SOLITONIC EXCITATIONS IN COLLISIONS OF SUPERFLUID NUCLEI

Kazuyuki Sekizawa[1], Gabriel Wlazłowski[1,2], Piotr Magierski[1,2]
[1] Faculty of Physics, Warsaw University of Technology, Warsaw, Poland
[2] Department of Physics, University of Washington, Seattle, Washington, USA

The effect of the pairing correlations on reaction dynamics has attracted substantial interests in nuclear physics. Although a number of studies have been performed so far, we have still quite poor knowledge about it. We attack this problem by applying a newly developed efficient computational code for the time-dependent density functional theory (TDDFT) including superfluidity, TDSLDA. Since we solve TDSLDA equations in 3D Cartesian coordinates without any symmetry restrictions, we can simulate both central and non-central collisions. As a first attempt, we utilize the FaNEDF^0 functional developed by Fayans *et. al.*, neglecting the spin-orbit interaction. We have performed TDSLDA calculations for ^{90}Zr+^{90}Zr and ^{240}Pu+^{240}Pu collisions at energies around the Coulomb barrier. To examine the role of the phase (gauge angle) difference between the two superfluid nuclei, we performed calculations for various phase differences. From the results, we have found that the phase difference significantly affects the reaction dynamics: *e.g.* the threshold energy for fusion in ^{90}Zr+^{90}Zr is changed as large as 30 MeV; total kinetic energy (TKE) of outgoing fragments is changed about 20 MeV; moreover, even the number of fragments can be different in ^{240}Pu+^{240}Pu. We have found that these effects are originated from solitonic excitations of superfluid medium associated with the phase discontinuity between two nuclei. In this talk, we will show the qualitatively new possibility indicated by the cutting-edge, microscopic simulations.