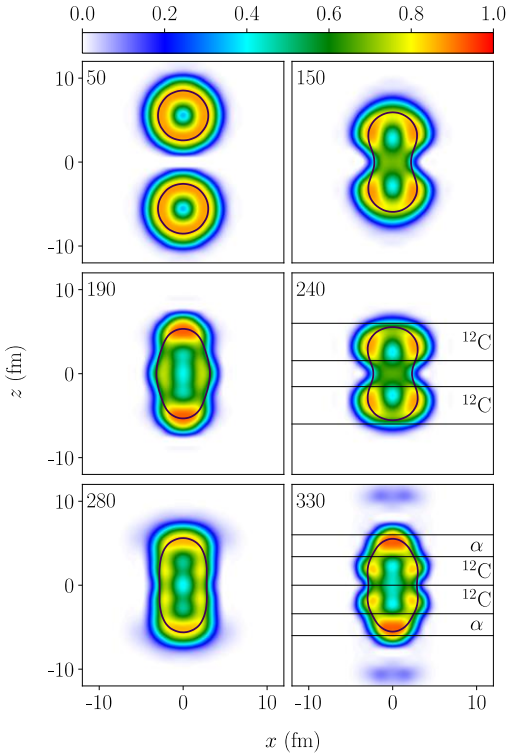
Computer studies of colliding oxygen nuclei

Objectives

- We use nuclear time-dependent density functional theory (TDDFT) to provide quantitative description of heavy ion reactions involving carbon, oxygen, and calcium nuclei.
- We utilize the TDDFT solver, which solves the time-dependent Hartree-Fock equations in coordinate space using fast Fourier transforms.

Impact

- The time-dependent nucleon localization is a very good indicator of cluster structures in complex states formed in heavy-ion fusion reactions.
- Our results supports the experimental findings that the presence of cluster structures in the projectile and target nuclei gives rise to strong entrance channel effects and enhanced α emission.



Nucleon localization for the central collision of $^{16}O+^{16}O$ at E_{cm}=20 MeV. The numbers indicate the collision time (in fm/c). At later times, the fused system exhibits a collective oscillation of two ^{12}C rings against two α clusters.

Accomplishments

- Publication: B. Schuetrumpf and W. Nazarewicz, Phys. Rev. C 96, 064608 (2017).
- Animations published in Supplemental Material.
- Highlighted as Editors' suggestion.
- Featured in Physics (phys.aps.org) as Physics Focus: Video-Nuclear Fusion in Hi-Def.
- Highlighted by GSI.