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The decay of thermal capillary waves on thin liquid films ADAM WILLIS, JONATHAN FREUND, University of Illinois at Urbana-Champaign — Thermal fluctuations are expected to excite capillary waves on free surfaces of liquids. For a liquid film on a solid wall, continuum models predict that waves of wavesnumber q will decorrelate at rate ω that scales as $\omega \sim q^4$ for thin films (the lubrication limit with a no-slip boundary condition) and as $\omega \sim q$ for thick films (flow in a viscous half-space). Atomistic simulations of model polymeric fluids are employed to confirm these expected scalings and probe how this behavior fails as the atomic granularity of the fluid becomes important. These expected scalings are indeed found, but an unexpected $\omega \sim q^2$ powerlaw is also evident at shorter wavelengths than the $\omega \sim q$ region. For these same q values, the capillary waves still seem to obey equipartition with energies defined simply by surface curvature, suggesting that there is not a complete failure of a continuum description of the fluid for these q. A $\omega \sim q^2$ would be expected for a slip boundary condition at the wall boundary, but no such slip is observed. Results for different polymer lengths collapse in this q^2 region when scaled with the radius of gyration of the polymer, suggesting that the anomaly is the result of a breakdown of the constitutive model.

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