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Investigation of Stratorotational Instability (SRI) in Taylor-Couette flows with axial temperature gradient

Christoph Egbers (1), Marcus Gellert (2), Uwe Harlander (1), Yongtai Wang (1), and Günther Rüdiger (2)

(1) BTU Cottbus, Aerodynamics & Fluid Mechanics, Cottbus, Germany (egbers@tu-cottbus.de), (2) Astrophysikalisches Institut, Potsdam, Germany (Marcus Gellert <mgellert@aip.de)

We investigate the instability and nonlinear saturation of
temperature-stratified Taylor-Couette flows in a finite height cylindrical gap and calculate angular-momentum transport in the nonlinear regime. The model is based on an incompressible fluid in Boussinesq approximation with a positive axial temperature gradient applied. While both ingredients alone, the differential rotation as well as the stratification due to the temperature gradient, give a stable flow, stratorotational instability occurs when stratification and differential rotation interact. In that case the instability triggers a nonaxisymmetric flow pattern.This flow configuration transports angular momentum outwards and will therefore be relevant
for astrophysical applications. The strength of the stratification, the fluids Prandtl number and the boundary conditions applied in the simulations are well-suited for a laboratory experiment using water and a small temperature gradient of about 5 K. Such an experiment has been developed and tested. We report on systematic parameter variations as a function of differential rotation rate and axial temperature gradient, i.e. variation of Reynolds number, Froude number, Grashof number with different experimental measuring techniques (thermographic camera, LDV, PIV). The aim is a direct measurement of the fluctuations of the radial and azimuthal velocity components to determine Reynolds stress and angular momentum transport.