

REBECCA J. CHRISTIANSON

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Employment

Jan. 2005 – Present Assistant Professor of Applied Physics, Olin College of Engineering, Needham, MA 02492
Sept. 2001 – Dec. 2004 Postdoctoral research fellow, Division of Engineering and Applied Sciences, Harvard University, Cambridge, MA.

Education

Massachusetts Institute of Technology. Cambridge, MA
Ph.D. physics, August 2001. Thesis Title: *Neutron and X-ray Scattering Studies of Low-Dimensional Magnetic Materials in a Magnetic Field.*

Stanford University. Stanford, CA. B.S. physics, B.A. music, June 1995.

Research

Current research: Collaboration with Professor of Biology Jean Huang to investigate the formation of biofilms of photosynthetic bacteria. Collaboration with Professor of Mechanical Engineering Jessica Townsend and Promethian Power to investigate heat transfer fluid and heat storage media. Continuing research on confocal microscopy of colloidal suspensions.

Postdoctoral research: Division of Engineering and Applied Sciences, Harvard University, Cambridge, MA.
September 2001-December 2004 (Research advisor: Prof. Dave Weitz)
Studies of self-assembly kinetics in two-component colloidal systems, including work on the Physics of Colloids in Space program. Techniques included light scattering and confocal microscopy. Additional studies of rheology of wax-stabilized lamellar surfactant phases.

Doctoral research: Department of Physics, Massachusetts Institute of Technology, Cambridge, MA.
September 1995- August 2001 (Research advisor: Prof. Robert J. Birgeneau)
Neutron and X-ray scattering studies of low-dimensional magnetism, including spin-Peierls and high-T_c superconducting systems. Extensive sample growth, preparation and characterization including float-zone and top-seed crystal growth, electrochemical doping, SQUID magnetometry, powder x-ray diffraction, iodometric titration, and electron probe microscopic analysis.

Awards/Honors

Certificate of Distinction in Teaching, Derek Bok Center for Teaching and Learning, Harvard University, for Fall 2002.
Goldhaber Prize in physics research, Brookhaven Women in Science, 2001.
Buechner Prize for Physics Teaching, MIT physics department, 1999.

Teaching Experience

Franklin W. Olin College Of Engineering, Needham, MA.
Solid State Physics for Engineers.
Introduction to Materials Science and Solid State Chemistry
Freshman Mechanics
Freshman Electricity and Magnetism
6 Experiments that Changed the World
Introduction to Microscopy

Mentored Students

Matthew Brouillard
Martina Balestra
Juliana Bernal-Ostos (Ph.D. candidate, Materials Department, UC Santa Barbara)
Katherine Kim (Ph.D. candidate, CU Boulder)
Kyle Rader (M.S. candidate, Aeronautical Engineering, Germany)
Adam Bry (M.S. candidate, Aeronautics and Astronautics, MIT)
Kelcy Adamec (M.S. Candidate, Civil Engineering, University of Massachusetts - Amherst)
Andrea Striz (Ph.D. candidate, Ocean Engineering, University of Washington)
Jeffrey Glickman (Energy company in San Francisco)
Peter Massari (Systems Engineer, General Dynamics)
Anthony Roldan (Electrical Engineer, Quickware)
Elizabeth Kneen (Design Continuum)
Victoria Hsiao
Michael Roenbeck (PhD candidate, Northwestern University)
Sean Shi (current Olin student)
Jose Jobim Santos (iRobot)
Adam Kenvarg
Erika Swartz (current Olin student)
Stanislaw Antol
Jillian Kiser (Researcher at National Underseas Warfare Center, graduate student Brown University)
Erin du Vair (current Olin student)
Caroline Condon (current Olin student)
Chase Kernan (current Olin student)

Presentations

28th North East Microbial Physiology and Ecology Meeting. Xu, M., Dong, Z, Lam, S., Allen, M.M., Christianson, R., and J.J. Huang. Architecture of photosynthetic biofilm growth in flow cells using *Synechocystis* sp. strain PCC 6803 and *Rhodospseudomonas palustris*. Abstracts of the 28th North East Microbial Physiology and Ecology Meeting, Blue Mt. Lake, NY, June, 2011.

MRS Spring Meeting. Contributed Talk: *Contradictory Evidence for the Role of Temperature and Particle Size in Nanofluid Thermal Conductivity*. San Francisco, CA. April, 2011.

Aspen Center for Physics: Materials and the Imagination. Invited talk: *Bees and Biofilms: Interdisciplinary Research with Undergraduates*. Aspen, CO. January, 2011.

APS April Meeting. Contributed talk: *The Effects of Aggregation on the Thermal Conductivity of Gold Nanoparticle Suspensions*. Washington, DC. February, 2010.

AAPT Winter Meeting. Contributed talk: *The Way Things Work: Project Based Electricity and Magnetism for Engineers*. Washington, DC. February, 2010.

International Mechanical Engineering Conference and Exposition (IMECE). Poster: *The Potential of Nanoparticle-Laden Fluids for Increased Cooling Performance*. Lake Buena Vista, FL. November, 2009. Presented by J. Townsend.

APS March Meeting. Contributed talk: *Thermal Transport Properties of Nanoparticle Suspensions*. Pittsburgh, PA. March, 2009.

INPBE Conference. Contributed talk: *INPBE Results and Analysis*. Beverly Hills, CA. January 2009.

ECI Nanofluids: Fundamentals and Applications. Poster presentation: *Nanofluids: a simple approach*. Copper Mountain, CO. September 2007.

Lytron. Invited talk: *Investigation of the Thermal Properties and Heat Transfer Mechanisms of Nanofluids at Olin College.* Woburn, MA. October 2006. (with J. Townsend)

Workshop on Nanofluid Technology at MIT. Invited talk: *Insights and Observations at the beginning of a nanofluids research program.* Cambridge, MA. August 2005. (with J. Townsend).

Gordon Research Conference: Colloidal, Macromolecular and Polyelectrolyte Solutions. Poster presentation: *Binary Colloidal Crystals.* Ventura, CA. February, 2004.

APS March Meeting. Contributed talk: *Crystallization of Two-Component Colloidal Mixtures.* Montreal, Canada. March, 2004.

Fall Teaching Conference. *Teaching in a Problem-Set Based Course.* With Liz Stuart. Harvard University, Cambridge, MA. September, 2003.

World Space Congress. Invited talk: *Physics of Colloids in Space.* Houston, TX. October, 2002. (sub. for D. Weitz).

6th Microgravity Conference. Poster presentation: *Binary Colloidal Crystals.* Cleveland, OH. 2002.

APS March Meeting. Contributed talk: *Dynamics of a Spin 5/2 2D Heisenberg Antiferromagnet.* Minneapolis, MN. March, 2000.

New England Complex Fluids Meeting Soundbites:

Thermal Conductivity of Aggregating Suspensions. Brandeis University, Waltham, MA. September 2009.

Thermal Transport Properties of Alumina Nanoparticle Suspensions. Kingston, RI. June 2008.

Rheology of Shampoo. Cambridge, MA. December 2003.

Settling of Colloidal Crystals. Waltham, MA. September 2003.

AB6 BCC Binary Crystal. Cambridge, MA. December 2002.

Grants

Promethian Power Systems: PI: Sorin Grama. *Improved Cold Thermal Energy Storage for Refrigeration Applications.* SBIR Phase I, NSF award number IIP-1113206. Subcontractor. Awarded May 2011.

Zhenya Zastavker, Debbie Chachra, Alisha Sieminski, Rebecca Christianson. *Acquisition of a confocal microscope for investigation of biophysical interactions and to enrich undergraduate bioengineering education.* Major Research Instrumentation, NSF. Awarded July 2006.

Patent Application

Patent Application number 20080171799

Title: Synthesis of polymer foam using sonic energy

Abstract: A process for synthesizing polymer foam. Polymer foams can be created through the direct mixing of chemicals. Prior research has shown that greater uniformity can be created by physically mixing the components of the foam before and during the foaming process. This invention covers the creation of polymer foam utilizing the mixing energy created by sound waves (herein referred to as sonication) prior to and during the foaming process. The result of physical mixing through sonication is a more uniform foam.

Agent: [Lindsay Redmond](#) - [Essex, VT, US](#)

Inventors: [Lindsay Redmond](#), [Rebecca Christianson](#), [Rebecca Scholl](#)

USPTO Applicaton #: 20080171799 - **Class:** 521149 (USPTO)

Invited Publication

CSWP Gazette. Vol 27, No. 2. *Success Story; Four Women, One Victory.* Yevgeniya Zastavker, Debbie Chachra, Rebecca Christianson, Alisha Sieminski. Fall 2008.

Publications

R.J. Christianson and J. Townsend. *Contradictory Evidence for the Role of Temperature and Particle Size in Nanofluid Thermal Conductivity*. 2011 MRS Meeting Spring Proceedings. (submitted).

J. Townsend, A. Kenvarg, E. Swartz, R. Christianson. *The Applicability and Accuracy of Thermal Conductivity Measurement Techniques for the Characterization of Nanofluids*. Presented 2009. Paper in consideration. International Journal of Thermophysics, 2010.

D.C. Venerus, J. Buongiorno, R. Christianson et al.. *Viscosity measurements on colloidal dispersions (nanofluids) for heat transfer applications*. Applied Rheology. 20,4,44582 (2010). (1)

Jessica Townsend and Rebecca J. Christianson. *Nanofluid properties and their effects on convective heat transfer in an electronic cooling application*. ASME Journal of Thermal Science and Engineering Applications. 1, 3, 031006 (September 2009, published March 16, 2010). (not indexed)

J. Buongiorno, D.C. Venerus, N. Prabhat, T. McKrell, J. Townsend, R. Christianson. et al. *A benchmark study on the thermal conductivity of nanofluids*. Journal of Applied Physics, 106, 094312 (2009). (44)

Bailey, A. E.; Poon, W. C. K.; Christianson, R. J.; Schofield, A. B.; Gasser, U.; Prasad, V.; Manley, S.; Segre, P. N.; Cipelletti, L.; Meyer, W. V.; Doherty, M. P.; Sankaran, S.; Jankovsky, A. L.; Shiley, W. L.; Bowen, J. P.; Eggers, J. C.; Kurta, C.; Lorik, T., Jr.; Pusey, P. N.; Weitz, D. A.. *Spinodal decomposition in a model colloid-polymer mixture in microgravity*. Physical Review Letters, 99 205701 (2007). (18)

T. Huberman, R. Coldea, RA Cowley, DA Tennant, RL Leheny, RJ Christianson, CD Frost. *Two-magnon excitations observed by neutron scattering in the two-dimensional spin-5/2 Heisenberg antiferromagnet Rb₂MnF₄*. Physical Review B, 72 014413 (2005). (15)

S. Manley, B. Davidovitch, NR Davies, L. Cipelletti, AE Bailey, RJ Christianson, U. Gasser, V Prasad, PN Segre, MP Doherty, S Sankaran, AL Jankovsky, B Shiley, J Bowen, J Eggers, C Kurta, T Lorik, DA Weitz. *Time-dependent strength of colloidal gels*. Physical Review Letters, 95 048302 (2005). (12)

S. Manley, L. Cipelletti, V. Trappe, A.E. Bailey, R.J. Christianson, U. Gasser, V. Prasad, P.N. Segre, M.P. Doherty, S. Sankaran, A.L. Jankovsky, B. Shiley, J. Bowen, J. Eggers, C. Kurta, T. Lorik D.A. Weitz. *Limits to Gelation in Colloidal Aggregation*. Physical Review Letters, 93, 108302 (2004). (31)

Y.J. Wang, Y.J. Kim, R.J. Christianson, S.C. LaMarra, F.C. Chou, T. Masuda, I. Tsukada, K. Uchinokura and R. J. Birgeneau. *X-rays scattering and magnetic susceptibility study of doped CuGeO₃*. Journal of the Physical Society of Japan, v.72, no. 6 (2003). (5)

David Weitz, Arthur Bailey, Suliana Manley, Vikram Prasad, Rebecca Christianson et al. *Results from the Physics of Colloids Experiment on ISS*. NASA/TM-2002-212011. IAC-02-J.6.04. (2002)

R.J. Christianson, Y.J. Wang, T. Masuda, V. Kiryukhin, R.J. Birgeneau, B. Keimer, S.C. LaMarra, I. Tsukada, K. Uchinokura. *X-ray scattering studies of the high-field incommensurate state in Cu_{1-x}Mg_xGeO₃*. Physical Review B, 66, 174105 (2002). (5)

R.J. Christianson, R.L. Leheny, R.J. Birgeneau, R.W. Erwin. *Critical dynamics of a spin-5/2 two-dimensional isotropic antiferromagnet*. Physical Review B, 63, 140401(R) (2001). (14)

Y.J. Wang, Y.-J. Kim, R.J. Christianson, S.C. LaMarra, F.C. Chou, R.J. Birgeneau. *X-ray scattering studies of two length scales in the critical fluctuations of CuGeO₃*. Physical Review B 63, BR-052502-1 (2001). (6)

R.L. Leheny, R.J. Christianson, R.J. Birgeneau, R.W. Erwin. *Spin Correlations in an Isotropic Spin-5/2 Two-Dimensional Antiferromagnet*. Physical Review Letters 82, 418 (1999). (17)

P. Blakeslee, R.J. Birgeneau, F.C. Chou, R. Christianson, M.A. Kastner, Y.S. Lee, B.O. Wells. *Electrochemistry and staging in $La_2CuO_{4+\delta}$* . Physical Review B 57, 13,915 (1998). (18)

R.J. Birgeneau, R.J. Christianson, Y. Endoh, M.A. Kastner, Y.S. Lee, G. Shirane, B.O. Wells, K. Yamada. *Structures and incommensurate spin excitations in excess oxygen-doped La_2CuO_{4+y}* . Physica B 237-238, 84 (1997). (2)

B.O. Wells, Y.S. Lee, M.A. Kastner, R.J. Christianson, R.J. Birgeneau, K. Yamada, Y. Endoh, G. Shirane. *Incommensurate Spin Fluctuations in High-Transition Temperature Superconductors*. Science 277, 1067 (1997). (134)