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**Separated rupture and retraction of a bi-layer free film** PETER STEWART, University of Glasgow, JIE FENG, Princeton University, IAN GRIFFITHS, University of Oxford — We investigate the dynamics of a rising air bubble in an aqueous phase coated with a layer of oil. Recent experiments have shown that bubble rupture at the compound air/oil/aqueous interface can effectively disperse submicrometre oil droplets into the aqueous phase, suggesting a possible mechanism for clean-up of oil spillages on the surface of the ocean. Using a theoretical model we consider the stability of the long liquid free film formed as the bubble reaches the free surface, composed of two immiscible layers of differing viscosities, where each layer experiences a van der Waals force between its interfaces. For an excess of surfactant on one gas–liquid interface we show that the instability manifests as distinct rupture events, with the oil layer rupturing first and retracting over the intact water layer beneath, consistent with the experimental observations. We use our model to examine the dynamics of oil retraction, showing that it follows a power-law for short times, and examine the influence of retraction on the stability of the water layer.

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