Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Finite and infinite wavelength elastocapillary instabilities with cylindrical geometry JOHN BIGGINS, CHEN XUAN[1], Cambridge University — In an elastic cylinder with shear modulus μ, radius R_0 and surface tension γ we can define an emergent elastocapillary length $l = \gamma/\mu$. When this length becomes comparable to R_0 the cylinder becomes undergoes a Rayleigh-Plateaux type instability, but surprisingly, with infinite wavelength λ rather than with wavelength $\lambda \sim R_0 \sim l$. Here we take advantage of this infinite wavelength behaviour to construct a simple 1-D model of the elastocapillary instability in a cylindrical gel which permits a high-amplitude fully non-linear treatment. In particular, we show that the instability is sub-critical and entirely dependent on the elastic cylinder being subject to tension. We also discuss elastocapillary instabilities in a range of other cylindrical geometries, such a cylindrical cavities through a bulk elastic solid, or a solid cylinder embedded in a bulk elastic solid, and show that in these cases instability has finite wavelength. Thus infinite wavelength behaviour is a curiosity of elastic cylinders rather than the generic behaviour or elasto-capiliarity.

[1]also Fudan University Shanghai

John Biggins
Cambridge University

Date submitted: 06 Nov 2015 Electronic form version 1.4