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Mixing time dependent mean-field trajectories to describe the dynamics of the collision between two superfluid nuclei

Recently the role of pairing correlations on the two particles transfer channel has received a surge of interest as new highly accurate measurements have been achieved [1,2]. The Hartree-Fock-Bogoliubov (HFB) theory accurately grasps superfluidity by explicitly breaking the particle number symmetry. However, a precise description of phenomena like the particle transfer during heavy-ion reactions can only be achieved by considering states with good particle number. A theoretical approach able to predict the dynamics of such symmetry restored states is a necessary tool to better understand nuclear reactions. We recently took a first step toward this objective by proposing a semi-classical approach to recombine an ensemble of time dependent HFB states [3]. Going further, we are now investigating a fully quantum mixing of the same ensemble of mean-field trajectories that takes properly into account the interferences arising in the dynamics.
In this talk, I will first review some recent results on the topic of the transfer of particles in sub-barrier collisions between open shell nuclei. I will insist on the role of the pairing residual interaction on the enhancement factor between the one and two particle exchange channel, and highlight the shortcoming of the time dependent HFB approach. I will then emphasize our recent attempts to treat the collisions between superfluid nuclei within a semi-classical and a fully quantal evolution of an ensemble of time dependent HFB trajectories. Finally, the possibility to apply such methods to a realistic collision will be discussed as well as the possible partner nuclei that would be best suited to probe the pairing correlations in futur experiments.

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