Defining and identifying pre-collective nuclei through electromagnetic transitions and moments

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Descriptions of nucleear structure are often split into two regimes: the single-particle (spherical), regime, in which excitations are largely governed by coupling of a few unpaired nucleons; and the collective (deformed) regime, in which the single-particle structure is forgotten and excitations are largely governed by the long-range part of the nucleon-nucleon residual interaction. The onset of nuclear collectivity occurs in the region between these two regimes and is poorly understood. Many of the nuclei in the region between have traditionally been described as vibrational, however more recent studies have questioned this interpretation [1, 2]. An explanation of the discrepancies noted in these papers may be that the nucleus is not becoming collective as a whole but rather developing collectivity in subsystems in a chracteristic manner.

While a model that fully captures the properties of pre-collective nuclei is not currently available, a description of the common characteristics is possible through the study of electromagnetic transition strengths and moments. The *Z*=50 region is the ideal region in which to study these properties due to the abundance of stable nuclei along isotopic chains and the proximity to the *Z*=50 shell closure with isotopes close to the neutron mid shell and *N*=82 subshell closure. Particular focus is given to the Te isotopes with only two protons outside the *Z*=50 subshell closure. Measurements of the transition strengths and excited-state *g* factors of the 4^+ states in $^{124-130}$Te are presented with comparison to large-scale shell-model calculations.

[1] P. Garrett and J. Wood, *Journal of Physics G: Nuclear and Particle Physics* **37** 064028 (2010).

[2] B.J. Coombes, A.E. Stuchbery, A. Blazhev, H. Grawe, M.W. Reed, A. Akber, J.T.H. Dowie, M.S.M. Gerathy, T.J. Gray, T. Kibédi, A.J. Mitchell, T. Palazzo, *Phys. Rev. C* **100** 024322 (2019).