

Majorana Parameters of the Interacting Boson Model of Nuclear Structure and their Implication for $0\nu\beta\beta$ -decay

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The well-known near-X(5) nucleus ^{150}Nd is the mother nucleus of a two-neutrino double beta ($2\nu\beta\beta$) decay and therefore also a candidate for neutrinoless double beta ($0\nu\beta\beta$) decay with the daughter being ^{150}Sm . $0\nu\beta\beta$ -decay is a process only allowed if the neutrino were a Majorana particle and recently gained much attention with numerous experiments searching for $0\nu\beta\beta$ -decays, even more so as it would furthermore allow the determination of the elusive neutrino mass from its decay rate. To extract the neutrino mass or estimate decay rates, however, a nuclear matrix element (NME) is needed, which has to be calculated through suitable nuclear structure models like the Interacting Boson Model (IBM). Those calculations are further complicated by the fact that many of the $0\nu\beta\beta$ -decay candidate nuclei are located in regions of shape coexistence with the pair of ^{150}Nd and ^{150}Sm even being in the region of a shape phase transition along their respective isotopic chains. For a precise calculation of the $0\nu\beta\beta$ -decay NME in the IBM in particular also a determination of the model's Majorana parameters is necessary. This can be achieved by investigating the properties of mixed symmetry states, such as the scissors mode, whose description in the IBM is dominated by the Majorana parameters. Hence, to improve $0\nu\beta\beta$ -decay NME calculations new data on the decay characteristics of the scissors mode in ^{150}Nd and ^{150}Sm was recently taken in nuclear resonance fluorescence experiments performed at the High Intensity γ -ray Source, which I would like to present. The decay characteristics of the scissors mode are known to be sensitive to the nuclear deformation and were found to induce strong constraints on the three Majorana parameters of the IBM. This in turn resulted in an improved prediction of the $0\nu\beta\beta$ -decay NME from an updated IBM calculation utilizing newly constrained IBM parameter sets for ^{150}Nd and ^{150}Sm [1].

[1] J. Kleemann et al., Phys. Rev. C 104, L061302 (2021)

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