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Localized states in convective systems

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Many fluid systems exhibit spatially localized structures in response to spatially homogeneous forcing. Such structures are examples of dissipative solitons and in convective systems are called convectons. This talk will focus on the origin and properties of convectons in binary fluid convection [1], i.e., a mixture of two miscible components heated uniformly from below. In this system the convectons come in two types, with odd and even parity. The convectons are located in parameter space in a region called the pinning region and are organized in the so-called snakes-and-ladders structure of this region [2]. This region also contains a variety of hole-like states as well as bound states of two or more convectons. The talk will describe this structure on large periodic domains and its modification in finite domains due to the suppression of concentration pumping across odd parity convectons [3]. The geometry responsible for this rich behavior implies applicability of the results to a wide variety of physical systems, including natural doubly diffusive convection, surface tension driven convection and shear flow instability, in addition to other pattern-forming systems.

[1] O. Batiste, E. Knobloch, A. Alonso, and I. Mercader, J. Fluid Mech. 560, 149 (2006)
[2] J. Burke and E. Knobloch, Chaos 17, 037102 (2007)
[3] I. Mercader, O. Batiste, A. Alonso and E. Knobloch, Phys. Rev. E 80, 025201(R) (2009)