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Visualization of Turbulence Structures Reorganization in Thermal Convection Subjected to External Magnetic Field

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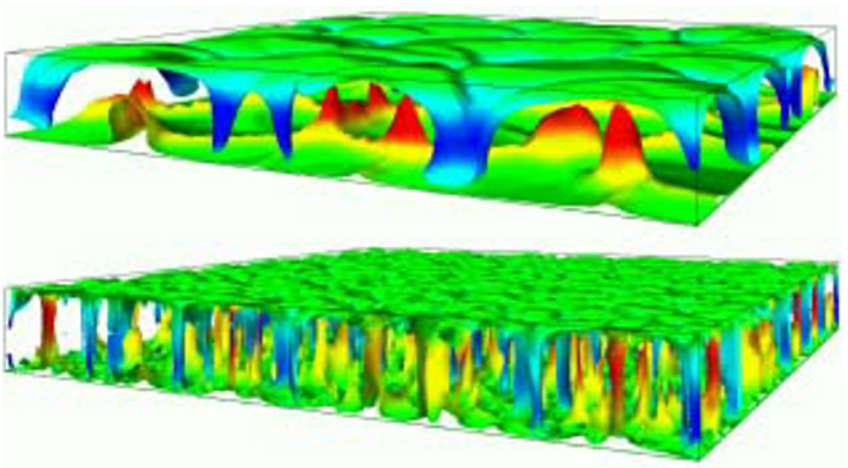

Fig. 1. Spatial reorganization of thermal plumes (isosurfaces of temperature, T_{ref}+0.1ΔT and T_{ref}-0.1ΔT, colored by vertical velocity, -0.3 <W<0.3) in magnetic Rayleigh-Benard convection: Ra=10^7, Ha=0, 100; Homogeneous magnetic field is applied in the vertical direction, B(0,0,B_z)

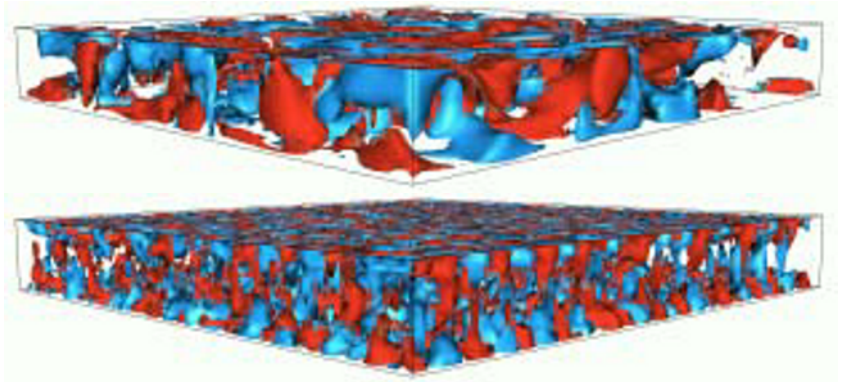

Fig. 2. Vertical vorticity component, $\omega_{\hat{z}}=\omega_z/|\omega|$=0.6 (blue) and –0.6 (red) for Ha=0 (above) and $\omega_{\hat{z}}=\omega_z/|\omega|$=0.3 (blue) and –0.3 (red) for Ha=100

Numerical simulations of classic and magnetic turbulent thermal convection between two infinite horizontal walls of different temperatures have been performed using the transient Reynolds averaged Navier-Stokes (T-RANS) method. A major effect of vertically oriented magnetic field is in the suppression of the velocity and vorticity components in the horizontal plane (i.e. the plane where the Lorentz force is active). This suppression leads to an alignment of the velocity vector with magnetic field deforming the convective roll/cells into vertically oriented cylindrical structures.