

Short range interactions between phospholipid bilayers: dissecting the forces

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Short range interactions between soft interfaces are important for the understanding of biolubrication and biofriction. Here the grand canonical Monte Carlo technique is used to reveal the origin of the repulsive pressure operating between supported DLPC bilayers at short separations. By partitioning the interbilayer pressure into physically distinct components, it is shown that the short-range repulsion comes mainly from the direct electrostatic lipid-lipid interaction of the head groups in the opposing leaflets. By contrast, the electrostatic lipid-lipid interaction between DLPE bilayers is strongly attractive, and the short-range repulsion is associated with the hydration (water-lipid) interactions. These findings explain e.g. why DLPC bilayers have a much larger interbilayer (fluid) separation at a given pressure, as compared to that for DLPE.