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Thickness fluctuations in pure lipid bilayers MICHIHIRO NAGAO, NIST and Indiana University, ANDREA WOODKA, PAUL BUTLER, NIST, LIONEL PORCAR, BELA FARAGO, ILL — Recently neutron spin echo (NSE) revealed dynamical processes in a surfactant membrane system around the length scale of the membrane thickness where the classical Helfrich treatment breaks down. This excess dynamics (on top of the bending fluctuations) observed in a nonionic surfactant, water and oil system, was attributed to thickness fluctuations of the membrane. In the case of bilayers formed with the nonionic surfactant in water the thickness fluctuation amplitude was estimated to be a few angstroms. In the study presented here, we apply the technique to explore thickness fluctuations in lipid bilayers. The result shows clear evidence of thickness fluctuations above T_m, where the lipid tails display liquid ordering, while none are discernable below T_m. The estimated amplitude of the observed membrane thickness fluctuations is approximately 4 Å. These results are consistent with theoretical expectation and recent molecular dynamics simulations. Varying the lipid tail length from 14 carbons to 18 carbons per tail does not appear to affect to the dynamics very much.

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