# Thematic day on fluid mechanics

Day and place: May 16, 2024. Room Gris 1 (ICMAT)

### Schedule:

## 10:00-10:45 Fan Zheng (ICMAT, CSIC)

Title: Singularity formation of hypodissipative forced Euler equation

Abstract: In this talk we establish the formation of singularities of classical solutions with finite energy of the forced fractional Navier Stokes equations where the dissipative term is equivalent to taking 0.1 derivatives, the forcing is integrable in the Holder norm up to the blow-up time, the velocity is smooth and finite energy before blow-up and the integral of the supremum of the vorticity diverges at blow-up time.

# 11:00-11:45 Óscar Domínguez (Matemáticas, CUNEF)

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 so-called DiPerna-Majda gap problem asks: concentration-cancellation vs. energy conservation in the 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 relying on sparseness. This is based on joint projects with Mario Milman and Daniel Spector.

### 12:00-12:45 Javier Peñafiel (ICMAT, CSIC)

Title: Extension of Euler flows and construction of singular weak solutions

Abstract: Given a smooth solution of the Euler equations in a bounded domain, we show how to extend it to a global weak solution. We use an adapted convex integration scheme as well as new results concerning the construction, extension and gluing of subsolutions. These techniques yield high spatial control on the subsolutions throughout the iterative process. In addition, we will discuss how to extend our approach to construct singular weak solutions that are reasonably well-behaved outside the singular set.