Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

A Procedure to Predict the Subcritical Turbulent Onset Criterion Applied to a Modified Hasegawa-Wakatani Model BRETT FRIEDMAN, LLNL, TROY CARTER, UCLA — Linear eigenmode analysis is often used to predict whether a plasma or fluid system will be turbulent, but it fails for systems which have highly non-orthogonal linear eigenvectors [1]. In fact, such systems may become turbulent despite having no unstable linear eigenvectors at all (subcritical turbulence). For about a century, researchers have attempted to predict critical parameters that mark the onset of subcritical turbulence with little success. Using recently-developed intuition regarding the role of non-orthogonal linear eigenvectors in subcritical turbulent sustainment, we have developed a method to calculate turbulent growth rates, which can be used to predict the onset of subcritical turbulence. We apply our procedure to 2D and 3D versions of the Hasegawa-Wakatani (HW) model [2], showing good agreement with nonlinear simulation results. We also use a modified version of the 3D HW model [3], which is subject to subcritical turbulence, in order to test our method in predicting the subcritical turbulent onset.

[1] L. N. Trefethen, A. E. Trefethen, S. C. Reddy, and T. A. Driscoll, Science 261, 578 (1993).
[2] A. Hasegawa and M. Wakatani, Phys. Rev. Lett. 50, 682 (1983).
[3] D. Biskamp and A. Zeiler, Phys. Rev. Lett. 74, 706 (1995).

Brett Friedman
LLNL

Date submitted: 07 Jul 2014 Electronic form version 1.4