Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Viscous dispersion effects on bound-state formation in falling liquid films MARC PRADAS, Department of Chemical Engineering, Imperial College London, London SW7 2AZ, UK, DMITRI TSELUIKO, School of Mathematics, Loughborough University, Leicestershire, LE11 3TU, UK, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London, London SW7 2AZ, UK — We examine the influence of viscous dispersion on the interaction of two-dimensional solitary pulses in falling liquid films at moderate Reynolds number. We make use of an averaged model that includes second-order viscous effects in the long-wave expansion. These effects play a dispersive role affecting primarily the shape of the capillary ripples in front of the solitary pulses. We show that different physical parameters, such as surface tension and viscosity, play a crucial role in the interaction between pulses giving rise eventually to the formation of bound states consisting of two or more pulses separated by well-defined distances and travelling at the same velocity. By developing a coherent-structures theory that assumes weak interaction between the pulses, we are able to theoretically predict the pulse-separation distances for which bound states are formed. It is shown that viscous dispersion significantly affects the distances at which bound states are observed. In all cases, there is very good agreement between the theory and computations of the fully nonlinear system.

Serafim Kalliadasis
Department of Chemical Engineering,
Imperial College London, London SW7 2AZ, UK

Date submitted: 05 Aug 2010 Electronic form version 1.4