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Transition to turbulence in pipe flow as a phase transition MUKUND VASUDEVAN, BJÖRN HOF, Institute of Science and Technology Austria — In pipe flow, turbulence first arises in the form of localized turbulent patches called puffs. The flow undergoes a transition to sustained turbulence via spatio-temporal intermittency, with puffs splitting, decaying and merging in the background laminar flow. However, the due to mean advection of the puffs and the long timescales involved ($\sim 10^7$ advective time units), it is not possible to study the transition in typical laboratory set-ups. So far, it has only been possible to indirectly estimate the critical point for the transition. Here, we exploit the stochastic memoryless nature of the puff decay and splitting processes to construct a pipe flow set-up, that is periodic in a statistical sense. It then becomes possible to study the flow for sufficiently long times and characterize the transition in detail. We present measurements of the turbulent fraction as a function of Reynolds number which in turn allows a direct estimate of the critical point. We present evidence that the transition has features of a phase transition of second order.

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