

UCLA Department of Physics & Astronomy

COLLOQUIUM

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Non-reciprocity in collective phenomena: pattern-formation, synchronization and flocking.

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The interaction between a peregrine falcon and a dove is visibly non-reciprocal. Unlike the dogma preached by Newton's third law, the actions they exert on each other are by no means equal and opposite. What happens to the well-established framework of phase transitions in non-reciprocal systems far from equilibrium?

In this talk, I will answer this question by looking at three archetypal classes of self-organization out of equilibrium: synchronization, flocking and pattern formation. Simple demonstrations with robots will be presented along with naturally occurring phenomena from various domains of science that share a common feature: reciprocity has no reason to exist. In all these cases, the emergence of unique time-dependent many-body phases can be captured by combining insights from non-Hermitian quantum mechanics and bifurcation theory. This approach lays the foundation for a general theory of critical phenomena in non-reciprocal matter.