Topics in Material Science

- **Title**: Stability and evolving morphologies of a thin solid film in the presence of wetting and surface electromigration
  Speaker: *Mikhail Khenner* (mikhail.khenner@wku.edu), Western Kentucky University

  Abstract: A PDE-based model combining surface electromigration and wetting is developed for the analysis of morphological stability of ultrathin solid films. Adatom mobility is assumed anisotropic, and two directions of the electric field (parallel and perpendicular to the surface) are discussed and contrasted. Linear stability analyses of small-slope evolution equations are performed, followed by computations of fully nonlinear parametric evolution equations that permit surface overhangs. The results reveal parameter domains of instability for wetting and non-wetting films and variable electric field strength, nonlinear steady-state solutions in certain cases, and interesting coarsening behavior for strongly wetting films.

- **Title**: A Model for Dynamics of Tear Film Breakup
  Speaker: *J. I. Siddique* (jis15@psu.edu), Penn State York
  Coauthors: *R.J. Braun* (braun@math.udel.edu), University of Delaware; *A. Winkeler* (cbegley@indiana.edu), Indiana University; *P.E. King-Smith* (EKing-smith@optometry.osu.edu), The Ohio State University

  Abstract: We model the problem for the dynamics of an evaporating tear film. This model includes the effects of surface tension, marangoni effects, insoluble surfactant transport, evaporation, osmolarity transport, osmosis, fluorescein concentration and fluorescent intensity as a function of time assuming an initially flat tear film. The tear film thins to a steady state value that depends on evaporation and osmotic supply. We present results for dynamics of Marangoni–driven breakup.

- **Title**: Two Layer Model for Local Tear Film Dynamics
  Speaker: *Nicholas Gewecke* (ngewecke@math.udel.edu), University of Delaware
  Coauthors: *Rich Braun* (braun@math.udel.edu), University of Delaware; *Chris Breward* (Chris.Breward@maths.ox.ac.uk), University of Oxford; *P. Ewen King-Smith* (eking-smith@optometry.osu.edu), Ohio State University

  Abstract: Many tear film models utilize a single layer, while some recent models include surfactant effects at the liquid-air interface to model effects of polar lipids. Clinical observations indicate more complicated dynamics of the lipid layer than demonstrated by these previous models. Our model includes a thin lipid layer between the aqueous layer and the air, and results demonstrate formation of lipid drops. The number of drops depends upon various parameters, especially the thickness ratio between the layers.

- **Title**: Mesoscopic Structures of Active Gels
  Speaker: *Zhenlu Cui* , Fayetteville State University

  Abstract: Active polar gels are viscoelastic materials formed by polar filaments maintained in a nonequilibrium state by constant consumption of energy. Examples include the actomyosin cytoskeleton. In this talk, I will present a hydrodynamic theory of active polar gels. Steady structures, flow states, stability and rheology will be discussed.