Effect of Dust Particles on Thermal Convection in a Ferromagnetic Fluid

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This paper deals with the theoretical investigation of the effect of dust particles on the thermal convection in a ferromagnetic fluid subjected to a transverse uniform magnetic field. For a flat ferromagnetic fluid layer contained between two free boundaries, the exact solution is obtained, using a linear stability analysis. For the case of stationary convection, dust particles and non-buoyancy magnetization have always a destabilizing effect. The critical wavenumber and critical magnetic thermal Rayleigh number for the onset of instability are also determined numerically for sufficiently large values of the buoyancy magnetization parameter M_1. The results are depicted graphically. It is observed that the critical magnetic thermal Rayleigh number is reduced because the heat capacity of the clean fluid is supplemented by that of the dust particles. The principle of exchange of stabilities is found to hold true for the ferromagnetic fluid heated from below in the absence of dust particles. The oscillatory modes are introduced by the dust particles. A sufficient condition for the non-existence of overstability is also obtained.

Key words: Ferromagnetic Fluid; Thermal Convection; Vertical Magnetic Field; Dust Particles.