Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Intracellular coupling modulates biflagellar synchrony[1] KIRSTY WAN, University of Exeter, HANLIANG GUO, University of Southern California and University of Michigan, YI MAN, EVA KANSO, University of Southern California — Beating cilia and flagella exhibit diverse synchronization modes. This has long been attributed to hydrodynamic coupling between the flagella. However, recent work using different flagellated algae has indicated that a mechanism internal to the cell, acting through the contractile fibers connecting the flagellar basal bodies, must be at play to actively modulate flagellar synchrony. Exactly how basal coupling mediates flagellar coordination remain unclear. Here, we examine the role of basal coupling in the synchronization of the model biflagellate Chlamydomonas reinhardtii using a series of mathematical models of decreasing complexity. We report that basal coupling is sufficient to achieve inphase, antiphase, and bistable synchrony, even in the absence of hydrodynamic coupling and flagellar compliance. These modes can be reached by modulating the activity level of the individual flagella or the strength of the basal coupling. We observe a slip mode when allowing for differential flagellar activity, just as in experiments with live cells. Lastly, we introduce a dimensionless ratio of flagellar activity to basal coupling, which is predictive of synchronization mode. This allows us to query biological parameters which are currently not accessible experimentally

[1]We acknowledge funding from the ERC under the EU's Horizon 2020 research and innovation programme (grant no. 853560) - KW, and NSF INSPIRE grant 1608744 - EK.

Kirsty Wan
University of Exeter

Date submitted: 03 Aug 2020 Electronic form version 1.4