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First Fully Microscopic Description of Fission with Three Collective Dimensions

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Nuclear fission occurs when a nucleus splits into smaller nuclei, releasing a significant amount of energy. Although nuclear fission was discovered more than seventy years ago, accurately predicting its behavior based on the basic constituents of nuclei remains challenging due to the extremely high dimensionality of the quantum space involving numerous particles. Hence, an approximation scheme is necessary to describe fissioning systems and simplify their complex nature into a more manageable form. The nuclear density functional theory is such a framework that can predict nuclear properties for most elements on the nuclear chart. However, it is still limited by computational constraints. As a result, most fully microscopic implementations have only considered two collective degrees of freedom, such as the elongation and the asymmetry of the fissioning system. Recently, we enhanced this approach by incorporating a third degree of freedom. This presentation explores our improvements to the theory and discusses the results we obtained with it.

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