Contribution ID: **63** Type: **not specified**

Shape coexistence in the n-deficient Hg isotopes

Tuesday 12 July 2022 10:05 (20 minutes)

Two of the main observables which have emerged as model-independent probes of the shape-coexistence phenomenon are the transition strengths, in particular B(E2) and ρ^2(E0) [1]. From them, the matrix elements can be extracted, which are particularly sensitive to the wavefunctions of the states they connect and to the degree of mixing between the different nuclear shapes. Therefore, they are one of the most stringent tests of the different theoretical models used to describe nuclei.

The n-deficient Pb region (to the south-west of Z=82, N=126) is characterized by clear cases of shape coexistence, with the Hg (Z=80) isotopes being a prime example [1]. A combination of experiments has yielded a consistent picture of two distinct shapes: a nearly-spherical ground state and a more deformed (prolate) one at low energies, corresponding to 2-proton promotions across Z=82. For the transitional isotopes between the stable ^{200}Hg and the beginning of the midshell ^{190}Hg, these two shapes are still reasonably separated in energy (the relative energy of the intruder states has a parabola-shape with a minimum at ^{182}Hg), thus reducing to negligible levels the mixing between the two bands. These presented a great opportunity to benchmark the normal ground-state configuration without the perturbations experienced in the lighter isotopes, simplifying the comparison with different theoretical calculations.

A systematic study of the decay of the n-deficient $^{188-200m}$Tl into Hg was performed using the GRIFFIN spectrometer at TRIUMF-ISAC. Lifetimes, angular correlations and conversion electrons were measured and B(E2) and ρ^2(E0) values extracted. For the transitional Hg isotopes, any significant mixing was discarded between the two shapes [2]. However, when the study was extended to the lighter ^{188}Hg, some hints appeared that maybe the structure inside the mid-shell cannot be simplified to a two-level mixing [3].

[1] K. Heyde, J. L. Wood, Rev. Mod. Phys. 83, 1467(2011).
[2] B. Olaizola et al. Phys. Rev. C 100, 024301 (2019).
[3] A. MacLean et al. Phys. Rev. C (in preparation).

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Session Classification: Empirical aspects of quantum phase transitions in nuclei

Track Classification: Transitional nuclei and shape coexistence