Introduction to disorder

Soft Matter In and Out of Equilibrium

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Outline

• Introduction and motivation
• Disorder near a continuous phase transition
• Disorder near ordered states
• Examples of physical systems
Physical examples

(a) biological membrane  
(b) wrinkled sheet  
(c) friction via crystal pinning  
(d) nematic elastomer  
(e) smectic on dirty substrate  
(f) vortex lattice with pinning
Physical examples

charge density wave

liquid crystals in aerogel
(Bellini, RT, Toner, Clark Science 2001)
Disordered bilayer membrane

(a) random-bond curvature disorder
(b) random-field stress disorder
Disorder-free critical point

critical surface
Random-bond critical point

$\Delta t$

RG flow on a critical surface, $t = t_c$

$N < 4$

WF

$\Lambda$
Random-field critical point