Soft condensed-matter theory: who?

Benny Davidovitch
Pattern formation, Elasticity of thin sheets, singularities

Chris Santangelo
Liquid crystals, Nonlinear elasticity, Materials geometry

Jon Machta
Statistical mechanics, Spin glasses, Theory of computation

Greg Grason (PSE)
Bundles and fibers, Polymer physics, Liquid crystals
Soft condensed-matter theory: what?

Fundamental physics of soft materials: geometrical frustration, nonlinear elasticity, far-from-threshold instabilities, how things pack and order

Elasticity of thin sheets  
Liquid crystals and self-assembly  
Pattern formation

Collaborations outside and within UMass, especially with experimental groups. Involved with many of the institutions and centers on campus.

Large group, many opportunities for paper and pencil theory as well as computation
Soft condensed-matter theory: Davidovitch

Pattern formation in elastic films

Pattern formation and wrinkling cascades

Wrinkling of sheets

Diffuse stress versus singularities in elastic sheets

Soft condensed-matter theory: Santangelo

Nonlinear elasticity and materials geometry

Buckling in origami

Experimental mathematics: programming shapes by specifying intrinsic geometry

“Geometric frustration” of anisotropic liquid crystals
Soft condensed-matter theory: Machta

*Computation and frustration in statistical mechanics*

The densest packing of simple shapes on simple domains is *not* simple!

Combines computation, number theory, and physics

The densest known packings of squares in periodic boundary conditions:  

- 21 squares
- 22 squares
- 23 squares

*(Don Blair)*
Soft condensed-matter theory: Grason

**nonlinear relationship between 2D order and out-of-plane geometry**

Nematic ordering of densely-packed chains under confinement (dsDNA packing in viruses)

Supramolecular assembly of intrinsically curved filaments (bacterial flagella)

Topological defects in optimal cross-sections of twist filament bundles (filamentous proteins)
Soft condensed-matter theory

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Your most important tool: