Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

**Dynamics of a self-propelled undulating swimmer**[1] SOPHIE RAMANANARIVO, MAXIME DANA, BENJAMIN THIRIA, RAMIRO GODOY-DIANA, PMMH UMR7636 CNRS, ESPCI ParisTech, UPMC (Paris 6), U. Paris Diderot (Paris 7) — Undulatory propulsion is a mean of locomotion shared by living organisms over a wide range of scales and in many different media. From eels to spermatozoa or motile bacteria, net forward motion is achieved by propagating backward, actively or passively, elastic waves along a deformable body. Here, we use a simple yet versatile experiment that constitutes a good framework to study the dynamics of undulatory swimmers. The set-up consists in a flexible filament forced to oscillate by imposing a harmonic motion to one of its extremities, and propelling itself at the free surface of a water tank. The present experiments pertain to the inertial regime for which Lighthill's elongated-body theory is the reference theoretical framework. We fully characterize the nature of the wave travelling the filament to understand the changes in the propulsive performance encountered in this inertial regime. We analyze in particular the role of the spatial envelope of the elastic wave, which is crucial in the present experiment where the oscillation of the filament is driven at the head of the swimmer and the deformation of the tail is passive.

[1]We acknowledge support from the French National Research Agency through project No. ANR-08-BLAN-0099 and of EADS Foundation through project "Fluids and elasticity in biomimetic propulsion."

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Date submitted: 31 Jul 2012 Electronic form version 1.4