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Wavy regime of a colloidal falling film DARISH JESWIN DHAS S, ANUBHAB ROY, Indian Institute of Technology Madras — Thin liquid films are observed in a wide range of scenarios, of both natural and engineering importance. Tear film formation, glaciers flowing down mountains and coating flows are some of the classical examples of shallow liquid flows where viscous effects are important. A lot of work has been done in the case of gravity driven falling films. Yih (1963) in his pioneering study carried out a linear stability analysis and identified a long wavelength instability in a falling film. Subsequently Benney (1966) derived a nonlinear long wave equation describing the evolution of the film height that reproduced the linear stability predictions as a limiting scenario. However with the introduction of particles brings in new physics - concentration dependent viscosity, shear-induced migration, normal stresses, etc. In this work, we analyze the dynamics of a particle-laden gravity driven falling film. The particles evolve by being both advected by the background flow while also diffusing due to Brownian motion. Both the linear and the non-linear regimes are studied by developing models using the lubrication approximation. The non-linear regime is studied using a Benney-like amplitude expansion and also a weighted residual approach in conjunction with the lubrication approximation.

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