Abstract Submitted
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Spatiotemporal measurement of surfactant distribution on gravity-capillary waves[1] STEPHEN STRICKLAND, Department of physics, North Carolina State University, MICHAEL SHEARER, Department of mathematics, North Carolina State University, KAREN DANIELS, Department of physics, North Carolina State University — Materials adsorbed to the surface of a fluid - for instance, crude oil, biogenic slicks, or industrial/medical surfactants - will move in response to surface waves. Due to the difficulty of non-invasive measurement of the spatial distribution of a molecular monolayer, little is known about the dynamics that couple the surface waves and the evolving density field. We report measurements of the spatiotemporal dynamics of the density field of an insoluble surfactant driven by gravity-capillary waves in a shallow cylindrical container. Standing Faraday waves and traveling waves generated by the meniscus are superimposed to create a non-trivial surfactant density field. We measure both the height field of the surface using moire-imaging and the density field of the surfactant via the fluorescence of NBD-tagged phosphatidylcholine. Through phase-averaging stroboscopically-acquired images of the density field, we determine that the surfactant accumulates on the leading edge of the traveling meniscus waves and in the troughs of the standing Faraday waves. We fit the spatiotemporal variations in the two fields and report measurements of the wavenumbers as well as a temporal phase shift between the two fields. These measurements suggest that longitudinal waves contribute to the dynamics.

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