Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

The onset of turbulence in a square duct flow GREGOIRE LEMOULT, BJORN HOF, IST Austria — Wall bounded shear flows experience a sudden transition from a laminar state to turbulence as Reynolds number, Re, increases. K. Avila *et al.* (Science 333, 2011) recently characterized the onset of turbulence in pipe flow. They measured the probability for a localized disturbance to decay or spread and defined the critical Reynolds number, Re_c, where the characteristic time for both process is equal. Using the same methodology, we measure these probabilities, decay and splitting, as a function of Re in a 1200 D long square duct, where D is the width of the duct. We found the expected exponential probability distribution for both processes which underlines their memoryless character. From the characteristic time of these distributions, we estimate the point where turbulence first becomes sustained in a square duct flow. The main difference with pipe flow is that the characteristic time at Re_c is shorter making it more suitable for measurements of critical exponents in the framework of phase transition. These results also emphasize the universal behavior of the transition to turbulence in wall bounded shear flows.

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Date submitted: 01 Aug 2014 Electronic form version 1.4