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Experimental fingerprints of shape coexistence

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Shape coexistence can be studied via a variety of experimental probes. The first indication of nuclear deformation can be obtained from the level energies, or alternatively from the electromagnetic transition strengths. In this context, the use of systematics is typically far more reliable than focusing on individual states in a specific nucleus, and it should ideally be followed by measurements of other quantities that are sensitive to the nuclear shape. For example, direct information on the charge distribution in the nucleus can be obtained from
the measurements of spectroscopic quadrupole moments using laser spectroscopy for longlived states and low-energy Coulomb excitation for the short-lived ones. However, shape coexistence is often accompanied by mixing of the wave functions corresponding to different microscopic configurations, which may influence those simple observables. Therefore, a more sophisticated approach is beneficial, involving determination of complete sets of electromagnetic transition rates between low-lying excited states, and static quadrupole moments. Those can be further analysed in terms of quadrupole invariants resulting from the Kumar–Cline sum rules yielding model-independent information on shape parameters of individual states. Alternatively, measurements of E0 transition strengths bring invaluable complementary data on configuration mixing, and microscopic components of the wave
functions can be deduced from nucleon-transfer cross sections.

I will briefly present the observables that are used to investigate shape coexistence, illustrating the discussion with recent examples showing the importance of complementary measurements when making conclusions about the structure of states.

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