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X-ray Scattering Experiments Support Tilt-dependent Membrane Theory MICHAEL S. JABLIN, JOHN F. NAGLE, Carnegie Mellon University — Recent molecular dynamics simulations have suggested that the traditional model for topographical fluctuations in lipid bilayers should be enriched to consider molecular tilt. We present the first experimental support for a tilt-dependent theory. X-ray scattering from a liquid crystalline stack of oriented fluid phase lipid bilayers was collected and compared to the predictions of tilt-dependent and tilt-independent membrane models. Both models satisfactorily fit the X-ray data dominated by in-plane lengths greater than membrane thickness (> 100 Å), but only the tilt-dependent model accounts for X-ray data primarily attributable to shorter length correlations. By fitting the measured X-ray scattering intensity, both the bending modulus $K_c = 8.3 \pm 0.6 \times 10^{-20}$ J and the tilt modulus $K_\theta = 95 \pm 7$ mN/m were determined for DOPC bilayers at 30 °C. Our experimental results support the enrichment of the classic Helfrich continuum model to include an internal degree of freedom, the fluctuations of lipid directors from the local normal.

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