Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Nonlinearity and the energy cascade in the resolvent analysis of wall turbulence[1] ATI SHARMA, University of Southampton, BEVERLEY MCKEON, California Institute of Technology — The resolvent analysis of wall turbulence can be used to characterise velocity response modes derived from a gain analysis of the linear resolvent operator obtained from the Navier-Stokes equations projected into wavenumber-frequency space (k, n, ω), e.g. McKeon & Sharma (JFM, 2010). Simple combinations of response modes that are triadically consistent in (k, n, ω) have been shown to give rise to complex coherent structure, Sharma & McKeon (JFM, 2013), however the selection of these combinations was phenomenologically-driven. In the full analysis, the nonlinear interaction between response modes necessarily gives rise to self-sustaining turbulence. In this paper, we report how the nonlinearity acts to reinforce certain combinations of modes over others, cascades energy between wavenumbers and modes, and determines the relative phase and amplitude of the resolvent response modes.

[1]The support of AFOSR grant #FA 9550-09-1-0701 is gratefully acknowledged (BJM).

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Date submitted: 02 Aug 2013 Electronic form version 1.4