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Unitary Lattice Simulations of Reconnection in Quantum Turbulence GEORGE VAHALA, William & Mary, JEFFREY YEPEZ, AFRL/Hanscom, LINDA VAHALA, Old Dominion University, MIN SOE, Rogers State University —
A unitary mesoscopic lattice algorithm is developed for the 3D Gross-Pitaesvkii equation, a Hamiltonian system. The equivalent moment representation is that of an ideal barotropic compressible fluid in which vortex reconnection occurs without viscosity. The internal energy plays an important role in the vortex development. For sufficiently small internal energies, the Hamiltonian system exhibits fast Poincare recurrence time even though there are strong vortex entanglements at intermediate times (c.f., Arnold Cat map). At higher internal energies, the Poincare recurrence time becomes extremely large and on 2880 x 2880 x 2880 grids, the incompressible kinetic energy spectrum exhibits a limited region of Kolmogorov scaling followed by weaker power law for larger k. Vortex loops are born not only from the vortex cores themselves but also from regions between the interacting vortex cores. These loops play a major role in the reconnection.

Linda Vahala
Old Dominion University

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