

Magnetoconvection in rotating fluid spheres and the Earth's magnetic field

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A linear and nonlinear analyses of magnetoconvection in a rotating fluid sphere is carried out. A uniform magnetic field parallel to the spin axis is applied to the sphere. According to the linear analysis, we find that there coexist a two-dimensional convective mode (E mode) with a few convection columns and a three-dimensional polar convective mode (P mode) characterised by a large-scale meridional convection at some circumstances of the magnetic field. In particular, the P mode produces an axial quadrupole magnetic field from a seed dipole field. In this study, we report some results of nonlinear magnetoconvection and argue the spatial and temporal characteristics of the Earth's magnetic field.