Abstract for an Invited Paper
for the DNP10 Meeting of
The American Physical Society

Recent Progress in Nuclear Density Functional Theory[1]

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The nuclear mean-field theory, with its various extensions, plays a major role in the description of nuclear structure and excitations, and has somewhat gained the status of "Standard Model" in nuclear structure. Until recently, its microscopic variant has relied essentially on a phenomenological nucleon-nucleon interaction. Although qualitatively very versatile, such nuclear mean-field approaches are often not as precise as Shell Model or Ab Initio techniques, and their connection with the underlying theory of nuclear forces is not very clear. Three recent evolutions are beginning to change this picture, and suggest that the spectroscopic-quality description of heavy nuclei could be possible in a not so distant future. Firstly, the remarkable achievements of the Density Functional Theory (DFT) in Quantum Chemistry have proved very fruitful for the development of its nuclear counterpart; simultaneously, major progress has been made in the construction of nuclear interactions based on chiral effective field theory; finally, the fast development of large-scale computing facilities across the world has allowed calculations that were unthinkable only a few years ago. This talk will begin by a brief overwiew of modern nuclear DFT, essentially from a practitioner's point of view. Some of the recent noticeable achievements in the field will then be reviewed. Finally, I will indicate some of the present avenues of research in nuclear DFT.

[1]This work was supported by the Office of Nuclear Physics, U.S. Department of Energy under Contract Nos. DE-FC02-09ER41583 (UNEDF SciDAC Collaboration).