Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

**Anisotropic bending rigidities in eukaryotic flagella can lead to stable planar beating dynamics** BHARGAV RALLABANDI, QIXUAN WANG, MYKHAILO POTOMKIN, University of California, Riverside — Flagella and cilia are common features of biological cells and play important roles in locomotion and feeding at the microscale. Flagellar beating is controlled by molecular motors that exert forces along the length of the flagellum and are regulated by a feedback mechanism coupled to the flagellar motion. Built on previous work on 2-dimensional (2D) flagella beating models, we develop a three-dimensional (3D) flagellum beating model on sliding-controlled motor feedback, accounting for both bending and twist — the latter a feature that is absent in 2D models. We show that anisotropic bending rigidities in the flagellum lead to stable planar beating dynamics out of a 3D beating machinery, a feature shown in many eukaryotic flagella such as mammalian spermatozoa. Perturbation analysis also reveals the parameter regimes of stable non-beating, planar or spiral beating dynamics. Finally we show that with isotropic bending, stable planar beating is no more feasible and only spiral beating can be spontaneously generated beyond a critical molecular activity, with either retrograde or anterograde wave propagation depending on the activity.

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Date submitted: 09 Aug 2020 Electronic form version 1.4