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**Hydrodynamic synchronization of spontaneously beating filaments** DAVID SAINTILLAN, BRATO CHAKRABARTI, University of California San Diego — Cilia and flagella are thin hair-like cellular projections that play a range of crucial roles from propulsion at low Reynolds number to long-range hydrodynamic transport. The movement of the cilium is produced by the bending of its core, known as the axoneme, consisting of 9+2 pairs of microtubules. In presence of ATP, molecular motors connecting microtubules undergo cycles of attachment and detachment and generate sliding forces that are converted to waving motion of the filaments. We present a microscopic model that accounts for the stochastic kinetics of molecular motors and mechanical feedback from the axoneme, and produces spontaneous oscillations consistent with those of sperm, cilia and *Chlamydomonas.* Using this model for the axoneme, we study elastohydrodynamic phase synchronization in a pair of beating filaments. Our computations reveal that symmetric sperm-like beats lead to in-phase synchrony while both in-phase or anti-phase synchrony can emerge for asymmetric ciliary waveforms. We find that phase-synchronization is well captured by a low-dimensional Adler equation and also elucidate the role of biochemical noise in driving phase slips.

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