SYSTEMATIC STUDIES OF $E0$ TRANSITIONS IN ^{54,56,58}Fe

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Doubly magic nuclei and their nearest neighbours serve as an ideal testing ground for the nuclear shell model, and consequently enable us to define effective nuclear interactions. Collective states in nuclei near ^{56}Ni can be attributed to multiparticle-multihole excitations from the $1f_{7/2}$ to the $2p_{3/2}$, $1f_{5/2}$ and $2p_{1/2}$ orbits across the N, Z = 28 shell gap. Properties of excited 0^+ states as well as $E0$ and $E2$ transition strengths are sensitive probes of the underlying nuclear structure.

A systematic study of the stable even-even iron isotopes was performed and $E0$ transitions between the lowest excited 0^+ states and ground states were measured. Data were obtained in an experimental campaign at the ANU Heavy Ion Accelerator Facility. The excited states of ^{54,56,58}Fe were populated using (p, p') reactions at beam energies of 6.9 MeV (^{54}Fe), 6.7 MeV (^{56}Fe) and 7.0 MeV (^{58}Fe). Internal conversion-electron and pair transitions were measured using the superconducting electron spectrometer "Super-e", and emitted γ-rays were measured with a HPGe detector. In addition, the investigation is supplemented with information on angular distributions, angular correlations, and $\gamma - \gamma$ coincidences measured with the CAESAR detector array under the same experimental conditions. In order to deduce $E0$ matrix elements, the experimental data were evaluated with available lifetime information from Doppler-shift attenuation measurements following inelastic neutron scattering, carried out at the University of Kentucky. Results and interpretation of the systematic study, as well as a more detailed description of the experiment and procedure will be presented in this talk.