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The Fidipro Deformed QRPA project: past, present and future

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QRPA calculations give important information about excited state properties of nuclei. The Fidipro nuclear theory group at the Dept. of Physics, University of Jyväskylä, has been developing advanced QRPA solvers based on Energy Density Functionals since 2008. Our goal is to produce fully self-consistent (ground state and QRPA with the same Energy Density Functional (EDF)) QRPA solvers both for axial and triaxial nuclei to the public domain. The solvers use iterative diagonalization methods generalized to handle the RPA eigenproblem [1].

The codes in development are HOSPHE-QRPA, whose HF version [2] has been published and QRPA enhanced version of HFODD [3]. Our iterative solution method has been shown to be stable, fast and resource efficient, and thus it is a good choice for more demanding QRPA calculations.

The next step in the QRPA project is to demonstrate the feasibility of iterative Arnoldi method when pairing is included and when the QRPA dimensions become very large, as with deformed nuclei. Our final goal is to be able to make accurate iterative QRPA calculations across the whole nuclear chart using either standard Skyrme or generalized EDFs.

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[2] B.G. Carlsson, J. Dobaczewski, J. Toivanen, and P. Veselý, Solution of self-consistent equations for the N3LO nuclear ener gy density functional in spherical symmetry. The program HOSPHE (v1.00) arXiv:0912.3230, submitted to Computer Physics Communications.

[3] J. Dobaczewski, W. Satuła, B.G. Carlsson, J. Engel, P. Olbratowski, P. Powałowski, M. Sadziak, J. Sarich, N. Schunck, A. Staszczak, M.V. Stoitsov, M. Zalewski, and H. Zduńczuk, Solution of the Skyrme-Hartree-Fock-Bogolyubov equations in the Cartesian deformed harmonic-oscillator basis. (VI) HFODD (v2.40h): a new version of the program, Comp. Phys. Commun. 180, 2361 (2009)

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