

# Liquid Crystals, Metamaterials, Transformation Optics, Photonic Crystals, and Solar Cells

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## Poster:

 [W2.27-3.2.18\\_poster.pdf \(https://www.ima.umn.edu/sites/default/files/2017-2018.3/W2.27-3.2.18\\_poster.pdf\)](https://www.ima.umn.edu/sites/default/files/2017-2018.3/W2.27-3.2.18_poster.pdf)

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Since their discovery at the end of the 19th century, liquid crystals have helped illuminate the many ways in which light interacts with matter. The capability of nematic liquid crystal molecules to align along preferred directions by the application of electric and magnetic fields has had a profound impact on the way that information is presented through the flat panel display industry. In addition to small molecule nematic structures, there is a wealth of liquid crystal phases that can offer several degrees of positional ordering. These include the one-dimensionally modulated smectic phases, the two-dimensional chromonic crystal structures, and the three-dimensional periodic blue phases, which are determined by arrays of defects in cholesteric materials. This workshop will focus on a number of novel optical applications of liquid crystals.



Since the early days of the internet, nonlinear optic applications of liquid crystals have found their place in fiber optic networks. Currently, there is a strong research focus in applications of the modulated liquid crystal phases, whose periodicity in the range of 10 nm to 1  $\mu\text{m}$  makes them appropriate to the development of metamaterials, photonic crystals, and transformation optics.

From a different perspective, hexagonal liquid crystal phases present a large charge mobility index along the column direction. A number of chromonic molecules have been synthesized which show increased mobility and luminosity indices, prompting their use in solar cell research. On the other hand, large ferroelectric and bent-core molecule liquid crystals have shown significant flexoelectric effects, appropriate to their use as piezoelectric devices for energy conversion.

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This workshop will gather mathematicians and scientists from many fields of liquid crystal research to explore the current trends of liquid crystal optics.

