Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Direct numerical simulation of Taylor-Couette flows between two co-rotating cylinders with radial heating[1] HAO TENG, NANSHENG LIU, XIYUN LU, Department of Modern Mechanics, University of Science and Technology of China, MULTI-SCALE COMPLEX FLOW LAB. TEAM — In the present work, Taylor-Couette (TC) flows subjected to radial heating have been investigated by using of direct numerical simulation (DNS). For our simulations, the base flow is driven between two co-rotating concentric cylinders; radial heating is modeled by a radial temperature gradient between the hot inner and cold outer cylinders, which introduces a coupling effect characterized by a ratio (σ Gr/Re^2) between the buoyancy force driving fluid elements moving axially and the centrifugal force driving a radial fluid motion. Here, the Grashof (Gr) and Reynolds (Re) numbers represent the non-dimensionalized buoyancy and centrifugal forces, respectively. It is demonstrated that increasing σ from 0 to 0.4 leads to a flow state transition from the wavy Taylor vortex (WTV) TC flows driven by the centrifugal force to the distorted Taylor vortex (DTV) TC flows arising as a result of the buoyancy and centrifugal force competition, and eventually to the buoyancy dominated turbulent (BDT) TC flows identified as the vanishing of Taylor vortices that are replaced by turbulent vertical structures of small scales. These three flow states are distinguished by their flow structures, dynamical properties, and energy spectra.

[1]This work is supported by NSFC No. 11272306.

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Date submitted: 17 Jul 2014 Electronic form version 1.4