Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Buckling and relaxation of an elastic filament in a viscous fluid under compression MOUMITA DASGUPTA, Clark University, JULIEN CHOPIN, Departamento de Engenharia Civil COPPE/Universidade Federal do Rio de Janeiro, ARSHAD KUDROLLI, Clark University — We discuss an experimental investigation of buckling of an elastic filament in a viscous fluid under compressive loading in which an interplay of elastic and viscous forces are important to the structure observed dynamically. Buckling of an elastic filament in a viscous medium is a common phenomenon in soft matter and biological systems, examples of which include buckling instability during uniflagellated bacteria locomotion and formation of short wavelength curvature of microtubule in surrounding cytoskeleton. The experimental system consists of an elastic PDMS filament with clamped boundary condition immersed in a viscous fluid. One end of the filament is then compressed through a prescribed speed and distance. It buckles with a wavelength which decreases with increasing speed. The amplitude of the buckled mode is observed to decrease from the end which is moved. Over long times, the filament is observed to relax to the fundamental Euler buckling mode. Focusing on the initial buckling, we measure the shapes of filament and the fluid flow, in response to the compression, using PIV and high speed imaging. We thus estimate and discuss the relative viscous and elastic stresses experienced by the filament during the growth of the various modes as a function of compression speed.

Moumita Dasgupta
Clark University

Date submitted: 01 Aug 2014 Electronic form version 1.4