Contribution ID: **12** Type: **not specified**

Pauli energy contribution to nucleus-nucleus interaction

The Pauli exclusion principle induces a repulsion between nuclei, widening the nucleus-nucleus potential barrier, thus hindering sub-barrier fusion.
Protons and neutrons can make different contributions to this Pauli repulsion, depending on the system. We investigate these contributions both in the bare (static) potential and in the dynamical potential obtained by accounting for shape polarization and transfer between the reactants.This is done through the analysis of the Pauli kinetic energy obtained from the nucleon localisation function. This approach is employed in the density constrained frozen Hartree-Fock (DCFHF) and in the density constrained time-dependent Hartree-Fock (DC-TDHF) microscopic methods. Our analysis suggests that Pauli repulsion effects occur primarily in the "neck" between fragments at a distance of approach comparable to the barrier radius. Moreover, inside the barrier neutron contributions dominate in neutron-rich systems.

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