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Microscopic description of fission process including intrinsic excitations

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The microscopic description of fission is very challenging due to the numerous degrees of freedom involved in the process: collectivity, pairing, individual excitations, dynamical effects. Furthermore, this phenomenon happens in heavy nuclei in which the number of nucleons prevents from an exact solution to the many-body problem. Several approaches based on mean-field approximations have been devised to capture its main characteristics. However, a unified description is still not available.
In this talk, I will present recent developments that open up new horizons for understanding fission within the framework of TDGCM approaches, namely the inclusion of the scission area and intrinsic excitations. To achieve these objectives, new protocols based on overlap constraints have been invented to generate continuous adiabatic and excited potential energy landscapes constructed from HFB vacua [1]. They enabled the first implementation [2] of the SCIM formalism [3] in the case of the 1D asymmetric path of Pu240. I will discuss in particular the properties of fragments close to scission as well as the energy balance, including intrinsic excitation energy.

[1] P. Carpentier, N. Pillet, D. Lacroix, N. Dubray, and D. Regnier, Phys. Rev. Lett. 133, 152501 (2024).
[2] P. Carpentier, « Microscopic and dynamical description of the fission process including intrinsic excitations », PhD thesis, Université Paris-Sacaly (2024), https://theses.hal.science/tel-04761482v1.
[3] R. Bernard, H. Goutte, D. Gogny, and W. Younes, Phys. Rev. C 84, 044308 (2011).

Type of contribution

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