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Beyond mean-field description of key nuclear physics inputs for r-process study

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Nuclear β-decay half-lives set the time scale of the rapid neutron capture process (r-process), and hence are important for understanding the origin of heavy elements in the universe. In β-decay process, the dominant transition is the Gamow-Teller (GT) transition.

As a widely used microscopic model for GT and β-decay study, quasiparticle random-phase approximation (QRPA) has its limitations in reproducing the resonance width, and often overestimates β-decay half-lives. To overcome these problems, beyond mean-field effect, i.e., the quasiparticle-vibration coupling (QPVC), are included on top of QRPA model in a self-consistent way. With this model, we successfully reproduce the experimental GT resonance width and beta-decay half-lives at the same time in both magic nuclei and superfluid nuclei. The interplay of QPVC and isoscalar pairing are studied in detail.

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Poster

Primary author: NIU, Yifei (L)

Presenter: NIU, Yifei (L)

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