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Viscous coordination in systems of rotating flagella[1] QIAN BIAN, THOMAS POWERS, KENNETH BREUER, Brown University — Bacterial flagella are helical filaments, 5-10 microns long and 20 nm in diameter that rotate at approximately 100 Hz and are responsible for cell motility and, in engineered systems, enhanced mixing and pumping. It has been previously hypothesized that adjacent flagella can coordinate, presumably due to viscous interactions between nearby filaments. To explore the physics of this phenomenon, we present results from a model experiment performed in a low-Re tank in which asymmetric paddles (representing the asymmetry of helical flagella) are rotated using servo motors. The first series of experiments explore the dynamics of a single "flagella" close to a planar wall, and the torque-speed behavior is characterized as a function of the flagella-wall separation and other geometric and dynamic parameters. The second series of experiments explores the dynamics of two flagella rotating in close proximity. Scaling arguments for the observed behavior are presented based on related theoretical results.

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