Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

A nonlinear variational approach to triggering transition in plane Couette flow S.M.E. RABIN, DAMTP, University of Cambridge, C.P. CAULFIELD, BPI & DAMTP, University of Cambridge, R.R. KERSWELL, University of Bristol — The study of the stability of shear flows has a long history dating back more than a hundred years. Understanding how and when turbulence emerges in such flows is highly significant to many processes studied throughout engineering. A feature of turbulent flows are that they have significantly higher kinetic energy than those that remain laminar. As a consequence research has focused on optimizing kinetic energy at a specific target time, initially for the linearized Navier Stokes equations (Butler & Farrell 1992), and more recently for the full Navier Stokes equations (Pringle & Kerwell 2010, Cherubini et al 2010). The belief is that by achieving high energies turbulence can be triggered. An alternative theory is that optimizing time averaged dissipation is more effective at triggering turbulence (Monokrousos et al 2011). In this study we optimize kinetic energy growth over all initial states and all target times for a given initial kinetic energy in order to reveal the "minimal seed" for turbulence (the disturbance of lowest kinetic energy which can trigger turbulence). We present results for a geometry originally considered by Butler & Farrell (1992) and also compare our minimal seed prediction with that made recently by Monokrousos et al (2011).

S. M. E. Rabin
DAMTP, University of Cambridge

Date submitted: 03 Aug 2011 Electronic form version 1.4