COMPREHENSIVE CALCULATIONS OF HEAVY ION INTERACTIONS

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Accurate knowledge of reactions which may occur when two heavy ions interact is of crucial importance in many trans-disciplinary fields, particularly in medicine and space physics. In these cases one needs to know not just the results of particular processes, as investigated in many experiments, but what happens in a natural process to which all possible reaction mechanisms contribute. The collection of this information requires a considerable experimental and theoretical effort. In fact, a theoretical calculation to be really usable should be able to reproduce large sets of data in wide energy and mass ranges. While such calculations are extensively made for nucleon induced reactions, heavy ion interactions are much less studied.

In this contribution an account is given of some results which we have recently obtained in a series of investigations aimed to contribute to fill this gap in our knowledge, considering heavy ion interactions from the Coulomb barrier up to relativistic energies and adopting different approaches.

Reactions induced by light projectiles at few tens of MeV/n are studied by very simplified mean field calculations coupled with the Boltzmann Master Equation theory, describing the preequilibrium deexcitation of the composite system created by the interaction of two nuclei. Its MonteCarlo implementation allows to predict a wide variety of cross sections, i.e. both double differential spectra of light particles and intermediate mass fragments and quite demanding observables, like excitation functions for the production of individual heavy residues.

Reactions between medium and heavy nuclei at several hundreds of MeV/n are analysed interfacing the FLUKA code with a Relativistic Quantum Molecular Dynamics model.

These calculations seem to suggest that it may be within our reach to provide a comprehensive description of large sets of data and predict with fair accuracy cross sections of unmeasured reactions.

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