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Unraveling cytoplasmic streaming using a coarse-grained model of microtubule hydrodynamics[1] DAVID STEIN, Simons Foundation, GABRIELE DE CANIO, ERIC LAUGA, University of Cambridge, MICHAEL SHELLEY, Courant Institute, RAYMOND GOLDSTEIN, University of Cambridge
— During the development of the fruit fly oocyte, flows with short-ranged correlations transition to a dramatic cell-spanning vortex, accompanied by coherent deformations in the microtubule cytoskeleton. Using a coarse-grained model for the hydrodynamics of ordered fibers, we show that sufficiently dense microtubule arrays, forced only by molecular motors transporting cargo, undergo a "swirling transition" that is fundamentally different than the buckling transition which leads to the flapping motion of isolated filaments. Our model produces streaming velocities consistent with *in vivo* measurements, and allows us to place bounds on the number density of kinesin-1 motors transporting cargo within the microtubule array.

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David Stein
Flatiron Institute

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