Phase ordering of a ferromagnetic spin-1 condensate

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An area of interest in many-body systems involves the dynamics induced by a quench across a phase transition to a symmetry-broken phase. Following the quench domains form with each making an independent choice for the symmetry-breaking order parameter. An important aspect involves how these domains coarsen over time (phase ordering) as the different broken-symmetry phases compete to select the equilibrium state. Often at late times the coarsening is universal: correlation functions of the order parameter collapse to a universal function when scaled by a characteristic length $L(t)$, where $t$ is the time after the quench.

We consider the dynamics of a quasi-two-dimensional spin-1 condensate quenched into a ferromagnetic phase and demonstrated that the late time coarsening is universal. A feature of spin-1 condensates is that the order parameter symmetry is dependent upon the value of the quadratic Zeeman energy, allowing us to explore regimes where the magnetic order is easy-plane, easy-axis or isotropic. In each case the ordering dynamics is different as is the relevant topological defects. We also demonstrate that one the topological defects have annihilated the system can still remain far from equilibrium.