Abstract Submitted
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Unitary qubit extremely parallelized algorithms for coupled nonlinear Schrodinger equations[1] ARMEN OGANESOV, CHRIS FLINT, GEORGE VAHALA, William & Mary, LINDA VAHALA, Old Dominion University, JEFFREY YEPEZ, AFRL-Hawaii, MIN SOE, None — The nonlinear Schrodinger equation (NLS) is a ubiquitous equation occurring in plasma physics, nonlinear optics and in Bose Einstein condensates. Viewed from the BEC standpoint of phase transitions, the wave function is the order parameter and topological defects in that manifold are simply the vortices, which for a scalar NLS have quantized circulation. In multi-species NLS the topological nature of the vortices are radically different with some classes of vortices no longer having quantized circulation as in classical turbulence. Moreover, some of the vortex equivalence classes need no longer be Abelian. This strongly effects the permitted vortex reconnections. The effect of these structures on the spectral properties of the ensuing turbulence will be investigated. Our 3D algorithm is based on a novel unitary qubit lattice scheme that is ideally parallelized - tested up to 780 000 cores on Mira. This scheme is mesoscopic (like lattice Boltzmann), but fully unitary (unlike LB).

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