

SPECIAL NUCLEAR SEMINAR

Dr. Nadezda Smirnova

Université de Bordeaux, France

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2:00 pm - Rm 184 NSH

Isospin-symmetry breaking in atomic nuclei and applications

A small breaking of the isospin symmetry due to electromagnetic interactions and u and d quark mass differences represents an important issue in nuclear structure, and it should be well controlled theoretically for a large class of problems. First, experimental studies at radioactive ion beam facilities bring more and more information on the structure and decay of proton-rich nuclei and nuclei along the $N=Z$ line, providing data on isospin-forbidden processes. Second, accurate calculations of nuclear structure corrections to weak processes in nuclei are crucial for studies of the fundamental interactions. In addition, theoretical treatment of isospin-symmetry breaking effects can be of relevance for the estimation of thermonuclear reaction rates involved in various astrophysical scenarios.

The talk will focus on some recent progress in the construction of precise phenomenological isospin-nonconserving Hamiltonians within the nuclear shell model with two specific applications.

The one is related to the use of the beta-delayed proton emission as a tool to extract the isospin-mixing. We will show that experimental data on the proton to gamma-ray branching ratio for the isobaric analogue state (IAS), supplemented by a simple shell-model input, can be used to extract spectroscopic factors for that isospin-forbidden proton emission. In the case of a well-justified two-level mixing approximation, it is even possible to determine the amount of isospin mixing in the IAS. This conjecture is illustrated by the theoretical analysis of a few pf shell emitters.

The other proposed application is related to the calculation of isospin-symmetry breaking corrections to superallowed $0^+ \rightarrow 0^+$ Fermi beta decay, serving for the tests of the Standard model.



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