

# Long time dynamics in hydrodynamical equations: metastability and time-delayed instabilities

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## Abstract.

In this talk I will describe two phenomena arising in the study of long time dynamics of solutions to different classes of PDEs, among which we include PDEs emerging in fluid dynamics.

The first phenomenon is known as **metastable dynamics**: from a general point of view, this behavior appears when solutions exhibit a first time scale (usually of order  $\mathcal{O}(1)$ ) in which they are close to some unstable configuration, before converging to their asymptotic limit in an exponentially long time.

We then focus on the influence of the viscosity in hydrodynamical equations: given a strongly unstable PDE, a small viscous term introduces a **time delay** in the instability (that is, we observe the solutions to have a linear growth in time before exhibiting an exponential growth).

These two phenomena have in common the fact that the solutions of the equation under consideration exhibit a certain stable (observable) behavior for a long time interval before they

1. converge to the asymptotic limit in the case of a metastable behavior;
2. experience an exponential growth in time in the case of a time-delayed instability.

Some of these results have been obtained in collaboration with Corrado Mascia (Università di Roma La Sapienza) and Benjamin Texier (Université Paris Diderot, IMJ-PRG).