

## Christian Santangelo

Assistant Professor  
Department of Physics  
University of Massachusetts  
Amherst, MA 01003

*office:* 405B Hasbrouck Laboratory

*phone:* 413-545-2099

*fax:* 413-545-1691

csantang@physics.umass.edu

<http://people.umass.edu/csantang/>

## POSITIONS HELD

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2007-present, **Assistant Professor**, Department of Physics, University of Massachusetts Amherst

2004-2007, **Post-doctoral Fellow**, Department of Physics and Astronomy, University of Pennsylvania

## EDUCATION

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2004, **Ph.D. Physics**, University of California, Santa Barbara, California

Thesis: *Fluctuations and Elasticity of Fluid Membranes and Lamellar Phases*

Advisor: Philip Pincus

1997, **B.A. Physics**, *cum laude*, Cornell University, Ithaca, New York

## RESEARCH INTERESTS

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**Soft condensed-matter physics:** Materials geometry, nonlinear elasticity of liquid crystals, liquid crystalline order on curved surfaces, self-assembly, wrinkling instabilities in thin elastic films.

## AWARDS

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2009, **CAREER Award**, National Science Foundation

2006, **Glenn H. Brown Prize**, International Liquid Crystal Society

2003, **Outreach award**, Materials Research Laboratory Scienceline

## PUBLICATIONS

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1. R.D. Kamien, D.R. Nelson, C.D. Santangelo and V. Vitelli, "Extrinsic Curvature, Geometric Optics, and Lamellar Order on Curved Substrates", *accepted to Physical Review E*, *arXiv:0908.4358* (2009).
2. H. Shin, G.M. Grason, C.D. Santangelo, "Mesophases of soft-sphere aggregates", *Soft Matter* **5**, 3629 - 3638 (2009) [arXiv:0902.4643].
3. C.D. Santangelo, "Buckling thin disks and ribbons with non-Euclidean metrics", *EPL* **86**, 34003 (2009) [arXiv:0808.0909].
4. M.L. Henle, B. DiDonna, C.D. Santangelo and A. Gopinathan, "Diffusion and binding of finite-size particles in confined geometries", *Phys. Rev. E* **78**, 031118 (2008) [arXiv:0809.0045].
5. C.D. Santangelo, and O. Farago, "Membrane fluctuations around inclusions", *J. Comp. Mat. Des.* **14**, 103-109 (2008).

6. C.D. Santangelo, V. Vitelli, R.D. Kamien and D.R. Nelson, “Geometric theory of columnar phases on curved substrates”, *Phys. Rev. Lett.* **99**, 017801 (2007) [cond-mat/0703206]. *Selected as editor’s suggestion, Also appears in the Virtual Journal of Nanoscale Science and Technology*, July 23, 2007.
7. M.A. Glaser, G.M. Grason, R.D. Kamien, A. Kovsmrlj, C.D. Santangelo, and P. Zihlerl, “Soft spheres make more mesophases”, *Europhys. Lett.* **78**, 46004 (2007) [cond-mat/0609570].
8. C.D. Santangelo, “Geometry and the nonlinear elasticity of defects in smectic liquid crystals”, *Liquid Crystals Today* **15**, 11 (2007).
9. C.D. Santangelo and R.D. Kamien, “Triply-periodic smectic liquid crystals”, *Phys. Rev. E* **75**, 011702 (2007) [cond-mat/0609596].
10. G. Grason and C.D. Santangelo, “Undulated Cylinders of Charged Diblock Copolymers”, *Eur. Phys. J. E* **20**, 335 (2006) [cond-mat/0605076].
11. R.D. Kamien and C.D. Santangelo, “Smectic Liquid Crystals: Materials with One-Dimensional, Periodic Order”, *Geometriae Dedicata* **120**, 229 (2006) [math.DG/0601494].
12. C.D. Santangelo, “Computing counterion densities at intermediate coupling”, *Phys. Rev. E* **73**, 041512 (2006) [cond-mat/0501498].  
*Also appears in the Virtual Journal of Biological Physics Research* **11**, 9 (2006).
13. C.D. Santangelo and R.D. Kamien, “Elliptic Phases: A Study of the Nonlinear Elasticity of Twist-Grain Boundaries”, *Phys. Rev. Lett.* **96**, 137801 (2006) [cond-mat/0511740].
14. M.C. Choi, C.D. Santangelo, O. Pelletier, J.H. Kim, S.Y. Kwon, Z. Wen, Y. Li, P.A. Pincus, C.R. Safinya, and M.W. Kim, “The first experimental observation of the biaxial confinement of semi-flexible filament in a channel”, *Macromolecules* **38**, 9882-9884 (2005).
15. C.D. Santangelo, R.D. Kamien, “Curvature and Topology in Smectic-A Liquid Crystals”, *Proc. R. Soc. A* **461**, 2911-2921 (2005).
16. C.D. Santangelo, L. Blum, “Interaction between two rows of localized adsorption sites in a 2D one-component plasma”, *Cond. Matt. Phys.* **8**, 325 (2005) [cond-mat/0412597].
17. O. Farago, C.D. Santangelo, “Pore formation in fluctuating membranes”, *J. Chem. Phys.* **122**, 044901 (2005) [cond-mat/0406149].  
*Also appears in the Virtual Journal of Biological Physics Research* **9**, 2 (2005).
18. J.L. Ross, C.D. Santangelo, V. Makrides, D. K. Fygenson, “Taxol cooperativity induced by Tau”, *Proc. Nat. Acad. Sci.* **101**, 12910-12915 (2004).
19. C.D. Santangelo, A.W.C. Lau, “Effects of counterion fluctuations in a polyelectrolyte brush”, *Eur. Phys. J. E* **13**, 335-344 (2004) [cond-mat/0307150].
20. M.L. Henle, C.D. Santangelo, D.M. Patel, P. Pincus, “Distribution of counterions near discretely charged planes and rods”, *Eur. Phys. Lett.* **66**, 284 (2004) [cond-mat/0310450].
21. C.D. Santangelo, Randall D. Kamien, “Bogomol’nyi, Prasad, Sommerfield configurations in smectics”, *Phys. Rev. Lett.* **91**, 045506 (2003) [cond-mat/0303532].
22. C.D. Santangelo and P. Pincus, “Coiling in multilamellar tubes”, *Phys. Rev. E* **66**, 061501 (2002) [cond-mat/0206246].  
*Also appears in the Virtual Journal of Biological Physics Research* **4**, 12 (2002).
23. R. Ragnarsson, J.L. Ford, C.D. Santangelo, E. Bodenschatz, “Rifts in spreading wax layers”, *Phys. Rev. Lett.* **76**, 3546 (1996).

## PREPRINTS

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J. Huang, B. Davidovitch, C.D. Santangelo, T.P. Russell, N. Menon, “A smooth cascade of wrinkles at the edge of a floating elastic film”, *submitted to Phys. Rev. Lett., arXiv:0901.2892 (2009)*.

## PROCEEDINGS

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C.D. Santangelo, “The Geometry and Elasticity of Liquid Crystals”, *appears in “Curvature and Variational Modeling in Physics and Biophysics”, AIP Conference Proceedings, v. 1002 (2008)*.

## FUNDING

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**Active**, National Science Foundation, DMR-0846582, “CAREER: Geometry of directed folding and soft packing”, Total: \$411,000, September 1, 2009 – August 31, 2014.

**Active**, Department of Energy, “EFRC: Polymer-Based Materials for Harvesting Solar Energy”, Total: \$16,000,000, one of 23 PIs, August 1, 2009 – August 31, 2014.

## INVITED PRESENTATIONS

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October 10, 2009, **Greater Boston Area Statistical Mechanics Meeting**, “The mesophases of soft sphere aggregates”

September 18, 2009, **New England Complex Fluids workshop**, “Self-folding origami: Buckling thin disks and ribbons with non-Euclidean metrics”

September 2007, **Lecturer**, “Geometry and Topology of Liquid Crystals”, International Graduate School on “Curvature and Variational Modelling in Physics and Biophysics”, Santiago de Compostela, Spain

June 2007, **Liquid Crystals Gordon Research Conference**, “Coercing columns to curve”

July 5, 2006, **Glenn H. Brown Prize Talk, International Liquid Crystal Conference**, “Curvature and Topology in Smectic Liquid Crystals”.

February 16, 2006, **New York University**, Soft Matter Workshop, “Schnerk’s First Surface”

September 30–November 2, 2005, **Workshop on Stabilized Embedded Defects**, “When Topology Isn’t Enough: Defects in Smectic Liquid Crystals”, McGill University, Montreal QC CA

Sept. 27, 2005, **Materials Science and Technology Meeting**, “Morphology Change in Diblock Copolymers”, Pittsburgh, PA

## SEMINARS AND COLLOQUIA

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November 3, 2009, Massachusetts Institute of Technology, Department of Mathematics, Physical Mathematics Seminar, “Programmable Buckling: Shaping Thin Films with Inhomogeneous Swelling”

October 28, 2009, University of Delaware, Department of Materials Science and Engineering, “Programmable Buckling: Shaping Thin Films with Inhomogeneous Swelling”

May 19, 2009, University of Chicago, James Franck Institute seminar, “Self-folding origami: Buckling thin disks and ribbons with non-Euclidean metrics”

October 16, 2008, Brown University, Condensed-Matter Physics Seminar, “Not so Flatland: order in two dimensions versus geometry in three dimensions”

April 2006, New York University, Colloquium, “Taming Competing Length Scales in Electrostatics and Self-Assembly”

March 2006, Georgia Institute of Technology, Colloquium, “Taming Competing Length Scales in Electrostatics and Self-Assembly”

February 2006, Massachusetts Institute of Technology, Chez Pierre Seminar, “Taming Competing Length Scales in Electrostatics and Self-Assembly”

February 2006, Syracuse University, “Taming Competing Length Scales in Electrostatics and Self-Assembly”

February 2006, University of Massachusetts Amherst, “Taming Competing Length Scales in Electrostatics and Self-Assembly”

September 2005, University of Pennsylvania, “Counterions Beyond Mean-Field Theory”

February 2005, University of North Carolina, Chapel Hill, “Counterions Beyond Mean-Field Theory”

February 2004, University of California, Santa Barbara, “Correlated ions in polyelectrolyte brushes”

October 2002, University of Pennsylvania, “Large inclusions in smectics”

May 2002, Rhodia (Cranberry, NJ), “Spherulites embedded in a lamellar phase”

March 2002, University of California, Santa Barbara, “Large inclusions in smectics”

## CONTRIBUTED PRESENTATIONS

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March 2009, **Talk**, “Buckling thin disks and ribbons with non-Euclidean metrics,” American Physical Society, March Meeting, Pittsburgh, PA

March 2009, **Talk**, with Homin Shin and G. Grason, “Soft Sphere Mesophases,” American Physical Society, March Meeting, Pittsburgh, PA

March 2008, **Talk**, “Soft Spheres Make More Mesophases,” American Physical Society, March Meeting, New Orleans, LA

June 2007, **Poster**, “Geometric Theory of Columnar Phases on Curved Substrates”, Liquid Crystal Gordon Research Conference

March 2006, **Talk**, “Spanning the gap between strong and weak-coupling electrostatics for charged rods”, American Physical Society, March Meeting, Baltimore, MA

March 2006, **Talk**, with R.D. Kamien, “Elliptic Phases: a Study of the Nonlinear Elasticity of Twist-Grain Boundaries”, American Physical Society, March Meeting, Baltimore, MA

Nov. 17-19, 2005, **Poster**, with R.D. Kamien, “Curvature and Topology in Smectic-A Liquid Crystals”, Workshop on Focusing Stress in Soft Interfaces, University of Chicago

2005, **Poster**, with R.D. Kamien, “Curvature and Topology in Smectic-A Liquid Crystals”, Liquid Crystal Gordon Research Conference

2005, **Poster**, with R.D. Kamien, “Curvature and Topology in Smectic-A Liquid Crystals”, Frontiers in Soft Condensed Matter, Exxon-Mobil

March 2005, **Talk**, with R.D. Kamien, “Bogomol’nyi-Prasad-Sommerfield Configurations in Smectics”, American Physical Society, March Meeting, Los Angeles

March 2004, **Talk**, with O. Farago, “Membrane fluctuations around pores and inclusions”, American Physical Society, March Meeting, Montreal, CA

February, 2004, **Poster**, with Jennifer L. Ross, Victoria Makrides, D. Kuchnir Fygenon, “Theoretical mechanisms of tau-induced taxol cooperativity”, Biophysical Society Meeting, Baltimore, Maryland

January 2004, **Poster**, with A.W.C. Lau, “Counterion fluctuations in a polyelectrolyte brush”, Materials Research Outreach Program Symposium, University of California, Santa Barbara, California

March 2003, **Talk**, with A.W.C. Lau, “Counterion fluctuations in a polyelectrolyte brush”, American Physical Society, March Meeting, Austin, Texas

January 2002, **Poster**, with P. Pincus, “Nonlinear effects of spherulites embedded in lamellar phases”, Materials Research Outreach Program Symposium, University of California, Santa Barbara, California

May 2001, **Poster**, with P. Pincus, “Coiling in myelin figures”, UCSB/UCLA Quarterly Meeting, University of California, Santa Barbara, California

## TEACHING AND OUTREACH

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Physics 715 (*Introduction to solid state physics*) (1 time), **UMass**, Physics 582 (*Introduction to solid state physics*) (1 time), Physics 422 (*Intermediate Electricity and Magnetism*) (2 times)

Spring 2005, **Penn**, Math 582 (*Seminar in Applied and Computational Science*) (1 time), Physics 696 (*Introduction to the Renormalization Group*) (1 time), University of Pennsylvania, Philadelphia, Pennsylvania.

Fall 2008-Spring 2009, **Mentor**, for NEAGEP student.

2001-2004, **Scienceline answerer**, Materials Research Laboratory, University of California, Santa Barbara, California

1998-2004, **Physics Circus**, University of California, Santa Barbara, California

1998-2001, **Teaching Assistant**, University of California, Santa Barbara, California

## PROFESSIONAL ACTIVITIES

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June-July 2008, **Co-organizer**, Aspen Center for Physics workshop on *Interfaces, Topological Defects and Flexible Packings: Applied Geometry in Condensed-Matter Physics*

September 2007, **Lecturer**, International Graduate School on “Curvature and Variational Modelling in Physics and Biophysics”, Santiago de Compostela, Spain

2006, **Participant**, Aspen Center for Physics, workshop on *Mathematical and Physical Aspects of Packing*

2003-present, **Biophysical Society**, Member

2000-present, **American Physical Society**, Member

2005-2007, **American Society of Materials**, Member

July 2002, **Boulder School for Condensed Matter Physics and Materials Physics**,  
University of Colorado, Boulder, Colorado

**Paper Reviewer:** *Physical Review Letters, Journal of Biological Physics, Europhysics Letters, European Physical Journal E, Macromolecules, Physics Letters, Journal of Chemical Physics*

**Proposal Reviewer:** National Science Foundation (DMR)