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Title: Parity-time symmetry breaking in microbial populations

Abstract: Biological systems always have multiple interacting components, including both active and passive elements. For example, animal groups physically engage with their surrounding objects and actively evade predators, while their social interactions make these systems highly complex. Remarkably, these intricate systems exhibit a diverse set of exotic phenomena ranging from synchronization to pattern formation, within a non-equilibrium context. Interestingly the dynamical matrix controlling these biological systems shows typical Pseudo-Hermitian features which offers new perspectives on understanding their complexities.

In this talk, I will specifically focus on the concept of nonreciprocity driving parity-time symmetry-breaking process in biological systems. We have experimentally observed that nonreciprocal interactions within dense microbial populations, consisting of active and passive individuals, lead to traveling waves, arrested phase separation, and chiral edge states. Although these concepts are well-established in condensed matter physics, I will speculate that they also have evolutionary implications in population biology. I will then demonstrate how widespread these responses are across different microbial communities, ranging from bacterial biofilms to nematodes.