Dynamics near the subcritical transition of the 3D Couette flow

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Abstract

It is well known that the 3D Couette flow is stable for the Navier-Stokes dynamics. However, the main question is to find the size of the allowed pertubation depending on the viscosity.

In this talk, we will discuss the dynamics of small perturbations of the plane, periodic Couette flow in the 3D incompressible Navier-Stokes equations at high Reynolds number. For sufficiently regular initial data, we determine the stability threshold for small perturbations and characterize the long time dynamics of solutions below this threshold. The primary stability mechanisms are an anisotropic enhanced dissipation effect and an inviscid damping effect of the velocity component normal to the shear, both a result of the mixing caused by the large mean shear. After detailing these linear effects, we will discuss some of the important steps in the proof, such as the analysis of the weakly nonlinear (potential) instabilities connected to the non-normal nature of the linearization. Joint work with Jacob Bedrossian and Pierre Germain.

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