APPLIED MATHEMATICS SEMINAR
INSCC 110, 3:30PM MONDAY
SEPTEMBER 20, 1999

A nonlocal model for phase changes with peculiar dynamics

by

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ABSTRACT

In recent years several authors (Bates, Chmaj, Ren, Wang) and myself have worked on a gradient flow for a nonlocal energy functional generalizing the scalar Ginzburg-Landau one. But as opposed to the latter, this flow, which is a simple integrodifferential equation, admits spatially discontinuous stationary solutions. It turns out that a natural extension of the previous gradient flow, but with respect to the same energy functional, produces an evolution problem whose solutions may have mobile spatial discontinuities. This motion further enhances the decrease in energy. When considered in the framework of a lattice system with spins, this extension can be viewed as resulting from a special kinetic mechanism which promotes spin changes near discontinuities.

The resulting evolution typically has many traveling waves (with a range of velocities) and solutions to the initial value problem exist but are nonunique. Moreover, it admits the spontaneous birth of discontinuities.