



Mathematical Sciences 2026 Colloquium Series



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April 10, 2026, at 3:00pm
Bell Hall, Room 130 and online
via Zoom *Scan the QR-code to access
the link.*



Models and numerical schemes for Nematic Liquid Crystals and their Applications.

Liquid crystals are important materials that are used in several technological applications. The most common usage is in the omnipresent liquid crystal displays which uses the birefringence property of the material to create images on a screen. However, liquid crystals also respond to other external stimuli, e.g. magnetic, mechanical, chemical, which can be used to induce complex shape changes in the material used for applications in biomedical devices, robotics, optics, textiles, and sensors. Liquid crystals exhibit intermediate phases between solid and liquid. One such phase is the nematic phase which possess the microscopic orientational order of a crystalline solid, however, the molecules have no positional order but flow freely past each other and thus display macroscopic properties of a liquid. Models of liquid crystals usually represent molecules as rods or disks and use some parameter to describe the orientation of the molecules.

In this presentation I will discuss the main ideas of two of the most popular models to represent nematic liquid crystals: the Oseen-Frank director theory and the Landau-de Gennes formulation. Moreover, I will present the main ideas to derive reliable numerical schemes to approximate these PDE systems. In both cases the key point is to try to preserve the properties of the original model while the numerical schemes are efficient in time.

Finally, I will talk about how these models and the ideas for deriving the associated numerical schemes can be extended to give insights of realistic situations observed in lab experiments.

Hosted by: Dr. Natasha S. Sharma.

For further information, please contact Dr. Emil Schwab, eschwab@utep.edu