Edoardo Bocchi

Title: Global-in-time estimates for the one-phase Muskat problem with contact points

Abstract: We address the dynamics of a free-surface incompressible viscous fluid confined in a Hele-Shaw cell or, equivalently, in a 2D bounded region of a porous medium with vertical lateral walls. The dynamics of the three-phases (fluid-solid-dry) contact points is inherently coupled with the surface evolution. In order to close a scheme of a priori estimates necessary to obtain a global well-posedness result, following the approach of Guo and Tice for the Stokes problem we bootstrap from energy-dissipation control of the time derivatives to higher spatial regularity via elliptic estimates. Despite the presence of corners, we avoid weights in the Sobolev norms and restrictions on the contact angles by exploiting the Neumann structure of the elliptic problem for the velocity potential. The control provided allows to derive a global-in-time higher order bound and a decay estimate for solutions close to the equilibrium. This talk is based on a joint work with Á. Castro and F. Gancedo.

Oscar Dominguez

Title: On the DiPerna-Majda gap problem for 2D Euler equations

Abstract: A famous result of Delort (1991) establishes the concentration-cancellation phenomenon for approximating solutions of 2D Euler equations with a vortex sheet whose vorticity maximal function has a log-decay of order 1/2 . On the other hand, DiPerna and Majda (1987) showed that if the log-decay assumption is strictly larger than 1 then the lack of concentration (and hence energy conservation) holds. Then the DiPerna-Majda gap problem asks: concentration-cancellation vs. energy conservation in the remaining log-range (1/2,1]?
In this talk, after reviewing earlier contributions to the DiPerna-Majda gap problem, I will present a new approach to this question based on sparseness. This is based on joint projects with Mario Milman and Daniel Spector.

Claudia García

Title: Vortex caps on the rotating unit sphere

Abstract: In this talk, we will analytically study the existence of periodic vortex cap solutions for the homogeneous and incompressible Euler equations on the rotating unit 2-sphere, which was numerically conjectured by Dritschel-Polvani and Kim-Sakajo-Sohn. Such solutions are piecewise constant vorticity distributions, subject to the Gauss constraint and rotating uniformly around the vertical axis. The proof is based on the bifurcation from zonal solutions given by spherical caps. This is a collaboration with Z. Hassainia and E. Roulley.

Björn Gebhard

Title: On the energy constrained optimal mixing problem

Abstract: The optimal mixing problem addresses the question of how fast a passive scalar can be mixed under the influence of an incompressible velocity field. The talk focuses on the case where the energy of the allowed fields, i.e. their L^2 norm, is uniformly bounded in time. In that setting perfect mixing in finite time is permitted and indeed realized in some examples by Depauw 2003 and Lunasin, Lin, Novikov, Mazzucato, Doering 2012. On the other hand a lower bound on the time in which perfect mixing can be achieved is known due to Lin, Thiffeault, Doering 2011. In the talk we will show an improvement of the lower bound for the special case of initial data depending only on one spatial coordinate. We will also discuss an example for which the new lower bound is sharp. The proofs rely on differential inclusions, variational methods and ideas of steepest descent.

Hyunju Kwon

Title: Non-Conservation of Generalized Helicity in 3D Euler Flows

Abstract: Recently, there has been significant research into the non-conservation of total kinetic energy in Euler flows, which has led to Onsager's theorem and its intermittent version. In this talk, I will discuss an analogous question for another conserved quantity: helicity. I will present the first example of a weak solution to the 3D Euler equations in C^0_t(H^{1/2-}\cap L^{\infty-}) for which the helicity, defined in a generalized sense, is not conserved in time. The talk will be based on recent collaboration with Matthew Novack and Vikram Giri.

Daniel Lear

Title: Traveling waves near shear flows for 2D Euler

Abstract: In this talk we will consider the existence of traveling waves arbitrarily close to shear flows for the incompressible 2D Euler equations. In particular we will present some results concerning the existence of such solutions near Couette, Taylor-Couette and Poiseuille flows. In the first part of the talk, we will introduce the problem and review some well-known results on this subject. In the second, we will outline some of the ideas underlying the construction of our traveling waves.

Luis Martínez-Zoroa

Singularity formation for IPM with a smooth source

Singularity formation in incompressible fluids is a topic that has received a lot of attention in the recent years. In this talk, we will present a recent result regarding finite time singularities: The construction of a smooth solutions to the IPM equation (incompressible porous media) with a smooth source term that develop singularities in finite time. This result is joint work with D. Cordoba.

Fran Mengual

Title: Turbulence rings originating from circular vortex filaments

Abstract: In this talk, we present the first existence result of weak solutions to the 3D Euler equation with initial vorticity concentrated in a circle and velocity field in $C([0,T],L^{2^-})$. For positive times, the energy becomes finite and decreases, while the vorticity remains concentrated in a turbulence ring that thickens and moves along the symmetry axis. The construction relies on finding a suitable subsolution, and later applying the convex integration method. This is joint work with F. Gancedo and A. Hidalgo-Torné.

Elena Salguero

Title: Global persistence of regularity for the Stokes-transport sharp interface problem.

Abstract: The Stokes-transport system models the dynamics of viscous flow under gravitational forcing. We consider the sharp interface problem for this system, where the interface separates two fluids with different densities. The evolution of this interface is driven by the interplay between gravity and density contrast. We investigate the existence of global solutions and the regularity for the free boundary in this evolution. This work is in collaboration with F. Gancedo and R. Granero-Belinchón.