NEUTRON-RICH LEAD ISOTOPES PROVIDE HINTS ON THE ROLE OF EFFECTIVE THREE-BODY FORCES

A. Gottardo[1,2], J.J. Valiente-Dobon[1], G. Benzoni[3]
and the RISING Collaboration
[1]*INFN, Laboratori Nazionali di Legnaro, Legnaro (Pd), 35020, Italy*
[2]*University of Padova, Padova, 35131, Italy*
[3]*University of Milan and INFN section of Milan, Milan, 20133, Italy*

Electromagnetic transition rates, in particular for E2 transitions, are a sensitive and well-studied probe of nuclear structure: their dependence on the nuclear wave function offers the possibility of strict tests of theoretical models. Usually, B(E2) rates are calculated in a restricted shell-model space and they are then renormalized with constant effective charges. However, even large-scale shell-model calculations may fall short in reproducing the experimental data, as in the case of proton-rich tin isotopes [1,2]. In this regard, there is a common but bad practice of neglecting effective three-body forces and two-body transition operators when calculating the B(E2) values which could be the origin of the problems encountered [3]. We have recently performed an experiment to measure the transitions rates from the seniority-isomers of semi-magic neutron-rich lead isotopes and they show indeed discrepancies with shell-model estimates. This region of the nuclide chart has been so far scarcely explored due to its high mass and neutron excess, which oblige to exploit fragmentations reactions with relativistic uranium beams. Consequently, neutron-rich nuclei beyond ^{208}Pb were populated by using a 1 GeV*A ^{238}U beam at GSI. The resulting fragments were separated and analyzed with the FRS-RISING setup [4,5]. Many neutron-rich isotopes were identified for the first time and a significant number of new isomers were hence discovered, enabling to study the structure of these isotopes. The new exotic isotopes observed extend up to ^{218}Pb along the Z=82 shell closure and up to N=134 and N=138 for the proton-hole and proton-particle Tl and Bi nuclei, respectively. New isomers were observed in $^{212-216}$Pb, in ^{217}Bi, in ^{211,213}Tl and in ^{210}Hg. In the talk, the experimental results will be presented as well as state-of-the-art shell-model calculations pointing out how the measured isomeric B(E2)s in neutron-rich lead isotopes seem to require state-dependent effective charges to be correctly reproduced. It will be shown how this is related with the aforementioned neglect of effective three-body forces, whose introduction improves the agreement with the experimental data. The unexpected structure of the very exotic ^{210}Hg isotope will also be discussed.

References

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