



Sommerfeld Theory Colloquium

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Active Cell Mechanics

Biological cells use non-equilibrium processes to actively generate forces, movement and growth [1]. Some of these processes can be re-constituted in biomimetic experiments with active soft matter, nurturing the vision of a synthetic cell built from the bottom-up. In this talk, I will first discuss how and why contractile forces are generated by cells, and how they can be measured. Surprisingly, quantitative experiments such as cell shape analysis [2], laser cutting [3] or optogenetic control of cell mechanics [4] reveal elastic properties for cellular systems that tend to flow on a molecular scale. I will discuss how these contractile systems can be mathematically described by continuum mechanics extended by active elements. In particular, I will discuss how macroscopic material laws can be derived using homogenization techniques, and how elasticity emerges on cellular scales.

[1] U. S. Schwarz and S.A. Safran, *Rev. Mod. Phys.* 85, 1327 (2013). [2] C.A. Brand et al., *Biophys. J.* 113, 770 (2017). [3] E. Kassianidou et al., *PNAS* 114, 2622 (2017). [4] P.W. Oakes et al., *Nature Communications* 8, 15817 (2017).

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