Role of the surface energy in heavy-ion collisions

P. D. Stevenson[1]
[1] *Department of Physics, Universirty of Surrey, Guildford, Surrey, GU2 7XH, United Kingdom*

A series of Skyrme interaction parameters (called SLy5sX for X=1..8) has recently been developed [1] in which there is a systematic variation of the surface energy, i. e. the coefficient a_{surf} term in the semi-empirical mass formula

$$E(A) \approx a_{vol} A + a_{surf} A^{\frac{2}{3}} + a_{curv} A^{\frac{1}{3}} + \ldots$$

An exploration of these interactions shows e.g. that the systematic variation of the surface energy leads to a conspicuous variation in the deformation energy for the fission barriers in ^{240}Pu as a_{surf} varies.

We systematically explore the properties of these SLy5sX parameters in heavy-ion collisions on the supposition that interesting results may occur since a lower surface energy means that a nucleus is more easily deformed and may be more easily polarized in the early stages of the fusion pathway, or during a glancing reaction.

Results of fusion calculations for ^{40}Ca + ^{48}Ca with the Frozen Hartree Fock approximation and with Time-Dependent Hartree-Fock show a slight but monotonic decrease in the fusion barrier height as the surface energy increases, with a barrier difference of ~200 keV between the extreme values of the surface energy.

Calculations of heavier nuclei, in which nuclear matter properties have a more dominant role than in lighter nuclei, are underway and will be presented.

[1] R. Jodon, M. Bender, K. Bennaceur, and J. Meyer, *Phys. Rev.* **C 94**, 024335 (2016)