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Interplay between surface and volume instabilities in heavy-ion collisions examined within mean-field extensions

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In the transition from nuclear matter to finite nuclei, complex finite-size effects which characterise open systems arise, in relation with either the nuclear surface or the bulk. In addition, the non-equilibrium character of the process, typical of violent heavy-ion collisions (from Fermi energy to the intermediate-energy domain) adds up as well. The resulting dynamics is the combination of surface and volume unstable modes which trigger large-amplitude fluctuations. As a result, a rich variety of fragmentation patterns may arise, ranging from collimated streams of nuclear clusters to the split of stretched nuclear complex into few large fragments. They imply different conditions of density and surface tension, and result in different chronologies. Such phenomenology has been observed in experiments, but it is often difficult to recognise and disentangle the underlying types of instabilities.

To draw some example, selected processes, related to extremely deformed nuclear systems produced below and above Fermi energy, will be followed microscopically from the collision to the rupture or disintegration into fragments and clusters, within extended mean-field approaches.

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