LadHyX Seminar – Jan 30, 10:45

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Dripping or not dripping in suspended falling films

Liquid films flowing down the underside of inclined plates are subject to the interaction of Kapitza and Rayleigh-Taylor (R-T) instabilities, causing intricate 3D patterned and wavy topologies. Owing to the R-T instability, large amplitude surface deformations form which can result in the formation of droplet and finally droplet detachment if no saturation mechanism arises. First, we examine the critical angle for the R-T instability in a falling film between the regime of absolute and convective instability using the weighted integral boundary layer (WIBL) approach. In the absence of saturation, the threshold determines whether immediate dripping occurs, e.g. in the entire domain, or if the instability is of convective type, such that waves and eventually drops form while the perturbation is moving downwards the inclined plate. The dripping transition is next explored by DNS and by experiments on an analogous centrifuged film falling along the outer surface of a rotating vertical cylinder. Finally, a nonlinear analysis is performed comparing the WIBL and DNS results for identifying the phase transitions corresponding to flow separation and flow recirculation inside travelling waves, which are believed to have significant influences on mass and heat transfers in falling liquid films, as encountered in numerous industrial applications."