Nuclear Excitations by Spuriosity-Free Skyrme QRPA and Beyond

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The quasiparticle random-phase approximation (QRPA) is a standard method to calculate collective excitations of even-even nuclei in the mean-field theories. Current computing resources allow to routinely calculate spherical and axially symmetric nuclei over the whole nuclear chart [1, 2]. However, the calculations in certain multipolarities are polluted by spurious states, originating from the spontaneously broken symmetries (E0: pairing, E1: translation, axial M1/E2: rotation). There are various procedures how to eliminate spurious admixtures from the spectra; and these can be described as different applications of a single generalized projection method, counting with both time-even and time-odd spurious components, see Ref. [3] and references therein. Moreover, it turns out that the projection of spurious modes can be done already before the RPA diagonalization, thus allowing to obtain an orthogonal set of spuriosity-free states, suitable, *e.g.*, for two-phonon calculations. We will briefly describe these methods, and present a representative set of calculations using Skyrme functional.

References

[1] A. Repko, "Theoretical Description of Nuclear Collective Excitations," PhD thesis, Charles University, Prague (2015). arXiv:1603.04383 [nucl-th]

[2] A. Repko, J. Kvasil, V.O. Nesterenko and P.-G. Reinhard, *Eur. Phys. J. A* **53** (2017) 221.

[3] A. Repko, J. Kvasil and V.O. Nesterenko, "Elimination of Spurious Modes within QRPA," *Phys. Rev. C* (in print). arXiv:1809.01911 [nucl-th]