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# Two-neutron transfer: shape phase transitions and coexistence

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A crucial problem in Physics is the study of Quantum Phase transitions. In nuclei, one finds shape phase transitions along isotopic chains where the nuclei change for example from a spherical ground state to a prolate one as long as we increase the number of neutrons above a certain critical value. This situation is usually studied in terms of energy ratios of the excited states and B(E2) values but it has been also found that two-neutron transfer reactions are sensitive to the phase transitions through two-neutron intensities, as calculated for example in the framework of the Interacting Boson Model [1-3]. Alternatively, one can find the same change in the shape of the ground state in a scenario different from the standard Quantum Shape Phase Transition. This is the case of shape coexistence, where a progressive mixing of the two phases can produce a sudden change in the dominant shape of the ground state.

Recently, we have been studying the possibility of distinguishing these two scenarios through two-neutron transfer reactions [4,5]. We perform second-order DWBA calculations along two different cases. In the Samarium isotopic chain, we calculate transfer cross section from the two-neutron intensities calculated in the IBM model [1,6]. In the Zirconium isotopic chain, two-neutron amplitudes calculated in Monte Carlo Shell Model framework from T. Togashi and collaborators [7] are considered.

Comparison with experimental data in the Samarium case [8] is consistent with a shape-phase transition, as expected. On the contrary, structure calculations for the Zirconium clearly show a shape coexistence. Two-neutron transfer cross sections reproduce the available experimental data [9] and exhibit a distinctive pattern distinguishable from a shape phase transition. Unfortunately, experimental data is not available in the relevant isotopes.

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## Topic

Theory

**Author:** Dr LAY VALERA, José Antonio (Dpto. de Física Atómica, Molecular y Nuclear, Universidad de Sevilla)

**Co-authors:** Mr JODIDAR, Praveen M. (Université Paris-Saclay, IJCLab, CNRS/IN2P3); FORTUNATO, Lorenzo (Dipartimento di Fisica e Astronomia, Universit\'a di Padova and INFN, Sezione di Padova, Italy); VITTURI, Andrea

(Dipartimento di Fisica e Astronomia, Universit\‘a di Padova and INFN, Sezione di Padova, Italy)

**Presenter:** Dr LAY VALERA, José Antonio (Dpto. de Física Atómica, Molecular y Nuclear, Universidad de Sevilla)

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