Turbulent bifurcations, multistability and slow-dynamics in high-Reynolds-number von Kármán flows

A. Chiffaudel, P.-P. Cortet, F. Daviaud, B. Dubrulle, R. Monchaux, & F. Ravelet

CEA Saclay, IRAMIS, Service de Physique de l’État Condensé, CNRS URA 2464, 91191 Gif-sur-Yvette, France
arnaud.chiffaudel@cea.fr

Experimental observations of highly turbulent von Kármán flows are presented. We report the dynamics of “turbulent bifurcations”, i.e. transitions between flows with different (time-averaged) symmetries. Turbulent bifurcations may be supercritical or subcritical. They may also occur sequentially in time, leading to slow-dynamics temporal-patterns.

For $Re > 10^4$, we also report examples of multistability of flow patterns of different symmetry and related memory effect.

Do such phenomena illustrate “phase transitions” between “states” of a highly fluctuating complex system driven very far far from equilibrium?