Abstracts of the June 21, 2024 session of the Paris-London Analysis Seminar

Frédéric Charve (Université Paris-Est Créteil)

Hidden asymptotics for the weak solutions of the strongly stratified Boussinesq system without rotation

Abstract. It is known that when the Froude number goes to zero, the solutions of the strongly stratified Boussinesq system tend towards those of a 3D-Navier-Stokes-type system (but with only two components). Surprisingly, this limit system does not depend on the thermal diffusivity $\nu' > 0$. In this talk we explain how to modify the initial data in order to obtain a limit system that really depends on ν' . We will first present the system, then formally obtain a general limit system that we will validate by choosing unconventional initial data. This limit induces a structure that will enable us to separate the solutions of the initial system into two parts, which we will study separately. The convergence will require new Strichartz estimates.

Michele Coti-Zelati (Imperial College, London)

Stability and entropy maximization in the two-dimensional Euler equations

Abstract. We investigate certain questions arising in two-dimensional statistical hydrodynamics, by relying on principles of entropy maximization for the vorticity of a two-dimensional perfect fluid in a disc. In analogy with the entropy functions used in statistical mechanics and thermodynamics, we show that similar concavity properties hold for the 2d Euler equations when maximizing entropies at fixed energy levels. The proofs rely on rearrangement inequalities, a modification of the classical min-max principle, and the properties of the Euler-Lagrange equations for the corresponding constrained optimization. As a byproduct, we obtain Lyapunov stability for Onsager solutions arising from a system of point-vortices.

Nejla Nouaili (Université Paris Dauphine)

Singularities in the Complex Ginzburg-Landau equation

Abstract. I will present recent results about the study of singularities for the Complex Ginzburg-Landau (CGL) equation. The cubic CGL equation is the most-studied nonlinear equations in the physics community. It was first derived by Newell and Whitehead in 1969 modeling the development of instability in fluid convection problems. The study of singularity formation for CGL equation has received a lot of attention in many works. Typically, we refer to Stewartson and Stuart 1971 for the description of an unstable plane Poiseuille flow. The rigorous proof of the existence of blowup solutions for the CGL equation remained an open question for a long time. I will present constructive examples of finite-time blow-up solutions to the CGL equation. This talk is based on results obtained in collaboration with J.K.Duong and H.Zaag.