TIFR Centre for Interdisciplinary Sciences
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Seminar

The puzzle of de Vries Smectics: Diffuse Cone or Sugarloaf?

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For more than 35 years, molecular organization in the de Vries smectic-A (SmA) and smectic-C (SmC) phases has remained an enigma. These one-dimensional crystals, referred to as fluid smectics, comprise of 2D fluid layers of calamitic mesogens. Liquid crystal molecules are normal to the smectic layers in the SmA phase but develop a temperature dependent tilt in the SmC phase. This tilt causes smectic layers to significantly shrink, which is an order-of-magnitude smaller in de Vries SmC phase than in the conventional SmC phase. The underlying reason of this difference has remained a mystery till now, and was explained by the diffuse-cone model[1] where molecules are believed to be distributed on the surface of a cone with azimuthal degeneracy which is gradually lost upon transition to the SmC phase. Lagerwall, et al.[2], proposed a significantly low orientational order and a broad sugarloaf shaped molecular distribution. Recent x-ray study of four organosiloxane mesogens[3] reveals a sugarloaf molecular distribution which narrows in the SmC phase, counteracting the effect of increasing molecular tilt and rendering the SmC layers nearly shrinkage-free. These and other advances in our understanding of the de Vries smectics materials will be discussed.

1. A. de Vries, J Chem Phys **71** , 25-31 (1979).
2. S. Lagerwall and P. Rudquist, Mol Cryst Liq Cryst **510** , 148 (2009).
3. D.M. Agra-Kooijman, H.-G. Yoon, S. Dey, and S. Kumar, Phys Rev **E 89** , 032506 (2014).

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11:30 AM (Tea/Coffee at 11:15 AM)

Seminar Hall, TCIS