Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Drops and waves on a viscous film coating a vertical fiber

CAMILLE DUPRAT, FREDERIQUE GIORGIUTTI-DAUPHINE, Laboratoire FAST, Orsay — We consider the nonlinear dynamics of a liquid viscous film flowing down a vertical fiber. The initially flat film spontaneously breaks up into a regular wavetrain due to the Rayleigh-Plateau instability. The characteristics of the fully developed structures then depend on the dominant mechanisms. When the advection of the waves by the flow dominates over the instability, we observe moderate amplitude waves that propagate without carrying mass. When surface tension is strong, the film breaks up into large amplitude drops exhibiting a recirculation region. The transition between drops and waves regimes and the corresponding structures have been characterized experimentally and numerically. When both surface tension and viscosity effects are strong, the system can be seen has a paradigm for active (unstable), dissipative and dispersive media. The particular shape of the resulting structures gives rise to complex interactions (attraction and repulsion) leading to the formation of bound states. The system then appears to select a finite number of preferred specific distances in agreement with a weak interaction theory developed by D. Tseluiko, S. Saprykin and S. Kalliadasis (Imperial College London).

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Date submitted: 07 Aug 2009 Electronic form version 1.4