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NON-EQUILIBRIUM HYDRODYNAMIC APPROACH AND COLLISION OF ATOMIC NUCLEI IN APPROXIMATION OF THE KORTEVEG-DE VRIES SOLITONS

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The main purpose of the study of heavy ion collisions is to study the equation of state of nuclear matter (EOS - equation of state). Along with molecular dynamics and the Vlasov dynamic equation, nuclear hydrodynamics is an effective method for describing the interaction of heavy ions at medium and intermediate energies. In our works [1-3], it was shown that local thermodynamic equilibrium in the process of heavy ion collisions is not established immediately, since the nonequilibrium component of the distribution function is important at the compression stage, which leads to the formation of a collisionless shock wave.

In this work, we used a kinetic equation to find the nucleon distribution function, which is solved together with the hydrodynamic equations, and at low energies leads to the equations of long-range hydrodynamics. Within the framework of the hydrodynamic approach, an analytical solution of the equations in the soliton approximation for the collision of nuclear slab layers is found. The compression stage, the expansion stage, and the fragmentation stage are considered in the framework of a single formula for layers with energies of the order of ten MeV per nucleon. This reduction of solutions of the hydrodynamic equations to the solution of two Korteweg - de Vries equations, as far as we know, has not been previously considered and is of independent interest for a wide range of applied problems.

As a result, we were convinced that the introduction of dispersion in the effective forces and in the pressure does not violate the idea of a hot spot formation. The introduction of additional dimensions will not fundamentally break this representation. The nonequilibrium equation of state, which is part of the hydrodynamic equations, allows us to describe the experimental energy spectra of secondary particles formed in collisions of heavy ions of intermediate energies better [2-3] than the equation of state corresponding to traditional hydrodynamics, which initially assumes the establishment of local thermodynamic equilibrium.

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