Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Noise induced state transitions, intermittency and universality in the noisy Kuramoto-Sivashinsky equation MARC PRADAS, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London, London SW7 2AZ, UK, GREG PAVLIOTIS, DEMETRIOS PAPAGEORGIOU, Department of Mathematics, Imperial College London, London SW7 2AZ, UK, DMITRI TSELUIKO, School of Mathematics, Loughborough University, Leicestershire LE11 3TU, UK — The Kuramoto-Sivashinsky (KS) equation is a paradigmatic model for a wide spectrum of systems exhibiting spatio-temporal chaos, such as a thin-liquid film falling down a vertical substrate. Here we deal with the noisy KS eqiation which can be derived for the falling film problem with a topographically random substrate. We examine the effects of additive noise in a regime close to the instability onset. We show that when the noise is highly degenerate, in the sense that it acts only on the first stable mode, the solution of the KS equation undergoes several transitions between different states, including a critical on-off intermittent state that is eventually stabilized as the noise strength is increased. Similar results are obtained with the Burgers equation, which has often been used as a prototype of one-dimensional turbulence. Such noise-induced transitions can be completely characterized through critical exponents, obtaining that both equations belong to the same universality class. The results of our numerical investigations are explained rigorously using multiscale techniques.

Serafim Kalliadasis
Department of Chemical Engineering,
Imperial College London, London SW7 2AZ, UK

Date submitted: 27 Jul 2011 Electronic form version 1.4