

Collective Dynamics in Fully Hydrated Phospholipid Bilayers Studied by Inelastic X-Ray Scattering

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The short wavelength density fluctuation of DLPC (dilaurylphosphatidylcholine) bilayers close to full hydration has been studied by the inelastic x-ray scattering technique below and above the main transition temperature. The analysis based on a generalized three effective eigenmode theory allows us to construct the dispersion relation of the high frequency sound mode for the first time. The marked softening of the excitation near $k=14 \text{ nm}^{-1}$, corresponding to the lipid chain-chain correlation peak in the structure factor, in the L_α phase implies prevalent occurrences of short-wavelength in-plane motions of lipid chains that might be of importance for transportation of small molecules across membranes.

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