
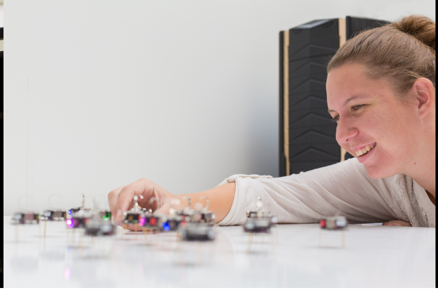


Physics colloquium

Molecular Motors use Mechanical Forces to Self-organize in the Noisy Interior of Cells: Does this Help?

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Date: **1/25/19**
Time: **10:00 AM**
Location: **COB2 170**

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Abstract: Many cells use mechanical forces to move, change shape or sense their environment. These forces are generated by tiny chemically-powered molecular motors embedded in the cell's "cytoskeleton" – a squishy meshwork of filaments that form the cell's skeleton. While various biochemical processes that drive cell functions have been traditionally studied by molecular biologists, recent experiments have begun to reveal the role that physical forces play in spatially organizing the cell's molecular machinery into mesoscale structural units. Such ordering happens in the face of chemical sources of noise ubiquitous in biology, a competition that is insightfully described by the statistical physics notion of an order parameter. Active forces by molecular motors, for example, lead to elastic interactions between parts of the cytoskeleton that help order muscle fibers into liquid crystalline patterns. I will describe how this may also explain the recently observed ordered superstructures of molecular motors in nonmuscle cells. The formation of such structures requires the active force-induced polymerization of actin. Complementary to such an active elastic picture, other phases can arise in cytoskeletal components such as when they form liquid crystal droplets discovered in recent experiments. The geometry of such an anisotropic fluid phase drives motor organization to preferred locations as well as droplet division. These ordered structures are biologically significant and play potentially important functional roles such as in muscle contraction and cell division. I conclude by noting that the mechanical interactions described in my talk act in concert with chemical and genetic factors to give rise to biological function. Studying such mechanochemical feedback inspires new physics-based modeling and theory.

Bio: Kinjal Dasbiswas is an assistant professor in physics at the University of California in Merced, one of the newest research universities in the country. Before starting at UC in the fall of 2018, I held postdoctoral positions at the Weizmann Institute (2012-2015) and the University of Chicago (2015-2018) working on a variety of problems in soft matter physics with a focus on the mechanics of cells – a rich and active interdisciplinary area involving biologists, physicists and engineers. I obtained a PhD in theoretical condensed matter physics from the University of Florida in 2012 working on the low temperature quantum phases of matter. I received the E. Raymond Andrew Memorial Award given to a graduate student for distinction in research by the University of Florida, and a postdoctoral fellowship from the Israel Council of Higher Education. Apart from research in theoretical biological physics, I am also interested in the pedagogy of physics, given the rapidly changing nature of scientific research, where interdisciplinary approaches involving biology and computational tools are increasingly important.