Snakes and Ladders: localized states in the Swift-Hohenberg equation

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Stable spatially localized structures occur in many systems of physical interest. Examples can be found in the fields of optics, chemistry, fluid mechanics, and neuroscience to name a few. The models used to describe these systems have much in common. They are typically of at least fourth order in spatial derivatives, invariant under spatial translations and reflections, and exhibit bistability between two spatially extended solutions.

In this talk I will focus on one particular model, the Swift-Hohenberg equation, which arises in many of the applications listed above. This equation contains a remarkable wealth of localized states, organized in a 'snakes-and-ladders' structure; a large number of these localized states are simultaneously stable. The talk will include an overview of the results for this model in both one and two spatial dimensions. The goal is to present a physical understanding of the mathematical and numerical results.

Despite the simple model used in this analysis there is evidence that the localized states observed in some experiments are organized in similar structures.