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The swimming of a perfect deforming helix LYNDON KOENS, University of Cambridge, HANG ZHANG, AHMED MOURRAN, RWTH Aachen University, ERIC LAUGA, University of Cambridge — Many bacteria rotate helical flagellar filaments in order to swim. When at rest or rotated counter-clockwise these flagella are left handed helices but they undergo polymorphic transformations to right-handed helices when the motor is reversed. These helical deformations themselves can generate motion, with for example Rhodobacter sphaeroides using the polymorphic transformation of the flagellum to generate rotation, or Spiroplasma propagating a change of helix handedness across its bodys length to generate forward motion. Recent experiments reported on an artificial helical microswimmer generating motion without a propagating change in handedness. Made of a temperature sensitive gel, these swimmers moved by changing the dimensions of the helix in a non-reciprocal way. Inspired by these results and helixs ubiquitous presence in the bacterial world, we investigate how a deforming helix moves within a viscous fluid. Maintaining a single handedness along its entire length, we discuss how a perfect deforming helix can create a non-reciprocal swimming stroke, identify its principle directions of motion, and calculate the swimming kinematics asymptotically.

Lyndon Koens
Univ of Cambridge

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