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A Model for Lipid Layer Dynamics on a Moving Domain

NICHOLAS GEWECKE, RICH BRAUN, University of Delaware, CHRIS BREWARD, University of Oxford — The human tear film consists of an aqueous layer and a thinner layer of nonpolar lipids, with polar lipids along the interface between them. Dynamics of the nonpolar lipid layer are not yet well understood. Experimental observations indicate that visible features in the lipid layer can persist through multiple blinks, but how this occurs is a matter of debate. One possibility is a concertina-like folding, corresponding to a serpentine instability in the lipid layer during a blink. Another possibility is due to a varicose instability. We use a two-layer thin film model to understand the dynamics of the lipid layer. We study the dynamics of a model Newtonian extensional layer floating on a less viscous shear layer. The upper layer includes van der Waals terms so that it dewets from the lower layer as expected in the tear film system. We give results for expanding and contracting domains for both varicose and sinuous disturbances.

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