Phase Transition in a Closed Turbulent Flow

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Using stereoscopic particle image velocimetry, we experimentally study the susceptibility to symmetry breaking of a closed turbulent von Kármán swirling flow from $Re = 150$ to $Re \simeq 10^6$. We report a divergence of this susceptibility at an intermediate Reynolds number $Re = Re_\chi \simeq 40\,000$ which gives experimental evidence that such a highly space and time fluctuating system can undergo a "phase transition". This transition is furthermore associated with a peak in the amplitude of fluctuations of the instantaneous flow symmetry corresponding to intermittencies between spontaneously symmetry breaking metastable states.

Références

P.-P. Cortet, A. Chiffaudel, F. Daviaud, and B. Dubrulle, Phys. Rev. Lett. **105**, 214501 (2010)