Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Unitary Mesoscopic Algorithms for 2D Quantum and Classical Turbulence BO ZHANG, GEORGE VAHALA, William & Mary, LINDA VAHALA, Old Dominion University, MIN SOE, Rogers State University — The nonlinear Schrodinger (NLS) equation plays an important role in physics: from plasma wave and soliton propagation to turbulence in Bose-Einstein condensates. There is much interest in unravelling the differences between 2D and 3D turbulence - in fluids, plasmas and BECs. In fluid turbulence there is a marked difference between: in 2D, there is an inverse cascade of energy and a direct cascade of enstrophy while in 3D only a direct cascade of energy. MHD, the cascades are similar in both 2D and 3D. To examine the effects of dimensionality on quantum turbulence we device an almost perfectly scalable unitary lattice gas algorithm to solve the NLS equation. Unlike classical or plasma turbulence, a vortex in quantum turbulence is a well-defined topological singularity. For various initial conditions we examine the spectra for both 2D and 3D turbulence on grids that scale from quantum to classical scales.

George Vahala
William & Mary

Date submitted: 15 Jul 2010 Electronic form version 1.4