

Abstract Submitted
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Crossover Between 2D and 3D Fluid Dynamics in the Diffusion of Islands in Ultra-Thin Freely Suspended Smectic Films¹ ZOOM NGUYEN, MARKUS ATKINSON, CHEOL PARK, JOSEPH MACLENNAN, MATTHEW GLASER, NOEL CLARK, University of Colorado-Boulder — fluid requires no force, leads, via the Einstein relation, to an infinite diffusion coefficient D for the disc. Saffman and Delbrück proposed that if the 2D fluid is a thin film immersed in a 3D viscous medium, then the film should behave as if it were of finite size, and $D \sim -\ln(a\eta')$, where a is the inclusion radius and η' is the viscosity of the 3D medium. By studying the Brownian motion of islands in freely suspended smectic films a few molecular layer thick, we verify this dependence using no free parameters, and confirm the subsequent prediction by Hughes, Pailthorpe and White of a crossover to 3D Stokes-like behavior when the diffusing island is sufficiently large.

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