

## PREFACE: Twist-bend nematics and beyond

The twist-bend nematic phase has been predicted twice, once in 1973 and then in 2001, even so its eventual discovery did not occur until about 10 years later. These were clearly exciting moments in the history of the nematic phase representing as it does the fifth and latest version of this important phase. Initially the formation of the  $N_{TB}$  phase by an odd-membered liquid crystal dimer was not universally accepted even though there were clear examples of such dimers and polymers exhibiting nematic – nematic transitions. The combination of the discovery of the twist-bend nematic phase and its fascinating properties presented an irresistible challenge to us. So much so that eventually, towards the end of 2015, we decided to organise a Workshop on this phase at the University of Southampton. Our aim was to help understand the behaviour of the twist-bend nematic phase and in part to place the existence and structure of the phase beyond doubt. To achieve this we sought to bring together those with an interest in the newest nematic for a brief but intensive meeting; that is a Workshop. Given the distribution of these scientists across the world we realised it might not be an easy task that we had set ourselves. To facilitate their meeting it would clearly be necessary to raise a fund to cover, at least in part, the costs of their participation. We are grateful to the British Liquid Crystal Society, Merck UK and the Taylor & Francis Group for their strong support which made our Workshop possible. We also wish to thank the participants who came from 11 countries in such numbers as to make the Workshop a very real success. They can be seen in the photograph taken of the Highfield Campus of the University in front of a bronze statue, the Two Figures by Dame Barbara Hepworth. Many of the other figures will be known to you but if not their names can be found at [captioned photo](#).



The interests both general and specific shared by the participants in the twist-bend nematic are diverse and often long held. Indeed some participants were involved in early studies of the nematic-nematic transitions; they are Andreja Lesac, Vitaly Panov, Goran Ungar and Jagdish Vij, it was good to see them there. The diversity of the topics covered in the Invited Lectures, Lectures and Posters was truly excellent and given by present and future leaders in the field. The experimental techniques, leading to a range of properties, included resonance and conventional X-scattering, NMR spectroscopy, dielectric spectroscopy, Raman scattering as well as the design and synthesis of mesogens. The theories encountered were also wide ranging involving coarse-grained, molecular-field, Onsager and elastic continuum theory. The

topics covered constituted a rich mixture often with novel outcomes; these prompted much discussion, both formal and informal, throughout the Workshop. As might have been expected with the varied participants there were differences of opinion which can on occasion be taken as an indication that the subject is in good health.

At an early stage of our planning it was suggested by Corrie Imrie that papers, based on the Workshop presentations, might be published in the journal *Liquid Crystals* with the Organisers as its three Guest Editors. As is clearly apparent this suggestion met with the approval of the participants and we have been busy processing the papers which appear here as Invited Articles. However, all of the papers which contain a mix of original and review material have been subject to refereeing in the usual way with at least one referee selected by a Guest Editor. Once accepted the paper has been printed, proof-read by the authors and then published on-line and so made generally available. The only difference from normal articles is that although the date of receipt is placed on the article that of acceptance is not. The process that has been adopted means that we have been able to arrange the papers in a logical, subject related order rather than the chronological order of a normal issue.

As can be seen we decided to start with a section on theory. This opens with three papers on macroscopic theory while the following two papers present microscopic theories of the twist-bend nematics. The following section of five papers is concerned overall with new mesogenic molecules, their design and synthesis. This is an important area of the development of twist-bend nematics and also concerns the relationship of molecular structure to the properties of the nematogens. The determination and investigation of the physical properties characteristic of the twist-bend nematic phase are addressed in the next section of eight papers. One provides a review of previous studies of the twist-bend nematic phase including the first to show the identity of that formed by CB7CB. Another contains a detailed study of key properties as the system passes through the  $N_{TB} - N$  transition and change in an unusual manner. The systems that we have considered are based on the odd liquid crystal dimers but in the last section we start with a paper describing the behaviour of a bent-core nematogen which makes a useful comparison with that of odd dimers. The final two papers both by Cieřła and his colleagues deal in a novel way with systems in two dimensions using Monte Carlo simulations. One is formed from hard bent-core systems and the other with biaxial particles interacting via quadrupolar and octupolar terms. We trust that we might be excused for not describing each of the papers in any detail. They are given in the following pages, the authors' words clearly speak for themselves and we commend them to you.

Before you leave this Preface we wish to recount an event from the last day of the Workshop. Those not leaving until the following day were invited to join the Organisers for dinner in the neighbouring, historic City of Winchester. Prior to dinner while walking in the grounds of the Cathedral we came across the Dean Garnier Garden and there discovered the Fish Sculpture by Charles Normandale which is reminiscent of a polar, heliconical structure. Being scientists with an interest in such things we just had to be photographed surrounding it; as you can see it was certainly overwhelming. This was a fitting end to what had proved to be a stimulating and successful Workshop.



Giampaolo D'Alessandro  
Mathematical Sciences  
University of Southampton  
Geoffrey R. Luckhurst  
Chemistry  
University of Southampton  
Timothy J. Sluckin  
Mathematical Sciences  
University of Southampton

*Guest Editors  
Liquid Crystals*