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Non-equilibrium Dynamics of Actomyosin Networks: Bridging Architecture and Activity

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Living cells are complex confined systems containing active matter, capable of generating intracellular flow. This flow, in turn, orchestrates a diverse array of processes ranging from the transport of nutrients to the control of asymmetric cell division and to cell locomotion. Moreover, dynamic flows and active stresses drive the self-propulsion of cells. These processes operate far from thermodynamic equilibrium shaped by self-organization, active stresses, and energy flows. Understanding the principles underlying these processes is a fundamental requirement to be addressed within the framework of active matter physics. In this study, we are utilizing actomyosin gel to investigate the emergence of internal flow generated by active matter and its consequences for self-propulsion. In line with that aim, we quantitatively study actomyosin architecture, viscoelasticity, and activity outside of the complicated environment of cells by using passive rheology and imaging techniques in vitro. Our findings provide fundamental insights into understanding how actomyosin networks are regulated by active stresses and flows, and how these processes drive self-propulsion and cellular motility through non-equilibrium processes.