



复旦大学数学科学学院 数学综合报告会

报告题目: On Magnetic Buoyancy Problem in the MHD Fluids

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摘要: We investigate a perturbation problem for the three-dimensional compressible isentropic viscous magnetohydrodynamic system with zero resistivity in the presence of a modified gravitational force in a vertical strip domain in which the velocity of the fluid is non-slip on the boundary, and focus on the stabilizing effect of the (equilibrium) magnetic field through the non-slip boundary condition. We show that there is a discriminant ξ , depending on the known physical parameters, for the stability/instability of the perturbation problem. More precisely, if $\xi < 0$, then the perturbation problem is unstable, i.e., the Parker instability occurs, while if $\xi > 0$ and the initial perturbation satisfies some relations, then there exists a global (perturbation) solution which decays algebraically to zero in time, i.e., the Parker instability does not happen. The stability results reveal the stabilizing effect of the magnetic field through the non-slip boundary condition and the importance of boundary conditions upon the Parker instability, and demonstrate that a sufficiently strong magnetic field can prevent the Parker instability from occurring. In addition, based on the instability results, we further rigorously verify the Parker instability under Schwarzschild's or Tserkovnikov's instability conditions in the sense of Hadamard for a horizontally periodic domain.

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