How Things Bend and Break:
Modeling Deformation and Fracture
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While materials science texts often picture dislocations and cracks in idealized simple geometries, in reality the evolution of such defects under applied stress can give rise to complex patterns. I'll present two quite simple models that provide insight into the process of pattern formation. First, I'll describe an idealized model of metal deformation that shows how dislocations self-organize into a pattern of coarse slip bands where applied strain is spontaneously localized. In the context of the model, we show that shear banding represents a phase separation between dislocation-rich and dislocation-poor phases, and we examine the mechanism associated with brittle vs ductile response of a crack loaded in shear. Second, I'll present a simulation study of a planar crack propagating in a 3-d solid along an interface of heterogeneous toughness. Here our focus is on the characteristic exponents associated with roughening of the crack front, and the observation of non-dispersive crack-front waves. In both cases, computer simulations play an important role in our exploration of pattern formation mechanisms.
The public is welcome
Refreshments at 4:10 p.m.
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