



Physics Colloquium

Friday September 13, 2019, 4 pm, PSC 3046

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Collagen fibrils: liquid-crystals, Ising models, and rubber

Collagen fibrils are self-assembled structures that provide mechanical integrity to skin, tendon, bone, and cornea. The radius of collagen fibrils vary widely depending on anatomical location; the tilt of individual molecules with respect to the fibril axis varies with radial distance; and fibrils exhibit a periodic modulation of density along the axial direction -- the "D-band". With a liquid-crystalline Franck free energy we have described how the molecular tilt stabilizes the fibril. By adding phase-field crystal terms we recover the D-band, and show how it distorts the tilt field and uncovers an Ising phase transition. We are now making theoretical rubber with our fibrils, as an initial step towards better treatments of corneal disease.