

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

11:30 - 12:30 am, Thursday, March 30th 2023
Seminar room: SR 1.067, Math Building 20.30

Global existence for the two-dimensional incompressible Navier-Stokes equations
with variable and rough density, and dynamic interpolation

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Abstract

We are interested in the inhomogeneous Navier-Stokes system (NSI) governing the evolution of fluids which, although incompressible, are of variable density. This system is a coupling between a transport equation for the density, and an evolution equation similar to the "classical" Navier-Stokes equation for the velocity. As for the constant density case, it is known since Kazhikhov's seminal paper in 1974 that any initial data with finite energy velocity and strictly positive bounded density generates a global weak solution of finite energy for (NSI). But, except in the constant density case and in dimension two, it is not known whether these solutions are unique. In this talk we will give a sufficient condition on the initial velocity, only slightly stronger than the finite energy condition, ensuring the existence and uniqueness in dimension two. We do not impose any smallness condition on the initial data, and no regularity on the density. The constructed solution admits a continuously differentiable flow, which ensures the persistence of the discontinuity interfaces for the density, for example. The proof relies on elementary energy and interpolation arguments, which are valid in rather general fluid domains.