Title:
Instability and Turbulence in Rotating Flows Exited by Electromagnetic Forcing

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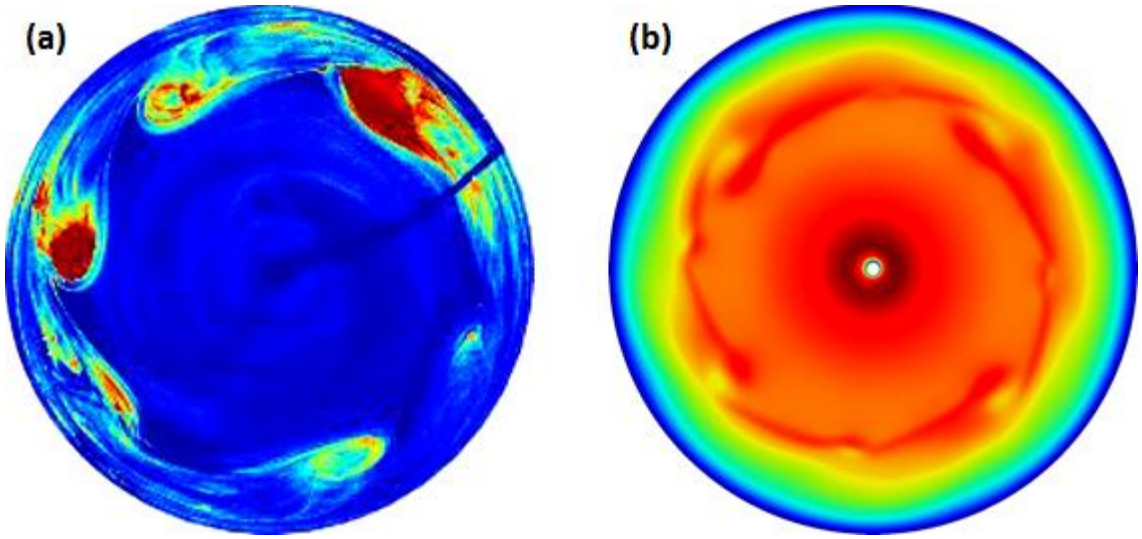
Grant:
Teaching Assistant Grant

Short Description:
Rotating flows are found in natural phenomena or in artificial devices and are thus crucial to different fields of Physics and Engineering. The domain of applications ranges from simple household equipment like vacuum cleaners to jet engines and magnetized thermonuclear plasmas in tokamaks. The aim of this project is to analyze and characterize numerically and experimentally the Taylor-Couette and non-axisymmetric instabilities of an electrolyte poured into a cylindrical container which is subject to electromagnetic forcing at low Reynolds numbers. Moreover, quasi-2D turbulence is analyzed in presence of magnetic field gradient to study zonal flows. The numerical simulations are performed using an in-house code developed using the open source C++ library OpenFOAM 5.0. Experiments are conducted using the Particle Image Velocimetry (PIV) at NDU lab to validate and compare with the numerical results.



(a) Non-axisymmetric vortices on the free surface of shallow rotating electrolyte obtained from experimental visualization and (b) tangential velocity distribution obtained from numerical simulations using CFD solver developed under OpenFOAM C++ library