The effects of the Taylor vortex on Taylor–Couette turbulence

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Taylor–Couette flow, the flow between two coaxial co- or counter-rotating cylinders, is one of the paradigmatic systems in the physics of fluids. The (dimensionless) control parameters are the Reynolds numbers of the inner and outer cylinders, the ratio of the cylinder radii, and the aspect ratio. One key response of the system is the torque required to retain constant angular velocities, which can be connected to the angular velocity transport through the gap. Whereas the low Reynolds number regime was well explored in the 1980s and 1990s of the past century, in the fully turbulent regime major research activity developed only in the past decade. [1]

One of the intruiging features of highly turbulent Taylor–Couette flow, is the survival of a large scale flow structure about the size of the gap width - the Taylor vortex [2]. This vortex plays a dominant role in the transport of angular velocity from one cylinder to the other, and hence the strength of the Taylor vortex is reflected in the torque on any of the cylinders. In this project we wish to investigate the susceptibility of the Taylor vortex to varying boundary and initial conditions, and in parallel, we wish to study the effects of the Taylor vortex on the turbulent flow statistics.

The research will be carried out by means of numerical simulations and with the use of High Performance Computers. Motivated students are encouraged to seek contact with the above mentioned supervisors.

References

[1] S. Grossmann, D. Lohse, and C. Sun. High Reynolds number Taylor-Couette turbulence. *Annu. Rev. Fluid Mech.*, 48:53–80, 2016.

[2] S. G. Huisman, R. C. A. van der Veen, C. Sun, and D. Lohse. Multiple states in highly turbulent Taylor-Couette flow. *Nature Commun.*, 5:3820, 2014.