Finite-time rupture in thin films driven by nonconservative effects

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Rupture of unstable layers of viscous fluids coating solid substrates gives simplified models for singularity formation in free-surface fluid flows. We study the dynamics leading to rupture in a generalized thin film equation with a nonconservative term. The governing nonlinear partial differential equation yields several different types of finite-time singularities controlled by balances between conservative and non-conservative terms. Non-self-similar behavior and two classes of self-similar rupture solutions are analyzed and validated against high resolution PDE simulations.

This is joint work with Hangjie Ji (Duke/UCLA).