Control of convection in both the vertical and the horizontal annulus

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Fluid mechanical instabilities are present in nature and engineering. Here we focus on the experimental and numerical study of viscous flow by geometric and dynamic similarity. The objective is to capture patterns, which exist due to specific initial and boundary conditions in dependence of the driving mechanism (i.e. Reynolds number, Rayleigh number).
To be specific, we consider the enhancement of heat transfer by means of ElectroHydroDynamic EHD force, which is set-up in the dielectric fluid-filled vertical annulus. With the permittivity to be temperature dependent and a radial temperature gradient as well as a radial alternating electric field we generate a radial electric buoyancy force, which increases with increasing applied voltage and with decreasing annular radii. The major effect observed is the enhancement of heat transfer via the convective flow pattern created. In a further step this annulus system is regarded horizontal, therewith inducing different basic flow and moreover different instabilities.

Aspects, which are addressed in the talk:
- Navier-Stokes equation
- dynamic similarity
- experimental design
- numerical simulation
- hydrodynamic stability