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The dynamic behaviors of bound spiral waves in excitable media[1]

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Recent large-scale computations have shown that at sufficiently high densities spiral waves spontaneously coalesce to form stable conglomerates (bound states) composed of spirals of similar or opposite chiralities. The most common form are pairs and triplets composed of spirals of the same chirality often called two-armed and three-armed spirals, respectively. The bound states generate waves with higher average frequencies than a single spiral and exhibit complex dynamic behaviors. My talk will concentrate on media with a single diffusing variable and Fitz-Hugh-Nagumo type kinetics, commonly used as a model of wave propagation in the heart. I will discuss the main types of bound states in such media and their dependence on the properties of the medium. In particular, I will describe newly discovered asymmetric bound states with one spiral orbiting the other at distances significantly exceeding the wavelength. A special emphasis will be given to bound spiral pairs, which have been recently discovered experimentally in monolayers of cardiac myocytes and in the intact heart.

[1]The results were obtained in collaboration with C. Zemlin, K. Mukund, R. Zaritsky.