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**INVARIANT MANIFOLDS FOR PDES AND THE MOTION OF PARTICLES DRIVEN BY ALLEN-CAHN DYNAMICS.**

PETER BATES

We consider particles described as peak-like solutions to a singularly perturbed nonlinear parabolic partial differential equation. Minimal energy stationary states were shown to exist by Ni and Takagi in a series of papers, where detailed qualitative properties of these states were also derived. Taking the gradient flow of the energy functional leads to a nonlinear parabolic equation and it is natural to ask about the motion of particles as dynamic peak-like solutions away from equilibrium. By proving an abstract theorem about the existence of a true invariant manifold in the neighborhood of an approximately invariant, approximately normally hyperbolic invariant manifold, we are able to answer this question, giving the global dynamics of a particle on the boundary of a smooth domain.

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