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Study of neutron rich carbon isotopes

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Electric quadrupole (E2) matrix elements are important quantities in nuclear structure. In particular they are sensitive to nuclear deformation, the decoupling of proton and neutron degrees of freedom, and are often affected by small components of the nuclear wave function. Neutron-rich carbon isotopes have attracted a great deal of attention recently, both experimentally and theoretically, with regards to the question of spatially extended (halo-like) and decoupled valence neutrons. For example, 19C and the drip-line nucleus 22C are proposed to have ground-state neutron halo structures. Electric quadrupole transition rates in 16C 18C and 20C are among the lowest found throughout the nuclear chart and this fact has been cited by some as evidence for a reduced coupling between the valence neutrons and the core nucleons. In this talk I will present the results from our experiments to measure the transition rates in 16,18,20C and discuss the evidence for a "decoupling" of valence neutrons from the core that goes beyond the usual shell model approach. Data will be compared to shell model and no-core (ab-initio) shell model calculations with NN and NN+NNN interactions.