High Energy Physics - Phenomenology

Transport-theoretical Description of Nuclear Reactions

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In this review we first outline the basics of transport theory and its recent generalization to off-shell transport. We then present in some detail the main ingredients of any transport method using in particular the Giessen Boltzmann-Uehling-Uhlenbeck (GiBUU) implementation of this theory as an example. We discuss the potentials used, the ground state initialization and the collision term, including the in-medium modifications of the latter. The central part of this review covers applications of GiBUU to a wide class of reactions, starting from pion-induced reactions over proton and antiproton reactions on nuclei to heavy-ion collisions (up to about 30 AGeV). A major part concerns also the description of photon-, electron- and neutrino-induced reactions (in the energy range from a few 100 MeV to a few 100 GeV). For this wide class of reactions GiBUU gives an excellent description with the same physics input and the same code being used. We argue that GiBUU is an indispensable tool for any investigation of nuclear reactions in which final-state interactions play a role. Studies of pion-nucleus interactions, nuclear fragmentation, heavy ion reactions, hyper nucleus formation, hadronization, color transparency, electron-nucleus collisions and neutrino-nucleus interactions are all possible applications of GiBUU and are discussed in this article.

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