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A numerical study of coarsening in the two-dimensional complex Ginzburg-Landau equation[1] WEIGANG LIU, UWE TAUBER, Department of Physics and Center for Soft Matter and Biological Physics, Virginia Tech — The complex Ginzburg-Landau equation with additive noise is a stochastic partial differential equation that describes a remarkably wide range of physical systems: coupled non-linear oscillators subject to external noise near a Hopf bifurcation instability; spontaneous structure formation in non-equilibrium systems, e.g., in cyclically competing populations; and driven-dissipative Bose-Einstein condensation, realized in open systems on the interface of quantum optics and many-body physics. We employ a finite-difference method to numerically solve the noisy complex Ginzburg-Landau equation on a two-dimensional domain with the goal to investigate the coarsening dynamics following a quench from a strongly fluctuating defect turbulence phase to a long-range ordered phase. We start from a simplified amplitude equation, solve it numerically, and then study the spatio-temporal behavior characterized by the spontaneous creation and annihilation of topological defects (spiral waves). We check our simulation results against the known dynamical phase diagram in this non-equilibrium system, tentatively analyze the coarsening kinetics following sudden quenches, and characterize the ensuing aging scaling behavior. In addition, we aim to use Voronoi triangulation to study the cellular structure in the phase turbulence and frozen states.

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