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Nonlinear Convective Patterns in Spherical Rayleigh–Bénard Systems

Xinhao Liao[(1)], Keke Zhang[(2)]

(1) *Shanghai Astronomical Observatory, Chinese Academy of Sciences, Shanghai, China*
(2) *School of Mathematical Sciences, University of Exeter, UK*

Nonlinear thermal convection in a spherical fluid layer in the presence of spherically symmetric gravity, spherical Rayleigh–Bénard convection, is investigated. At the onset of spherical Rayleigh–Bénard convection, there exists the (2l+1)-fold degeneracy of the linear solution, where l is the degree of a spherical harmonics. Nonlinear convection is studied through fully three-dimensional numerical simulations. Several new spherical patterns of nonlinear convection are found. In particular, a steadily drifting pattern in the form of a single giant spiral roll covering the whole spherical surface without defects is discovered for various Prandtl numbers for the first time.

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