Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Onset of sustained turbulence in pipe flow KERSTIN AVILA, ALBERTO DE LOZAR, BJOERN HOF, Max Planck Institute for Dynamics and Selforganization — The onset of turbulence in pipe flow was first investigated by Reynolds more than 125 years ago. The laminar Poiseuille profile is linearly stable, so that the precise Reynolds number at which the flow becomes turbulent depends on the care taken to minimize disturbances in the experimental setup. In order to avoid this setup effects, an external localized perturbation is induced in the laminar flow and the development of the ensuing localized turbulent patch (puff) while traveling downstream is studied. Although it was recently found that the puffs are transient for all Re, puffs may grow and split, leading to a spread of turbulence. Here we analyze the splitting of puffs quantitatively and show that it is the competition between decaying and splitting that determines the onset of sustained turbulence. In an in depth experimental investigation, of more than 100.000 measurements in pipes of up to 3.400 diameters in length, we determine the critical Reynolds number for the onset of sustained turbulence in pipe flow.

Kerstin Avila
Max Planck Institute for Dynamics and Selforganisation

Date submitted: 03 Aug 2010 Electronic form version 1.4