Karlsruhe Institute of Technology

Seminar of the Work Group
Nonlinear Partial Differential Equations
WS 23/24

November 7th, 2023, 12:15 - 13:00
Seminar room: SR 3.061

Stability Threshold of the 2D Couette Flow in a Homogeneous Magnetic Field

Michele Dolce, EPFL

Abstract

A planar incompressible and electrically conducting fluid can be described by the 2D Navier-Stokes-MHD system. One simple yet physically relevant laminar state is the Couette flow with a constant homogeneous magnetic field, given by $u_E = (y, 0)$, $B_E = (b, 0)$ in the domain $T \times R$. The goal is to estimate how large can be a perturbation of this state while still resulting in a solution close to the laminar regime, thereby preventing the onset of turbulence. We prove that Sobolev regular initial perturbations of size $O(Re^{-2/3})$, with Re being the Reynolds number, remain close to u_E, B_E and exhibit dissipation enhancement. The latter quantifies the convergence towards an x-independent state on a time-scale $O(Re^{-1/3})$, much faster than the standard diffusive one $O(Re^{-1})$.