Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

DNS prediction of the properties of solitary waves running down a vertically falling film[1] P.-K. NGUYEN, V. BONTOZOGLOU, Dept. of Mechanical Engineering, University of Thessaly, 38334 Volos, Greece, S. CHAKRABORTY, C. RUYER-QUIL, Laboratoire FAST, UMR CNRS 7608, Campus universitaire, 91405 Orsay, France — The present work computes the properties of stationary, traveling wave by solving the Navier-Stokes equation using the Galerkin finite element method. Solitary-like waves are derived by considering a long enough computational domain and necessarily a strong mesh refinement in the vicinity of the solitary wave in order that the properties of the wave converge asymptotically to the true solitary limit. The solitary wave can be characterized by its maximum height, and phase speed in terms of the modified Reynolds number, $\delta = 3^{4/3} Re^{11/9} Ka^{-1/3}$. Both the wave height and the phase speed curves exhibit inflection points in the transition region, then maxima at intermediate values of δ, and finally a drop to a plateau at high enough δ. These are unique characteristics of the full second-order model by Ruyer-Quil and Manneville. In particular, the behavior deep in high δ limit shows that (i) the phase speed tends asymptotically to a value almost unaffected by Ka, and (ii) the wave height increases roughly linearly with Ka, which underlines the stabilizing effect of viscous diffusion at low Kapitsa numbers.

[1]Research partially supported by the EU/FP7-ITN-MULTIFLOW

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Date submitted: 28 Jul 2011 Electronic form version 1.4