Boulder School for Condensed Matter and Materials Physics

Geometry and Topology in Soft Matter Physics

July 6 - 31, 2026

Soft matter is a truly interdisciplinary field of study encompassing an ever broadening array of subjects, ranging from elasticity, complex fluids, and metamaterials, to physics of living matter and much more. Naturally, the study of soft matter brings together scientists from physics, biology, engineering, and mathematics. This summer school offers a unique opportunity for graduate students to be exposed to a more advanced formal training in the relevant mathematics for soft matter, helping them gain a language and expertise for formulating and attacking new research problems. The program will provide students with essential mathematical tools, including differential geometry, topology, and network science, and will discuss their application to elasticity, complex fluids, topological defects and more, all increasingly vital for understanding complex physical systems. Engaging lectures from mathematicians, engineers, and physicists will offer students a comprehensive understanding of how these tools are applied to real-world problems. This program is designed to provide a strong mathematical foundation that will empower the next generation of researchers to push the boundaries of soft matter physics.

Greg Grason (UMass-Amherst)
Richard James (Minnesota)
Randall Kamien (UPenn)
Eleni Katifori (UPenn/Flatiron)
Cristina Marchetti (UCSB)
Xiaoming Mao (UMichigan)
Carl Modes (Max Planck Institute)
Michael Moshe (Hebrew U, Jerusalem)
Julian Panetta (UC-Davis)
Chris Rycroft (Wisconsin-Madison)
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Michael Shelley (Courant Inst./Flatiron)
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Ian Tobasco (UMichigan)
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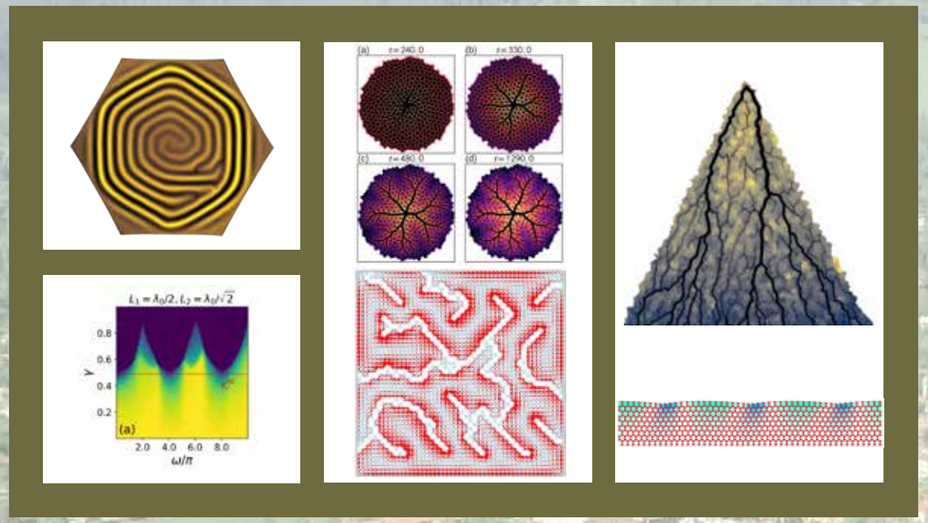

Top left: simulation of a positively curved thin shell, resting on the surface of a liquid. Wrinkling domains are visible. Nat Phys, 18 1099-1104 (2022). Bottom left: Loopiness phase diagram for pulsatility driven flow network that adapts via local rules. Loops get stabilized at resonant frequencies. PRR 6, 043015 (2024). Top center. Hierarchical formation of an optimized flow network. PRL 117, 138301 (2016). Bottom Center: computational configuration of a percolation model with cumulative frustration (PRL.134.147401). Top right: Simulated river tidal river delta. Geophysical Research Letters 10.1029/2022GL098284 (2022). Bottom right: Floppy mode of a twisted Kagome lattice, described by a conformal transformation (PNAS.109(31).12369-12374).

Scientific Organizers:
Xiaoming Mao (Michigan)
Ian Tobasco (Michigan)
Eleni Katifori (UPenn/Flatiron)
Leo Radzihovsky (CU Boulder)

Director: Leo Radzihovsky (CU Boulder)

The school will pay for most local expenses, and there are travel grants available for participants from U.S. universities. Students and postdocs interested in participating should submit an electronic application by the January 15 deadline.

The Boulder School in Condensed Matter and Materials Physics provides expert training, not usually available within the traditional system of graduate and post-graduate education, for advanced graduate students and postdoctoral researchers working in condensed matter physics, materials science and related fields. The School is supported by the National Science Foundation and the University of Colorado Boulder Physics,and meets annually during July in Boulder, Colorado.