

Dr. Carl D. Modes
Curriculum Vitæ

The Rockefeller University
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Education

2008 **Ph.D. Physics and Astronomy** University of Pennsylvania, Philadelphia, PA
2002 **A.B. Physics** Princeton University, Princeton, NJ

Professional Experience

2011 – **Postdoctoral Associate** Laboratory of Mathematical Physics, The Rockefeller University
2008 – 2011 **Postdoctoral Research Associate** Theory of Condensed Matter Group, Department of
Physics, Cavendish Laboratory, University of Cambridge
2009 – 2010 **Teaching Supervisor** for Natural Sciences Tripos Maths IB, Corpus Christi College,
University of Cambridge
2006 – 2008 **Research Assistant** Department of Physics and Astronomy, University of Pennsylvania
2002 – 2006 **Teaching Assistant** Department of Physics and Astronomy, University of Pennsylvania
2004 – 2005 **Teaching Assistant** Department of Mathematics, University of Pennsylvania: lecturing to
recitation sections 4 hours/week
2002 – 2008 **Doctoral Candidate** Department of Physics and Astronomy, University of Pennsylvania
2001 **Undergraduate Researcher** Radio Astronomy Group, Princeton University
1999 – 2001 **Undergraduate Researcher** MiniBooNE Neutrino Oscillation Experiment, Princeton
University
1998 **Researcher** Magnetic Reconnection Experiment, Swarthmore College

Awards & Honors

Leckhampton Research Associate, Corpus Christi College, Cambridge (2009 – 2011).
Chosen as GSNP Student Speaker Award Finalist for APS March Meeting, 2008.

Peer-Reviewed Publications

1. C. D. Modes and R. D. Kamien, “Hard Discs on the Hyperbolic Plane,” *Phys. Rev. Lett.* **99** 235701 (2007). [doi:10.1103/PhysRevLett.99.235701]
2. C. D. Modes and R. D. Kamien, “Geometrical Frustration in Two Dimensions: Idealizations and Realizations of a Hard Disc Fluid in Negative Curvature,” *Phys. Rev. E* **77** 041125 (2008). *Chosen to appear in the 1 May 2008 Virtual Journal of Biological Physics Research.* [doi:10.1103/PhysRevE.77.041125]

3. M. Warner, C. D. Modes, and D. Corbett, “Curvature in Nematic Elastica Responding to Light and Heat,” *Proc. R. Soc. A* **466** 2122 2975-2989 (2010). [doi:10.1098/rspa.2010.0135]
4. M. Warner, C. D. Modes, and D. Corbett, “Suppression of Curvature in Nematic Elastica,” *Proc. R. Soc. A* **466** 2124 3561-3578 (2010). [doi:10.1098/rspa.2010.0139]
5. C. D. Modes, K. Bhattacharya, and M. Warner, “Disclination-Mediated Thermo-Optical Response in Nematic Glass Sheets,” *Phys. Rev. E* **81** 060701(R) (2010). [doi:10.1103/PhysRevE.81.060701]
6. C. D. Modes, M. Warner, C. L. van Oosten, and D. Corbett, “Anisotropic Response of Glassy Splay-Bend and Twist Nematic Cantilevers to Light and Heat,” *Phys. Rev. E* **82** 041111 (2010). [doi:10.1103/PhysRevE.82.041111]
7. C. D. Modes, K. Bhattacharya, and M. Warner, “Gaussian Curvature from Flat Elastica Sheets,” *Proc. R. Soc. A* **467** 2128 1121-1140 (2011). [doi:10.1098/rspa.2010.0352]
8. C. D. Modes and M. Warner, “Blueprinting Nematic Glass: Systematically Constructing and Combining Active Points of Curvature for Emergent Morphology,” *Phys. Rev. E* **84** 021711 (2011). [doi:10.1103/PhysRevE.84.021711]
9. C. D. Modes and M. Warner, “Responsive Nematic Solid Shells: Topology, Compatibility, and Shape,” *EPL* **97** 36007 (2012). [doi:10.1209/0295-5075/97/36007]
10. C. D. Modes, M. Warner, C. Sánchez-Somolinos, L. T. de Haan, and D. Broer, “Mechanical Frustration and Spontaneous Polygonal Folding in Active Nematic Sheets,” *Phys. Rev. E* **86** 060701(R) (2012). [doi:10.1103/PhysRevE.86.060701]
11. C. D. Modes, M. Warner, C. Sánchez-Somolinos, L. T. de Haan, and D. Broer, “Angular Deficits in Flat Space: Remotely Controllable Apertures in Nematic Solid Sheets,” *Proc. R. Soc. A* **469** 2153 20120631 (2013). [doi:10.1098/rspa.2012.0631]

Invited Conference Proceedings

12. C. D. Modes and M. Warner, “The Activated Morphology of Grain Boundaries in Nematic Solid Sheets,” *Proc. SPIE* 8279 82790Q (2012). [doi:10.1117/12.916788]

Manuscripts in Preparation

13. C. D. Modes and M. O. Magnasco, “A Geometric Knotspace Template,” *submitted*. [arXiv:1302.1146]
14. C. D. Modes and R. D. Kamien, “Spherical Foams in Flat Space,” *submitted* [arXiv:0810.5724]
15. J. Grawer, C. D. Modes, M. O. Magnasco, and E. Katifori, “The Architecture of Biologically Inspired Adaptive Transport Networks,” *in preparation*.

16. C. D. Modes, E. Katifori, and M. O. Magnasco, “A Generalized Loop-Coalescence Algorithm for 3D Biological Distribution Networks,” *in preparation*.
17. C. D. Modes and M. O. Magnasco, “Frequency Selection and Timing: The Geometry of Calcium Channel Blockers,” *in preparation*.
18. C. D. Modes and M. Warner, “The Curious Case of the Cornucopia,” *in preparation*.

Invited Talks and Seminars

1. “Photo-Actuation in LC Glass: Fundamentals, Routes, and Effects,” joint session of the Isaac Newton Institute for Mathematical Sciences Programme on the Mathematics of Liquid Crystals and the I-CAMP Summer School on Liquid Crystals, University of Cambridge, Cambridge, UK, June 2013.
2. “Liquid Crystals and Solid Body Mechanics,” I-CAMP Summer School on Liquid Crystals, University of Cambridge, Cambridge, UK, June 2013.
3. “Avenues to Active Shape Control in Nematic Solid Sheets,” Isaac Newton Institute for Mathematical Sciences Programme on the Mathematics of Liquid Crystals, University of Cambridge, Cambridge, UK, June 2013.
4. “Avenues to Active Shape Control in Nematic Solid Sheets,” Gordon Research Conference on Liquid Crystals, University of New England, Biddeford, ME, June 2013.
5. “From Sheets to Shapes: Using Topological Defects to Blueprint Curvature,” Materials Seminar, Wright-Patterson Air Force Base, Dayton, OH, November 2012.
6. “The Activated Morphology of Grain Boundaries in Nematic Solid Sheets,” SPIE Photonics West, Moscone Center, San Francisco, CA, January 2012.
7. “From Sheets to Shapes: Using Topological Defects to Blueprint Curvature,” Workshop on Topology: Identifying Order in Complex Systems, Princeton Center for Theoretical Science, Princeton University, December 2011.
8. “From Sheets to Shapes: Using Topological Defects to Blueprint Curvature,” International Liquid Crystal Elastomers Conference, Lisbon, Portugal, September 2011.
9. “From Sheets to Shapes: Blueprinting Nematic Solids for Active Morphology Control,” Center for Studies in Physics and Biology Seminar Series, The Rockefeller University, May 2011.
10. “Hard Discs on the Hyperbolic Plane: A Proposal for a New Model of Glassy Systems,” Theoretical Physics Seminar, University of Bristol, March 2009.
11. “Hard Discs on the Hyperbolic Plane: A Proposal for a New Model of Glassy Systems,” Condensed Matter Seminar, Syracuse University, April 2008.

12. "Hard Discs on the Hyperbolic Plane: A Proposal for a New Model of Glassy Systems," MRSEC Chalk Talk, University of Pennsylvania, February 2008.
13. "Hard Discs on the Hyperbolic Plane: A Proposal for a New Model of Glassy Systems," Condensed Matter Theory Seminar, Harvard University, February 2008.

Presentations

14. "From Sheets to Shapes: Blueprinting Nematic Solids for Emergent Morphology," Gordon Research Conference on Liquid Crystals, June 2011 – Poster.
15. "Cones and Anticones: Mechanical Response of Disclinations in Nematic Glasses," APS March Meeting, Portland, OR, March 2010 – Contributed Talk.
16. "Elasticity and Shape from Texture and Light: Disclinations in Nematic Elastomer Membranes," Gordon Research Conference on Liquid Crystals, June 2009 – Poster.
17. "Hard Discs on the Hyperbolic Plane: A Proposal for a New Model of Glassy Systems," Institute for Mathematics and its Applications, University of Minnesota, July 2008 – Poster.
18. "Hard Discs on the Hyperbolic Plane," APS March Meeting, New Orleans, LA, March 2008 – Contributed Talk.
19. "Changing the Packing Fraction by Changing the Geometry: a Hyperbolic Approach to Jamming," APS March Meeting, Denver, CO, March 2007 – Contributed Talk.

Professional Activities

Lecturer, I-CAMP Summer School on Liquid Crystals, University of Cambridge, Cambridge, UK (June 2013).

Participant, Isaac Newton Institute for Mathematical Sciences Workshop on Liquid Crystal Defects and Their Geometry, Active and Solid Liquid Crystals, and Related Systems, University of Cambridge, Cambridge, UK (June 2013).

Participant, Isaac Newton Institute for Mathematical Sciences Programme on the Mathematics of Liquid Crystals, University of Cambridge, Cambridge, UK (June 2013).

Participant, Gordon Research Conference on Liquid Crystals, University of New England, Biddeford, ME (June 2013).

Participant, Through the Looking Glass: A Glimpse into the Geometry and Topology of Materials, Princeton Center for Theoretical Science, Princeton, NJ (December 2012).

Participant, 7th Plant Biomechanics International Conference, Clermont-Ferrand, France (August 2012).

Participant, SPIE Photonics West, Moscone Center, San Francisco, CA (January 2012).

Participant, Workshop on Topology: Identifying Order in Complex Systems, University of Pennsylvania, Rutgers University, IAS, PCTS (monthly, rotating location, November 2011 –).

Participant, International Liquid Crystal Elastomers Conference, Universidade Nova de Lisboa, Lisbon, Portugal (September 2011).

Participant, Gordon Research Conference on Liquid Crystals, Mount Holyoke College, South Hadley, MA (June 2011).

Participant, Gordon Research Conference on Liquid Crystals, Colby-Sawyer College, New London, NH (June 2009).

Participant, Institute for Mathematics and its Applications Summer Workshop on “Geometrical Singularities and Singular Geometries,” University of Minnesota, Minneapolis, MN (July 2008).

Participant, Mid-Atlantic Soft Matter Workshop, Georgetown University, Washington D.C. (November 2007).

Participant, ACS Colloid & Surface Science Symposium, University of Delaware, Newark, DE (June 2007).

Participant, 96th Statistical Mechanics Conference, Rutgers University, New Brunswick, NJ (December 2006).

Participant, Penn-NYU Soft Matter Workshop, University of Pennsylvania, Philadelphia, PA (November 2006).

Participant, Boulder School for Condensed Matter Physics on “Physics of Soft Matter: Complex Fluids and Biological Materials,” University of Colorado, Boulder, CO (July 2006).

Penn Soft Condensed Matter Journal Club coordinator and website administrator (July 2007 – November 2008).

Referee for *Physical Review Letters* (February 2008 –).

Referee for *Physical Review E* (September 2007 –).

References

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