

## The Strathclyde liquid crystal reading group

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### ABSTRACT

In this article we give an overview of the Strathclyde Liquid Crystal Reading Group, a new student-led initiative organised by PhD students, and aimed at PhD students and early-stage post-docs, researching in the field of Liquid Crystals. In this article we begin by covering the premise behind the reading group, what we hope to achieve, and describe the structure of the meetings. We then give a detailed summary of the first two meetings of the reading group, touch on some future plans, and finally discuss how successful the reading group has been thus far.

### KEYWORDS

student-led initiative;  
reading group; liquid crystals



**Figure 1.** The current organisers of the Strathclyde liquid crystals reading group are Sophie McLauchlan (left) and James Dalby (right), two PhD student in the group of Apala Majumdar.

The Strathclyde Liquid Crystal Reading Group is a new student-led initiative, which is currently being funded by the Strathclyde Alumni fund. One of the merits of this reading group is that it is organised by students and for students who are researching in the highly interdisciplinary field of liquid crystals. The reading group is currently being organised by Sophie McLauchlan (Figure 1 (left)) and James Dalby (Figure 1(right)) and is aimed at PhD students and early-stage post-docs. We (James and Sophie) are PhD students in the department of Mathematics and Statistics at the University of Strathclyde, working with Professor Apala Majumdar. While our background is in mathematics, the reading group is open to students from all disciplines.

The idea behind the Strathclyde Liquid Crystal Reading Group is to create a network for early-career liquid crystal researchers. There already exist strong networks in liquid crystals in the UK and internationally, such as the Durham-Oxford-Strathclyde Network on Anisotropic Materials (funded by the London Mathematical Society) and the newly founded network on Nematic Based Materials for the Next Generation of Applications (funded by the Royal Society of Edinburgh), but there was previously no such network led by students, aimed at early-career researchers. We believe our reading group now fills this gap. It is our aim and hope that this reading group will be beneficial to the research of participating students and will give them a platform to share their work and develop key skills necessary for research, such as presenting their work and communicating ideas. Furthermore, these meetings should provide students with an excellent chance to learn about liquid crystals and to be exposed to new ideas when hearing talks from researchers with different backgrounds and perspectives. Finally, through this reading group we want to facilitate the sharing of ideas via the discussion sessions, and perhaps even bring students together in new collaborations.

The Strathclyde Liquid Crystal Reading Group currently has funding for four meetings, the first of which took place on the 28<sup>th</sup> of October 2021, and the second on the 9<sup>th</sup> of December 2021. The final two meetings will be held between February and May 2022. The first and second meetings took place virtually over Zoom, but we hope that the 2022 meetings can be held in person. The first two meetings consisted of one academic speaker, two student talks, and finally a student

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discussion session. The reason for this structure and having most of the meetings filled by student activities is because we want students to actively take part and be the main driver in these meetings.

What makes these meetings unique is the discussion session, which were held for early-career researchers only. Our hope was to allow for a more informal environment for students to share ideas without the pressures of more senior academics being present. The discussion sessions ran for thirty to forty-five minutes and were a chance for students to discuss the talks in greater depth and ask the student speakers any additional questions. The principal focus of the discussion sessions, however, is to consider questions put forward by us, the organisers. The purpose of these questions is to facilitate conversations between researchers from all different backgrounds. To this end, the discussion questions are quite broad, giving scope for perspectives from researchers from different disciplines. For example, a question for discussion at the first meeting which allowed for this was, 'How do our respective disciplines link together in the study of liquid crystals; and how does this link to the real world?'

## Meeting 1

The first meeting on the 28<sup>th</sup> of October began with welcoming remarks from James Dalby at 10.30am GMT. Our academic speaker, Professor Apala Majumdar, was then introduced by Sophie McLauchlan before giving the opening talk, titled 'Mathematical Modelling of Nematic Liquid Crystals for Applications'. With the variety of backgrounds in the audience in mind, Professor Majumdar gave an overview of some of the exciting mathematical research she has been involved in over the last couple of years, but also emphasised the wide range of applications for liquid crystals. It was particularly interesting to see examples of how mathematicians and experimentalists can work together towards realising such applications, which was certainly relevant to the multidisciplinary audience.

Two shorter talks followed the academic speaker, the first by Bristol PhD student Benjamin Carter, and the second by Strathclyde postdoctoral researcher Dr Yucen Han. Benjamin spoke about his compelling research in cholesteric liquid crystals, and his talk was as engaging as his great title, 'Let's Twist Again: Transition Pathways in Cholesteric Liquid Crystals'. Dr Yucen Han works closely with Professor Majumdar, and her talk, 'Pattern Formation for Nematic Liquid Crystals on 2D Polygons', elaborated on some of the

research mentioned in the first talk and highlighted the quality of research in liquid crystals being carried out at Strathclyde.

Shortly after Dr Han's talk the student- and post-doc-only discussion session began. To direct the conversation, we chose the following two themes to talk about in advance:

- (1) How do our respective disciplines link together in the study of liquid crystals; and how does this link to the real world?
- (2) How sustainable are applications of liquid crystals? Is sustainability the responsibility of researchers?

Interestingly, in discussing the first topic, participants had a chance to share both their experience of their discipline and their perception of other disciplines. It was understood that the link between disciplines is quite clear due to the vast array of applications of liquid crystals. Moreover, there was a general consensus that each discipline makes up an essential part of a chain from theory to physical applications, with conclusions drawn from theory informing experimentalists, and the results of experimentalists informing engineers and manufacturers.

The second topic for discussion was particularly pertinent as the COP26 climate conference was due to begin in Glasgow just three days after the first meeting, on the 31<sup>st</sup> of October. Participants noted that sustainability was not an aspect of liquid crystal research that they often considered. Participants talked about how sustainability varies by application. For example, the use of liquid crystals in smart glass products appears to be sustainable, and smart glass itself can help reduce the costs of central heating and air conditioning. Conversely, there are issues in the liquid crystal display (LCD) industry as currently most LCDs are incinerated or placed in landfill at the product's end-of-life. While there do exist processes to harvest components of LCDs for reuse, they are currently either inefficient or expensive. This could be an area for improvement in research. In addition, participants agreed that sustainability is the responsibility of liquid crystals researchers, but that researchers in certain disciplines with the right skill set and knowledge can have more of an impact on the sustainability of applications than others. For example, theorists cannot possibly predict every application that their research might be used for, and any restriction in research in the name of sustainability could prevent the development of new sustainable and environmentally friendly technologies. The same might be true for experimentalists, but perhaps more can be done to reuse materials in

experiments or more emphasis can be placed on the efficiency of processes. We were grateful that participants in the discussion session had taken the time to come up with thoughtful contributions and take part in what was an incredibly stimulating and thought-provoking conversation.

## Meeting 2

Our second meeting took place on the 9<sup>th</sup> of December and began at 10:30am GMT with welcoming remarks and the introduction of the first speaker by James Dalby. We were privileged to have the opening talk given by Professor Jan Lagerwall from the University of Luxembourg. His talk was titled 'Enabling Technological Revolutions with the Endless Potential of Cholesteric Liquid Crystal Spherical Reflectors', which was specially tailored to the broad range of disciplines in our audience. Professor Lagerwall gave us a crash course in cholesteric liquid crystal spherical reflectors and how they are made, before moving on to new and exciting applications for this technology, and provided us with many striking pictures throughout. It was interesting to hear in detail how these cholesteric spherical reflectors can be used to combat counterfeiting and related supply chain issues, problems which are ubiquitous in our society. Moreover, we heard about how this technology can even be used to improve the sensitivity of lateral flow tests. We found his talk incredibly captivating and are certainly excited to hear about his work in the years to come.

The first of our student talks was given by Dr Joseph Cousins, who recently finished his PhD which was based between both the Universities of Strathclyde and Glasgow, he is now a post-doc at the same institutions. He spoke enthusiastically about his research in pinned ridges of nematic liquid crystal in his talk 'Weak-Anchoring Effects in a Pinned Ridge of Nematic Liquid Crystal'. He also spoke about how his work on this topic resulted in a collaboration with experimentalists at Nottingham Trent University. Our second student talk was given by Baoming Shi, a second-year PhD student at Peking University. Baoming gave us an overview of his research in his talk 'Nematic Liquid Crystals in Rectangular Confinement: Solution Landscape and Bifurcation'. Baoming contrasted his work on a rectangle with existing work on a square in the literature, and it was interesting to see where novelties arose.

After the student talks, we moved on to our discussion session. Participants took the opportunity to ask Joseph Cousins more questions about his talk in the first half of the session, and he was able to elaborate

more on some details that he did not have time to cover in his talk. We then moved on to our discussion questions:

- (1) What motivated you to pursue academia this far, and will you carry on?
- (2) If a theory or process is not exactly right, can it still be useful?

As time was limited, we discussed only the first question and we intend to discuss the second at our next meeting. The first discussion question led to two topics of conversation: why participants chose to pursue a PhD; and whether participants plan to continue in academia. With regards to the first topic, participants described a number of reasons as to why they choose to do a PhD. A common theme was that participants had particularly enjoyed and performed well in their undergraduate studies and as such, felt that a PhD was the natural next step. Further, there was a general feeling that participants enjoy learning and understanding the physical reasons behind a process or phenomena, and when considering the next step after finishing their undergraduate studies, participants felt that working towards a PhD would provide a challenging opportunity to do so. As for the question of whether participants planned to continue down an academic career path, several points were raised. Firstly, it was noted that academia is a very competitive profession that requires a lot of dedication to be successful in, so it is not a career path to embark on lightly. However, it was pointed out that an academic position is just like any other job, so it is always possible to leave and pursue other opportunities, even after obtaining a post-doctoral research position. Finally, we discussed the pros and cons of a career in academia. For example, it may be necessary to relocate after a PhD or post-doc to continue in research which may not suit everyone. On the other hand, the flexibility in terms of working hours and research problems that a career in academia can bring can be very appealing. Participants concluded that there are many factors that contribute to whether someone will continue in academia following the completion of their PhD. Much like in the first meeting, we were grateful for participants' contributions to the discussion session, and we look forward to the next one.

More details of the first two meetings, including slides and recordings of the talks, as well as full minutes of the discussion sessions, can be found here: [Strathclyde Liquid Crystal Reading Group – The Majumdar Group](#) (wordpress.com). We have documented these meetings by uploading details to our group website for two reasons. Firstly, it ensures there is a record of these meetings and

its achievements and secondly, we hope it will be a useful resource to our participants and perhaps some other member of the liquid crystal community. This is something we will continue to do for the 2022 meetings.

Should the 2022 meetings be able to run in person the structure will be much the same as their virtual counterpart, but we also plan to run a poster session provided there is sufficient interest. Having the chance to run the remaining two meetings in person would be great from the perspective of getting the chance to meet people in person. As good of a tool as Zoom is, it cannot recreate the experience of an in-person meeting. Be that as it may, running the first two meetings virtually has had its benefits. We were able to gather an international group of students, with participants from the US, China and India all signed up, which simply would not have been possible in person due to the amount of funding and the fact that these meetings took place over only one day. We were also lucky to have Professor Jan Lagerwall, a world leading researcher in the physics of liquid crystals, speak at our second meeting, which also would not have been possible in person.

At present there is a good level of interest in this initiative, with forty-eight students having signed up for the Strathclyde Liquid Crystal Reading Group. The

first and second meetings had between fifteen and twenty students attending each talk, along with a few academics, whilst six to twelve students attended the discussion sessions. Thus far we have received positive feedback from our speakers and discussion participants. It is also worth noting this reading group has been well received by many of the academics we have contacted, who have also shown a great deal of support. We are particularly grateful for the support from Professor Apala Majumdar and Professor Nigel Mottram. Our supervisor Professor Majumdar is our mentor for this reading group, providing guidance on the organisation of these meetings, whilst Professor Mottram has advised us of funding avenues we could explore should we wish to extend the scope of our meetings and continue into the next academic year. Overall, the idea of a student led reading group has been welcomed by both students and academics, with some even considering starting similar initiatives amongst their research groups.

#### **Disclosure statement**

No potential conflict of interest was reported by the author(s).