

Physics Colloquium

Prof. Shashank Shekhar

“Self-assembly of the Cellular Skeleton, One Molecule at a Time”

Living cells employ self-assembly to build intracellular structures orders of magnitude larger than their individual constituent units. One such example is the actin cytoskeleton, formed from self-assembly of actin monomers into linear actin filaments. Cells use actin polymerization to generate forces required for processes such as cell movement, cell division and wound healing. Although the key components of the actin remodeling machinery have been identified, how they act in concert remains a mystery. Our lab combines bottom-up and top-down experimental methods with mathematical modelling to investigate how living cells integrate multicomponent molecular activities to regulate physiological actin dynamics. We employ a range of quantitative biophysical approaches such as microfluidics, multispectral single-molecule and single-filament imaging. First, I will show how a dynamic interplay between enhancers (formin) and inhibitors (capping protein) of actin polymerization leads to tunable control of actin assembly. Second, I will present a novel multicomponent mechanism comprising of two actin disassembly factors resulting in over 300 fold enhancement of actin depolymerization. These results illustrate the interplay between molecular components and mechanical forces underlying complex cytoskeleton dynamics. Our research exemplifies the power of synthetic biophysical approaches in dissecting fundamental biological mechanisms.

Dr. Shashank Shekhar is an assistant professor of physics and cell biology at Emory University. His research interests in biological self-assembly lie at the interface of physics, biology and biochemistry. He is a recipient of several awards including the Whitman Early Career Award at the Marine Biological Laboratory and the Grand advances in Biology Prize from the French Academy of Sciences. He received his PhD in experimental cell biophysics from University of Twente (The Netherlands). He earned his master's in Nanoscience and Molecular Bioengineering from TU Delft (Netherlands) and TU Dresden (Germany) and undergraduate degree in Physics from India.

Thursday March 4th at 4:25 via Zoom

**If you are outside the Lehigh Physics Department, please email
Professor Bitan Roy (bir218@lehigh.edu) for a link.**