Rearrangement Terms in Second Tamm–Dancoff Approximation Based on Relativistic Point Coupling Interaction

D. Vale[1], **N. Paar**[2]

[1]Istrian University of Applied Sciences, Riva 6, 52100 Pula, Croatia

[2]Department of Physics, Faculty of Science, University of Zagreb, Bijenička c. 32, 10000 Zagreb, Croatia

Theoretical description of collective excitations in nuclei and astrophysically relevant processes require development of methods going beyond Random Phase Approximation (RPA), based on simple configuration space composed of 1 particle – 1 hole (1p1h) configurations. For a quantitative description of nuclear collective excitations, it is essential to describe the fragmentation of excited state spectrum at the microscopic level by introducing couplings with complex configurations. We have developed a complete self-consistent Second Tamm-Dancoff Approximation (STDA) based on the relativistic nuclear energy density functional theory. This approach allows for a comprehensive analysis of nuclear excitations by incorporating the complex interplay of 1p1h and 2 particle 2 hole (2p2h) configurations. This work is focused on analyzing isoscalar and isovector monopole and quadrupole transitions in ^{40}Ca and ^{48}Ca within the framework of STDA. We have used the relativistic contact interaction with DD-PC1 parameterization in the particle-hole channel and investigated the role of rearrangement terms on the spectrum of excited states, in particular, the position of centroid energies, and the strength distribution. This work opens perspective for the future development of a complete self-consistent description of excitation phenomena in the framework of second RPA.