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Dynamic Structure in a Two Dimensional Fluid of Oriented Lipid Multibilayers by Non-linear EPR Spectroscopies

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Abstract

The lipid-water system forms various kinds of two-dimensional fluid at certain temperature ranges, where the orientational order is more dominant than the positional order of the lipid molecule. Vector electron paramagnetic resonance spectroscopy (V-EPR) and Pulsed FT-EPR spectroscopy were successfully applied to an oriented multibilayer to explore the anisotropic dynamics of fluctuations in the lipid multibilayer at the slow motional domain. V-EPR analyzed the slow dynamics in the various lipid phases with a high precision. FT-EPR explores the type of lipid fluctuations.

A highly anisotropic structure in the correlation times of molecular fluctuations was found in the two dimensional fluid of lipids. This indicates that anisotropy exists in both the correlation time as well as the correlation length of molecular fluctuations. The modes of motions have been elucidated in the multiple mesophases of lipids with the several phase transitions. The temperature variation of correlation time shows that the pre-transition and main-transition correspond to the onsets of full axial rotation and the wobbling of lipids, respectively.