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High spatiotemporal resolution imaging of mechanical processes in live cells using T- shaped cantilevers NICOLA MANDRIOTA, OZGUR SAHIN, Columbia University — Mechanical properties of cells are paramount regulators of a plethora of physiological processes, such as cell adhesion, motility and proliferation. Yet, their knowledge is currently hampered by the lack of techniques with sufficient spatiotemporal resolution to monitor the dynamics of such biological processes. We introduce an atomic force microscopy-based imaging platform based on newly-designed cantilevers with increased force sensitivity, while minimizing viscous drag. This allows us to uncover mechanical properties of a wide variety of living cells - including fibroblasts, neurons and Human Umbilical Vein Endothelial Cells - with an unprecedented spatiotemporal resolution. Our mechanical maps approach 50nm resolution and monitor cellular features within a minute's timescale. To identify the counterparts of our mechanical maps' features we perform simultaneous fluorescence microscopy and recognize cytoskeletal elements as the main molecular contributors of cellular stiffness at the nanoscale. Furthermore, the enhanced resolution and speed of our method allows the recognition of dynamic changes in the mechanics of fine cellular structures, which occurred independently of changes within optical images of fluorescently-labeled actin.

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