Karlsruhe Institute of Technology

Mini-Workshop "Analysis of PDEs"
March 27th - March 31st, 2023

10:00 - 11:00 am, Thursday, March 30th 2023
Seminar room: SR 1.067, Math Building 20.30

Hyperbolic effects in incompressible fluid mechanics

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Abstract

In this talk, we are interested in the well-posedness of certain systems of PDEs arising in models of fluid mechanics and which present a hyperbolic structure.

After a short overview of previous results available for the incompressible Euler equations, both in its homogeneous and non-homogeneous versions, we focus on the special case of a system which describes the dynamics of an incompressible fluid having variable density and presenting *non-dissipative* viscosity effects. Examples of such fluids arise both in quantum and classical hydrodynamics.

At the level of the mathematical model, the non-dissipative nature of the viscosity is encoded by an odd term, dubbed precisely *odd viscosity* tensor. As the odd viscosity term involves higher order space derivatives of the velocity field and of the density, it is responsible for an apparent loss of regularity in the classical *a priori* estimates.

In this talk, we will show how to circumvent such a loss of derivatives by introducing a set of *good unknowns*, which allow to highlight a hyperbolic structure underlying the system of equations. As a consequence, we will establish a well-posedness result in the framework of Sobolev spaces of high enough regularity.

The talk is based on a joint work with *Rafael Granero-Belinchón* (Universidad de Cantabria) and *Stefano Scrobogna* (Università degli Studi di Trieste).