

REALISTIC MANY-BODY WAVE FUNCTIONS FOR HEAVY-ION COLLISIONS SIMULATION

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In the past decade measurements utilizing high energy electron-nucleus scattering at Thomas Jefferson Laboratory, have identified two-nucleon Short Range Correlations (SRCs), studied their structure and related them to the underlying basic short range Nucleon-Nucleon (NN) interaction. The local nuclear matter density of the SRC-pair is several times larger than that of the central density in nuclei and comparable to that expected in neutron stars. The significant value of SRCs observed recently could be important to understand the physics of neutron stars, where a small concentration of protons is compensated to large extent by a significantly larger probability of SRCs in proton-neutron systems as compared to neutron-neutron systems. The study of SRCs could therefore help to answer several questions on their formation, resulting from the interplay of gravitational pressure and repulsion due to fundamental microscopic phenomena in QCD. Theoretical calculations show that the startlingly large ratio of np-SRC/pp-SRC is a strong indication of the operation of an NN tensor force in the pair at those nucleon separations and relative momenta studied in dedicated experiments; I discuss here such experiments and theoretical description of NN correlations effects, which can also be important in high-energy collisions. These effects can be included consistently in Monte Carlo event generator for the production of nucleon configurations in complex nuclei; we adopted an approach based on the Metropolis search for those configurations satisfying essential constraints imposed by the findings of realistic calculations of one- and two-body densities for medium-heavy nuclei and the produced event generator can be effectively used for simulation studies of pA and AA collisions.