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HYPERBOLIC KINETIC CONSISTENT 3D MHD FOR HIGH PERFORMANCE PARALLEL COMPUTING

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The tremendous progress of the kinetic consistent schemes in solution of the gas dynamic problems and development of the effective parallel algorithms for the modern high performance parallel computing systems leads the tendency to development of advanced methods for solution of the MHD problems for critical areas of today and future.
The novel method proposed to extend the Boltzmann like distribution function with implementation of electromagnetic terms as complex distribution function. This gives powerful tools for the solution of the MHD system of equation in frame of kinetic consistent schemes with common approach for the electromagnetic and gas dynamic processes.
The numerical algorithm is based on the explicit scheme, considered preferable for the new generation of the high performance parallel computing systems. It is explained by the logical simplicity and efficiency the algorithms and possibility of easy adaptation to the modern high performance parallel computer systems, including hybrid computing systems with graphic processors. However, the stability conditions are the price to be paid for algorithmic simplicity of the explicit schemes. The detailed space discretisation, from physics point of view and accuracy could require an inordinately small time steps to perform the simulation. The present study propose the extend method of stabilisation of explicit scheme by introducing the hyperbolic terms of MHD equations in particular the second order derivative in time with the regularization parameter which chosen from physics point of. The original physically founded approach gives the significant improvement in the stability condition for explicit schemes. The results of numerical modelling of a set of gas dynamic and confinement of the expanding ionized gas in strong magnetic field are discussed.

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