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Programmable Active Matter: Dynamics of active filaments on patterned surfaces VIKRANT YADAV, DANIEL TODD, PEKER MILAS, University of Massachusetts, Amherst, PAUL RUIJGROK, ZEV BRYANT, Stanford University, JENNIFER ROSS, University of Massachusetts, Amherst — Interfaces are ubiquitous in biology. For a sub-cellular component moving inside the cell, any change in its local environment across an interface whether chemical concentration, density, or any other physical variables can produce novel dynamics. Recent advances in bioengineering allow us to control motor proteins' velocities when prompted by an optical trigger. Using an optical diaphragm and a gear-shifting myosin XI construct containing a photoactive LOV domain, we can spatially pattern light to create interfaces across which speed of a gliding actin filament can differ by as much as a factor of two. We observe that when a gliding actin filament crosses an interface that has a discontinuous velocity jump, it buckles and changes its angle of orientation due to the velocity mismatch. Our preliminary data suggests that for small angels of incidence, the angle of emergence increases linearly. If we increase the angle of incidence further we observe that the angle of emergence saturates. For some actin filaments approaching the interface near-tangentially we observe total internal reflection as they fail to crossover the boundary. We have modeled our system using Cytosim software package and find excellent agreement with experimental data.

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