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An intermittency route to global instability in low-density jets¹
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Hong Kong University of Science and Technology — Above a critical Reynolds
number (Re), a low-density jet can become globally unstable, transitioning from a
steady state (i.e. a fixed point) to a self-excited oscillatory state (i.e. a limit cycle)
via a Hopf bifurcation. In this experimental study, we show that this transition
can sometimes involve intermittency. When Re is just slightly above the critical
point, intermittent bursts of high-amplitude periodic oscillations emerge amidst a
background of low-amplitude aperiodic fluctuations. As Re increases further, these
intermittent bursts persist longer in time until they dominate the overall dynamics,
causing the jet to transition fully to a periodic limit cycle. We identify this as Type-
II Pomeau-Manneville intermittency by quantifying the statistical distribution of
the duration of the aperiodic fluctuations at the onset of intermittency. This study
shows that the transition to global instability in low-density jets is not always abrupt
but can involve an intermediate state with characteristics of both the initial fixed
point and the final limit cycle.

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