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The hydrodynamically optimal length of a flagellum[1] ALEXANDER CHAMOLLY, ERIC LAUGA, University of Cambridge — Many bacteria use appendages termed flagella for swimming. A flagellum consists of a semi-rigid helical filament passively driven by a rotary motor via a short flexible hook. While the rich elasto-hydrodynamics of the propulsion process and the interactions between multiple flagellar filaments have been investigated theoretically, numerically and experimentally in many studies, the mechanism that determines the length of the flagellar filaments has so far been looked at mainly from a biological point of view, identifying key proteins that control their growth and length. But is there a physical rationale for the observed lengths of flagellar filaments observed in nature? One well-known answer lies in the requirement of a finite-size cell body, relative to flagellar filaments, in order to balance hydrodynamic moments on swimming bacteria. In this talk we propose that a second hydrodynamic mechanism can also set the optimal length of bacterial filaments.

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