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Viscous evolution of a point vortex in a half-plane

Monday, 12 January 2026 09:00 (1 hour)

As a model for vortex-wall interactions, we consider the two-dimensional incompressible Navier-Stokes equations in a half-plane with no-slip boundary condition and point vortices as initial data. We concentrate on the paradigmatic example of a single vortex in an otherwise stagnant fluid, which is already quite challenging from the mathematical point of view. As a warm-up, we prove that this system has a unique global solution for all values of the Reynolds number, which can be defined in this context as the ratio of the circulation of the vortex to the kinematic viscosity of the fluid. The solution we construct has finite energy for all positive times, and converges to zero in energy norm as time goes to infinity. Our ultimate goal is to understand the motion of the vortex center in the vanishing viscosity limit, but this question is very difficult due to the vortex-induced boundary layer separation, a phenomenon that is well documented in the physical literature. This talk is based on an ongoing work with Anne-Laure Dalibard (Sorbonne Université).

Presenter: GALLAY, Thierry