A Lattice Drift Equation for Magnetised Plasma Dynamics

A. Kendl

Institut für Theoretische Physik, Universität Innsbruck,
Technikerstr. 25, A-6020 Innsbruck, Austria

The Lattice Boltzmann Method (LBM) is an intriguingly intuitive and still mathematically rigorous method for numerical simulation of nonlinear incompressible fluid dynamics. An increasing range of fluid phenomena, including turbulence, reactive flows, colloids or magnetohydrodynamics, has been investigated within its framework during recent years.

Here, a Lattice Boltzmann equation for the dynamics of a plasma in the 2D drift plane perpendicular to a magnetic field is presented and is solved numerically with standard LB methods. The electrons are here assumed to be adabatic. The relation to the Hasegawa-Mima (HM) equation in the fluid limit and to dynamics of HM turbulence is shown.

The portential of LBM for application to more realistic problems related to magnetised plasma turbulence (e.g. to Hasegawa-Wakatani or interchange dynamics) and apparent difficulties and limitations of the method in this respect are discussed.