

## Exploring collective behavior in a swarmalator system

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In this talk, we introduce a system of swarmalators and explore their collective behavior. Swarmalators are a mobile version of phase oscillators that can sync in time and swarm through space. Our study focuses on an XY-type model of identical swarmalators moving on a one-dimensional ring and subject to thermal noise. We found that both interactions and thermal noise impact the behavior of swarmalators, leading to four distinct collective states. We will discuss these states and present a comprehensive phase diagram supported by Fourier mode analysis and numerical simulation results. Our model offers a minimal yet insightful representation of thermal systems that both synchronize and self-assemble.

[1] H. Hong, K. P. O’Keeffe, J. S. Lee, and H. Park, *Phys. Rev. Research* **5**, 023105 (2023).