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Undulatory swimming in shear-thinning fluids: Experiments with Caenorhabditis elegans DAVID GAGNON, PAULO ARRATIA, University of Pennsylvania — The swimming behavior of microorganisms can be strongly affected by the rheology of their fluidic environment. In this talk, we experimentally investigate the swimming behavior of the nematode Caenorhabditis elegans (≈1 mm length, 80 μm diameter) in shear-thinning fluids using tracking and velocimetry methods. We find substantial differences in the resulting flow fields between the shear-thinning and Newtonian cases, even though the swimming kinematics (e.g. speed and frequency) remain similar. For example, velocimetry data show that shear-thinning viscosity enhances vorticity and increases circulation near the strongest body vortex, located near the head of the nematode. These findings are in good agreement with recent theoretical and numerical results. We then estimate the local viscosity around the swimmer, measure the spatial decay of the flow field, and estimate the mechanical power (i.e. viscous dissipation) due to the worm's motion in shear-thinning fluids. We find that the flow decays more slowly in shear-thinning fluids than in Newtonian fluids, but the resulting mechanical power is approximately the same for swimming in shear-thinning fluids when compared to the Newtonian case.

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