# Co-existence of Gel and Fluid Lipid Domains in Single-component Phospholipid Membranes

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The coherent properties of photons and neutrons are used to study structure and dynamics in elastic and inelastic x-ray and neutron scattering experiments. Matching the coherent properties of the scattering probe with those of the sample becomes important in soft-matter and biology because of: (1) the missing long ranged order; and (2) the large length scales involved. Good monochromaticity is a prerequisite for atomic resolution in crystal and protein structure determinations. However, such radiation is also highly coherent with large coherence lengths, of the order of several thousands of Angstroems. A large coherence length may, however, average over small structures, such as nanoscale domains. By controlling ξ in a neutron diffraction experiment, we present direct experimental evidence for co-existing gel and fluid domains in a phospholipid bilayer.

The sample examined consisted of highly oriented multi-lamellar stacks of 1,2-dipalmitoylsn-glycero-3-phosphocholine (DPPC) prepared on polished Si wafers. Twenty such Si wafers were stacked with aluminum spacers to allow for full hydration of the membranes. The "sandwich" sample was kept in a temperature and humidity controlled chamber.

With this sample a series of in-plane and out-of-plane scans were conducted. Instead of a continuous phase transition from the well ordered gel into the fluid phase, which adheres to a well known critical behaviour, we observe a first order transition with a co-existence of gel and fluid domains. The experiment was very successful and the data are currently being prepared for publication.

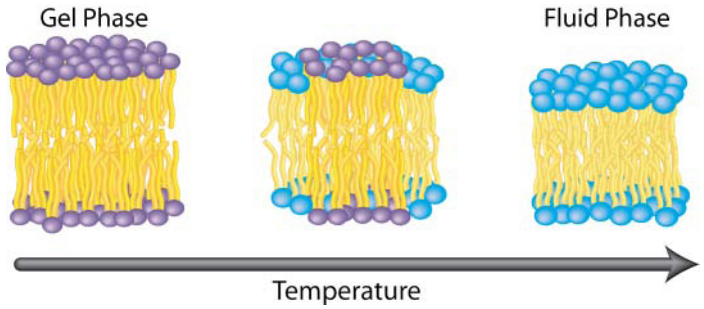


**Fig. 1** Schematic of the gel-fluid transition in phospholipid membranes with co-existing gel and fluid domains.