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Nano to Meso-scale Structure in Liquid Crystals: the Cybotactic Nematic Phase of Bent-core Mesogens

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The extent of molecular order and the resulting broken symmetry determine the properties and mesophase type of liquid crystals (LCs). Thermotropic bent-core mesogens (BCMs) represent a new class of LCs exhibiting substantially different physical properties than traditional linear (calamitic) materials. In recent years BCMs have become the focus of intense experimental and theoretical investigation, with several exciting new developments. These include chiral mesophases composed of achiral BCMs, giant flexoelectricity, biaxial nematic (N) order, a ferroelectric response in the N phase, and a large flow birefringence. A key issue that is currently widely debated concerns the actual nature of the N phase of BCMs which gives rise to some of the above mentioned effects and is unambiguously identified by a peculiar low-angle X-ray diffraction pattern (the "four-spot pattern"). The consensus emerging is that this N phase of BCMs constitutes a new type of mesophase, namely, a cybotactic nematic (N_{cyb}) phase unrelated to pretransition cybotaxis, in agreement with experimental [1-3] and theoretical findings [4]. This N_{cyb} phase is composed of nanometer-size clusters of BCMs exhibiting a relatively high degree of internal order—orientational as well as translational order (strata) imposed by close packing the BCM nonlinear shape. This peculiar supramolecular structure of the N_{cyb} mesophase of BCMs—evanescent, biaxial clusters of tilted and stratified nonlinear mesogens percolating the nematic fluid—accounts for their unusual properties, e.g., biaxial order [4], ferroelectric response [1], and extraordinary field-induced effects [5]. In this talk I will give an overview of the most recent developments and the current state of research on this subject.

[1] O. Francescangeli *et al.*, Adv. Funct. Mater. **19**,2592 (2009).
[2] O. Francescangeli and E.T. Samulski, Soft Matter **6**, 2413 (2010)
[3] O. Francescangeli *et al.*, Soft Matter **7**, 895 (2011).
[4] A.G. Vanakaras and D.J.Photinos, J. Chem. Phys. **128**, 154512 (2008).
[5] O. Francescangeli *et al.*, Phys. Rev. Lett. **107**, 207801 (2011).