Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Evaporative suppression of Rayleigh-Taylor instability in pure and binary mixtures[1] RANGA NARAYANAN, DIPIN PILLAI, University of Florida Gainesville — The classic configuration of an interface between a liquid lying above its vapor is well-known to be unstable due to the Rayleigh-Taylor instability. We study this heavy-over-light configuration in the presence of evaporation. For this, a model configuration of a liquid lying above its vapor confined between two flat plates is chosen. The system is heated from the vapor side by maintaining the temperature of the plate in contact with the vapor higher than that in contact with the liquid. A weighted residual-integral boundary layer model is developed for this system. We show that strong evaporation can linearly stabilize Rayleigh-Taylor instability. Interestingly, when evaporation is weak and the system is linearly unstable, it can still evolve nonlinearly to a steady interface configuration that sustains a stable layer of vapor. In the presence of weak evaporation, the interface reaches near the bottom plate. Under such conditions, the system exhibits features of a pure Rayleigh-Taylor. Inertia is shown to slow down the rate at which the interface reaches the steady state. It also results in non-monotonic evolution of the interface. The study is extended to the case of a binary mixture with solutal Marangoni taken into account.

[1]NSF 0968313, FSGC NNX15 005

Ranga Narayanan
University of Florida Gainesville

Date submitted: 25 Jul 2016 Electronic form version 1.4