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Transitions To Door-way States And Nuclear Responses Against 2-body External Fields

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A nucleus is a good stage to study a many-body quantum system in nature. Excited nuclei generate a variety of vibrations, rotations, and so on, which are called nuclear collective motions. It is known that the leading-order effect of nuclear vibrational excitations is 1-particle 1-hole (1p1h) states. With increasing the excitation energy, higher-order correlations beyond 1p1h states become important. The 2 particle 2-hole (2p2h) state, the so-called doorway state, is the next leading-order effect of nuclear excitations. This configuration is important for microscopic understanding of preequilibrium states and thus high-energy particle emissions from nuclei. We recently studied 2p2h states within a second-random-phase approximation (SRPA) and found that those states are essential to describe particle emission following muon captures [1]. In addition, we also confirmed that 2-body external fields that are characterized by meson-exchange current also play a significant role to reproduce experimental data, especially those of proton spectra. Since nuclear responses against 2-body external field have not studied well as compared to those against 1-body external field, we carried out the analyses by SRPA. As a result it was found that the 2p2h states show less nuclear collectivities than 1p1h ones. In addition, depending on type of 2-body external fields, nuclei show a different characteristic collectivity from usual. We will demonstrate the detail of this mechanism and discuss its impact on particle emissions from nuclear excited states.

[1] F. Minato, T. Naito, O. Iwamoto, Phys. Rev. C107, 054314 (2023).

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