Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Exact coherent states in a reduced model of parallel shear flows

CEDRIC BEAUME, Imperial College London, EDGAR KNOBLOCH, UC Berkeley, GREG CHINI, University of New Hampshire, KEITH JULIEN, University of Colorado at Boulder — In plane Couette flow, the lower branch Nagata solution follows simple streamwise dynamics at large Reynolds numbers. A decomposition of this solution into Fourier modes in this direction yields modes whose amplitudes scale with inverse powers of the Reynolds number, with exponents that increase with increasing mode number (Wang et al., Phys. Rev. Lett. 98, 204501 (2007)). In this work, we use this scaling to derive a reduced model for exact coherent structures in general parallel shear flows. The reduced model describes the dynamics of the streamwise-averaged flow and of the fundamental fluctuations and is regularized by retaining higher order viscous terms for the fluctuations. Numerical methods are designed to find good approximates of nontrivial solutions which are then converged using a preconditioned Newton method. This procedure captures both lower branch and upper branch solutions and demonstrates that these branches are connected via a saddle-node bifurcation.

Cedric Beaume
Imperial College London

Date submitted: 18 Jul 2014 Electronic form version 1.4