Using TDHF simulations of quasifission to probe the fission surface of Og-294

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Nuclear fission, especially in heavy and superheavy nuclei, is heavily influenced by strong shell effects. The much more easily obtained quasifission reaction may probe some of the same shell effects,[1] but in order to use quasifission to understand shell effects in fission, we need to understand how shell effects manifest in quasifission. Comparisons between static calculations of potential energy surfaces and dynamic calculations of many-body processes allows a direct picture of which static effects appear in the dynamics. Time-dependent Hartree-Fock (TDHF) software [2] was used to simulate reactions forming oganesson-294 in different entrance channels, at energies chosen to produce mostly quasifission paths. These paths and their resulting fragments were compared with the fission potential energy surface (PES).[3] The comparison shows that the quasifission trajectories are strongly influenced towards the same modes as seen in the PES and suggests that quasifission can effectively probe shell effects in the fission of superheavy nuclei. The trajectories can be used to generate a map of the fission surface, which differs from the underlying PES in a few ways. The effect of excitation energy on quasifission is investigated, revealing information also corresponding to excited fission. The process of energy dissipation during quasifission is described in terms of its effect on compound nucleus shape. Results are promising for using this same method in future theoretical studies of fission modes, as well as experimental measurements of quasifission including beyond the current nuclear chart.

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[2] J. A. Maruhn, P. G. Reinhard, P. D. Stevenson, and A. S. Umar. The TDHF code Sky3D. *Comput. Phys. Commun.*, 185(7):2195–2216, jul 2014.

[3] P. G. Reinhard, B. Schuetrumpf, and J. A. Maruhn. The Axial Hartree–Fock + BCS Code SkyAx.