Hot fragment formation in heavy-ion collisions at non relativistic energies

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The fragmentation process starts early during the hot stage of heavy-ion collisions, when colliding nuclei come close to each other and may overlap, depending on the impact parameter, and is completed in the following de-excitation phase, when the hot fragments initially formed lose their energy by processes such as photon emission, evaporation, fission and Fermi break-up. These two phases take place on time scales which may differ by several order of magnitudes, so they are better described by different models. In this work the first phase is modelled by means of a code we have built according to Quantum Molecular Dynamics principles with refinements, while the second one is simulated through models embedded in the FLUKA code. The identification of the hot fragments at the end of the first stage is thus crucial to establish the inputs for the following de-excitation phase.

Working in the framework of a QMD-like approach, methods to identify hot fragments at the end of the fast stage of ion-ion collisions are investigated. One consists in defining projectile-like and target-like residues on the basis of ion-ion geometrical overlap and nucleon-nucleon collision occurrence. One should investigate if this schematization may reproduce the multifragmentation which takes place in central collisions at projectile bombarding energies of the order of several tens MeV/A. The alternative Minimum Spanning Tree method, which is based on the phase-space nucleon distribution, seems to be suitable to reproduce these data. Modifications of this method are proposed by us, made taking into account nucleon-nucleon potential effects, beyond nucleon-nucleon phase-space distance. The effects on the final results of the theoretical simulations of heavy-ion collisions are discussed, considering the constraints posed by experimental data concerning fragment distributions at the end of both phases.