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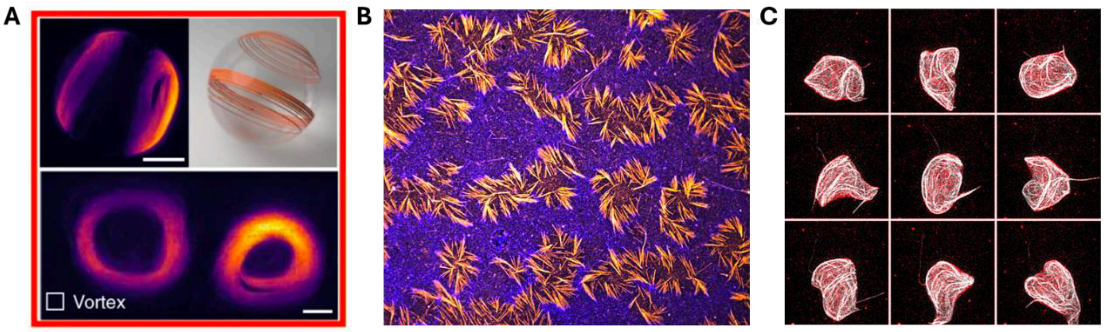

Reconstituting active cytoskeletal systems, between physics and biology

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Cells have the stunning ability to change shape to adapt, move, and divide. Most of these processes are governed by their cytoskeleton, a set of dynamic filaments that not only provide structural stability but also exert and respond to forces. To perform their task, networks of cytoskeletal filaments, assisted by partner proteins such as molecular motors, need to precisely self-assemble into definite structures at the right moment and time. Failures can result in cell death and disease. Understanding the microscopic dynamics of the cytoskeleton is hence key to understanding fundamental biological processes. However, due to biological complexity, studying the cytoskeleton in cells is difficult. An alternative strategy is using purified proteins and microfabrication techniques to reconstitute cytoskeletal networks with a minimal number of components and in a controlled environment. This allows not only to build individual modules of the cell's cytoskeleton to study them, but also to take advantage of nature's toolset of "micro-machines" to construct biology-inspired active systems and understand the fundamental physics behind their self-assembly in a more fundamental way. In this talk I will describe my past, present and future efforts along these lines, and how I went from using cytoskeletal filaments and molecular motors to study their active self-assembly to a more ambitious goal of reconstituting realistic dynamic cellular architectures in the lab, with the final long-term aim of building a "synthetic cell".