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Electric Monopole Transition Strengths in ^{62}Ni

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Excited states in ^{62}Ni were populated with a (p, p') reaction using the 14UD Pelletron accelerator at the Australian National University. The proton beam had an energy of 5 MeV and was incident upon a self-supporting ^{62}Ni target of 1.2 mg/cm^2. Electric monopole transition strengths were measured from simultaneous detections of the internal conversion electrons and γ-rays emitted from the de-excitating states, using the Super-e spectrometer coupled with a Germanium detector. The Super-e spectrometer has a superconducting solenoid magnet with its magnetic axis arranged perpendicular to the beam axis, which transports the electrons from the target to the 9 mm thick Si(Li) detector array which is situated 350 mm away from the target.

The strength of the $0_2^+ \rightarrow 0_1^+$ transition has been measured to be $77^{+23}_{-34} \times 10^{-3}$ and agrees with previously reported values. Upper limits have been placed on the $0_3^+ \rightarrow 0_1^+$ and $0_3^+ \rightarrow 0_2^+$ transitions. The measured $\rho^2(E0)$ value of the $2_2^+ \rightarrow 2_1^+$ transition in ^{62}Ni has been measured for the first time and found to be the largest $\rho^2(E0)$ value measured to date in nuclei heavier than Ca.

The low-lying states of ^{62}Ni have previously been classified as one- and two-phonon vibrational states based on level energies. The measured electric quadrupole transition strengths are consistent with this interpretation. However as electric monopole transitions are forbidden between states which differ by one phonon number, the simple harmonic quadrupole vibrational picture is not sufficient to explain the large $\rho^2(E0)$ value for the $2_2^+ \rightarrow 2_1^+$ transition. A discussion of the results and experimental technique will be presented, along with preliminary shell model calculations.

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