be strongly increased, driving to enhanced collectivity. The determination of the $B(E2)$ values of the low-lying transitions is therefore very important to measure these features and to constrain the interaction used for the shell model calculations.

We have recently measured the $B(E2; 0^+ \rightarrow 2^+)$ of ^{74}Ni in an intermediate-energy Coulomb excitation experiment performed at NSCL (MSU). The ^{74}Ni beam has been produced by fragmentation of the primary ^{86}Kr beam at 140 AMeV on a ^{9}Be thick target. The primary beam was provided by the Coupled Cyclotron Facility of the NSCL and the production reaction fragments were analyzed using the A1900 fragment separator. As a matter of fact, this setup produced a secondary "cocktail-beam" containing ^{74}Ni ions with an intensity of ≈ 1 pps as well as higher intensity ^{77}Zn and ^{75}Cu fragments. An ^{197}Au foil of $640\ \mathrm{mg/cm^2}$ was used as secondary target. The scattered ions were identified by the focal plane detectors of the S800 spectrograph and coincidence γ-rays emitted by Coulomb excited ions were detected by the 4π CAESAR array. Taking into account a proper cut on the impact parameter and using the code DWEIKO for theoretical cross sections calculation, our results do not point towards an enhanced value for the transition matrix element. Compared to what already measured by Aoi and co-workers in [3], this result opens new scenarios in the interpretation of the shell evolution of the Z=28 isotopes.

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