TWO-PHONON STRUCTURES OF BETA-DECAY RATES

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The β-decay properties are very important for understanding the nuclear structure evolution at extreme *N*/*Z* ratios, for analysis of radioactive ion-beam experiments, and modeling of the astrophysical r-process. For this reason, the β-decay properties of r-process "waiting-point nuclei" ^{129}Ag, ^{130}Cd, and ^{131}In provides valuable information, with important tests of theoretical calculations. One of the successful tools for nuclear structure studies is the quasiparticle random phase approximation (QRPA) with the self-consistent mean-field derived from the Skyrme interaction. The framework allows to relate the properties of the ground states and excited states through the same energy density functional. On the other hand, it would be desirable to overcome the discrepancies between the theoretical predictions low-energy 1^+ spectrum using the one-phonon QRPA wave functions of the daughter nucleus and the measurements [1]. We have generalized the approach to the coupling between one- and two-phonon terms in the 1^+ wave functions and the tensor force effects on the β-decay rates of neutron-rich nuclei [2]. We applied the influence of the phonon-phonon coupling on the multi-neutron emission probabilities [3]. The even-even Cd isotopes near the r-process paths at $N = 82$ was studied. In the talk we will conclude that the present approach makes it possible to perform the new microscopic analysis of the properties of the 1^+ states of the daughter nuclei ^{126,128,130}In. The model is extended by enlarging the variational space for the 1^+ states with the inclusion of the two-phonon configurations constructed from the 3^+ phonons. We find that the first 1^+ state has the dominant two-phonon configuration composed of the 3^+ phonons.

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