# MATERIALS SCIENCE GRADUATE PROGRAM

**SEMINAR ON LIQUID CRYSTALS**

**Fall 2024**

KENT STATE UNIVERSITY

## WEDNESDAY, OCTOBER 23RD 3:20PM

## AMLCI 101

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## Optics of Cholesteric Liquid Crystals, Unique Natural Members of the Photonic Crystal's Family

Cholesterics were the first liquid crystals discovered more than 150 years ago with observation of a drastic color change with temperature. The temperature tuned color is not caused by absorption but is a result of the Bragg diffraction on the pitch P of helicoidal structure of a cholesteric.

More than 50 years ago, Meyer and de Gennes predicted the existence of a distinct electric-field-induced cholesteric state with an oblique helicoid in materials where the bend elastic constant is the smallest. Usually, the bend constant is largest; and ChOH was observed only 10 years ago in chiral mixtures that also exhibit NTB phase. ChOH is capable of continuous change of the pitch P in response to an applied electric field and reflects 50% of the unpolarized light incident along the ChOH axis in the band determined by P/2 similar to the regular field-free cholesteric.

Our recent results show that for an oblique incidence of light ChOH exhibits unique optical properties. The Bragg reflection bands are observed at multiple wavelengths that correspond to the P, P/2, P/3, and P/4 and reflect up to 100% of light of any polarization; the developed model describes their spectral and polarization characteristics. A single ChOH cell acted upon by an electric field tunes all these bands in a very broad spectral range, from ultraviolet to infrared and beyond, thus representing a structural color device with enormous potential for optical and photonic applications.

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