

INDAM MEETING:
**HYPERBOLIC DYNAMICAL SYSTEMS
IN THE SCIENCES**

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Lagrangian Coherent Structures, finite-time hyperbolicity and Lyapunov exponents

We review the fundamental physical motivation behind the definition of Lagrangian Coherent Structures (LCS) and show how it leads to the concept of finite-time hyperbolicity in non-autonomous dynamical systems. Using this concept of hyperbolicity, we define LCS in mathematical terms and obtain sufficient and necessary conditions for their existence in terms of finite-time Lyapunov exponents. We show several applications of LCS detection in laboratory flow experiments, as well as in atmospheric and oceanic data sets.