

Gordon Christopher, PhD

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Lubbock, TX.

Research Interests

Developing techniques to examine complex fluids and interfaces in confined flows and extracting rheological parameters to understand micro-scale fluid behavior and structure.

Characterizing and modeling two phase flow in microfluidic channels in order to replicate multi-step lab processes, commonly referred to as "lab on a chip."

Academic Positions

January 2011 – Texas Tech University, Lubbock, TX

Present

- Assistant Professor, Edward E. Whitacre Jr. College of Engineering, Department of Mechanical Engineering

Education

August 2008 **Carnegie Mellon University**, Pittsburgh, PA
Ph.D. Mechanical Engineering, Cumulative GPA: 3.9/4.0
Thesis: "Manipulation of Droplets in Microfluidic Channels Using T-Junction Geometry"
Advisor: Professor Shelley L. Anna
M.S. Colloids, Polymers and Surface Science Chemical Engineering, Cumulative GPA: 3.9/4.0

May 2004 M.S. Mechanical Engineering, Cumulative GPA: 4.0/4.0

May 2003 **Columbia University**, New York, NY
B.A. Film, Cumulative GPA: 3.4/4.0

May 2002 B.S. Mechanical Engineering, Cumulative GPA: 3.81/4.0
Magna Cum Laude
Mechanical Engineering Certificate of Merit
Dean's List 1998-2002

Honors and Awards

2013 **Mechanical Engineering Department Teaching Award**

2005 **Dowd ICES Fellowship**, Pittsburgh, PA

- 1 year Fellowship for "Microfluidic Synthesis of Structured Particles for Drug Delivery"

Research Experience

2011 - Present **Texas Tech University**, Lubbock, TX

- Principal Investigator of the Christopher Lab at Texas Tech
- Areas of focus include interfacial rheology of particle laden interfaces, deformation of Pickering drops, role of elastic instabilities in microfluidic flows, and rheology of biofilms

January 2009 – December 2010 **National Institute of Standards and Technology**, Gaithersburg, MD

- NRC Post Doctoral Associate in Complex Fluids Group of Polymer Division
- Designing, developing and characterizing MEMS based oscillating plate rheometer to characterize soft matter and complex fluids confined to micron sized gaps
- Developing techniques to use microfluidic channels to characterize complex fluids, interfacial rheology, and nano-particle

- August 2004 - August 2008** **Carnegie Mellon Micro Complex Fluids Laboratory, Pittsburgh, PA**
- Dissertation work characterizing and modeling the breakup of viscous and viscoelastic fluids in microfluidic T-junctions
 - Splitting viscoelastic droplets in microfluidic channels and characterizing the extensional viscosity and relaxation time from subsequent filament thinning
 - Designing, implementing and testing laboratory-built extensional rheometer to characterize extensional rheology of complex fluids
 - Examining behavior of confined, colliding droplets in microfluidic channels and characterizing conditions for coalescence using a variety of fluids
- August 2003 - May 2004** **Carnegie Mellon NanoRobotics Laboratory, Pittsburgh, PA**
- Developed and designed MicroSwimming Robot inspired by E. Coli Bacteria
 - Modeled fluid dynamics of proposed robot design using slender body theory
 - Conducted initial testing of early prototypes
- Summers 2003 and 2001** **Xerox Wilson Center for Research and Technology, Sleepy Hollow, NY**
- Mechanical engineering intern problem solving design flaws in new products
 - Designed and modeled heating systems for Xerox products in development
- May 2002 - January 2003** **Columbia MEMS Lab, New York, NY**
- Undergraduate researcher under supervision of Professor Luc Frechette
 - Modeled air thrust bearing in MEMS steam generator using Fluent

Funding

- September 2014** **National Science Foundation, Chemical Engineering and Biological Transport Division, Particulate and Multiphase Process**
- Total Award: \$294,924
 - # 1437710 "Role of Composition on Mesostructure-Flow Interaction and Rheology of Particle Laden Interfaces"
- May 2013** **American Chemical Society Petroleum Research Fund Doctoral New Investigator**
- Total Award: \$100,000
 - PRF# 53312-DNI9 "Role of Elastic Instabilities around Confined Cylinders on Excess Pressure Drop and Oil Displacement"
- January 2013** **Texas Tech, Vice Provost Proposal Stimulus**
- Total Award: \$10,000
 - "Development of a MEMs Based Microrheometer"
- May 2012** **Sandia National Laboratories MEMS Design Competition, Lubbock, TX**
- Winner of the novel design category for the MEMS based microrheometer for characterization of confined thin films.
- May 2009** **NIST Exploratory Research Grant, Gaithersburg, MD**
- \$30,000 Grant awarded for exploratory research of "Zeta Potential and Particle Size Measurement through Electrokinetic Sonic Amplitude Measurements using a Microfluidic Platform"

Teaching and Supervising

- 2011 - Present** **Texas Tech University, Lubbock Texas**
- ME 3370 Undergraduate Fluid Mechanics

- ME 6330 Interfacial Fluid Mechanics – Course was taught and developed to teach a range of topics related to interfacial fluid mechanics to advanced graduate students.
- ME 4331 (In Development for Spring 2015) Special Topics: Microfluidics – This will be an advanced elective for undergrads incorporating classroom and lab learning on the topic of microfluidics and their fabrication.

**May 2010-
August 2010**

National Institute of Standards and Technology, Gaithersburg, MD

- Supervised “Summer Undergraduate Research Fellow” student
- Developed summer research project and guided student in accomplishing project goals, culminating in research presentation

**August 2004 -
August 2008**

Carnegie Mellon Micro Complex Fluids Laboratory, Pittsburgh, PA

- Directed 3 undergraduates, teaching lab procedure and designing projects
- Advised students on how to best accomplish goals and analyze results from experimental work
- Projects resulted in 2 peer reviewed published papers

**August 2004 -
May 2005**

Carnegie Mellon University, Pittsburgh, PA

- Teaching Assistant for “Fundamentals of Mechanical Engineering” 24-101 for both fall and spring semesters
- Taught classes and recitations, graded homework and exams, and held office hours
- Directed semester long “Mousetrap Race Car Competition,” helped students design, fabricate and refine vehicles that performed complicated tasks
- Design Competition: “Airplane Launchers” in which students designed, built, and refined a project over the course of 2 weeks

Current Students

Ph.D Sourav Barman – Topic: *Interfacial Rheology of Particle Stabilized Interfaces*
 Xueda Shi – Topic: *Manipulation of Interfaces using Microfluidics*
 Zhenhuan Zhang – Topic: *Microrheology and Biomaterial Rheology*

Former Students

Undergraduate Philip Carmack– Topic: *Elastic Instabilities in Microfluidics*
 Samuel Castellanos– Topic: *Elastic Instabilities in Microfluidics*
 Stephen Fixter– Topic: *Elastic Instabilities in Microfluidics*
 John McPherson– Topic: *Elastic Instabilities in Microfluidics*
 Craig Sanders– Topic: *Elastic Instabilities in Microfluidics*
 Manuel Holguin – Topic: *Magnetic Microfluidics*
 Kelley Spencer - Topic: *Magnetic Microfluidics*
 Demetri Likomitros – Topic: *Microrheometer Design*
 Stephen Kenney – Topic: *Elastic Instabilities in Microfluidics*
 Amri Ravisspour – Topic: *Interfacial Rheology using Microfluidics*
 Kade Poper – Topic: *Analysis of droplet deformation in Microfluidics*
 Ganesh Chapagain – Topic: *Rheology of Shear Thickening Suspensions*

Ph.D Committees Served On

Mechanical Dil Kumar, Luke Mayer, Azese Martin, Jenna McCollum, Cory Farley
Electrical Sahil Oak
Chemical Swastika Bithi, Deepak Solomon, Govind Hedge, Kim Zhay, William Wang

Master Committees Served On

Mechanical Richa Padye, Kade Poper

Professional Affiliations

2013-Present	Society of Rheology Membership Committee
2010 – Present	Member, American Institute of Chemical Engineers
2008 - Present	Reviewer for Scholarly Journal: Journal of Applied Polymer Science, Journal of Rheology, Microfluids and Nanofluids, PLOS ONE, Lab on a Chip...
2004 - Present	Member, Society of Rheology
2002	Inducted, Tau Beta Pi Engineering Honor Society
2002	Inducted, Pi Sigma Tau Mechanical Engineering Honor Society

Service

2014	Member, Membership Committee of Society of Rheology
2014	NSF Fluids Panel Reviewer
2014	AIChE Annual Meeting Session chair
2013	Member, Ad hoc committee to improve graduate program
2013	Member, Faculty Hiring Committee
2013	Program Session Chair, Society of Rheology annual Meeting
2012 - Present	Volunteer Teacher, "Science it's a Girl Thing"
2011	Member, Whitacre Endowed Chair Search Committee
2011	NSF Particulate and Multiphase Flow Panel Reviewer
2011	AIChE Annual Meeting Session chair
2011	Member, Associate Dean of Research search committee
2011	Chair, Mechanical Engineering graduate seminar program

Courses and Training

November 2011	TLPDC: Tenure Academy , Lubbock, TX
April 2011	CMMI 2011 Career Proposal Writing Workshop , Hartford, CT
March 2011	NSF Day , Albuquerque, NM
October 2010	Society of Rheology 82nd Annual Meeting Short Courses , Santa Fe, NM "Colloidal Dispersion Rheology" and "Microrheology: Theory, Practice, and Applications"
May 2010	Commerce Learning Center "Effective Writing" , Gaithersburg, MD
October 2009	TA Instruments "New Rheology Instrumentation" , New Castle, DE
February 2009	NCNR Small-Angle Neutron Scattering Tutorials , Gaithersburg, MD
October 2006	Society of Rheology 78th Annual Meeting Short Course , Portland, ME "Complex Fluids (SANS)"

Skills

Microscale	Optical microscopy, Soft lithography, Microfluidics, Nanofluidics
Rheology	Shear rheology and rheometers, Extensional rheology and rheometers
Software	Matlab, Autocad, Illustrator, Premier, TA Orchestrator
Language	3 Years of College Mandarin Chinese

Publications

Refereed Journal Publications

1. Snoeyink, C., Barman, S., and G. Christopher S. *Three dimensional Structure and Dynamics of particle monolayers at liquid-liquid interfaces*. In preparation.
2. Barman, S. and G Christopher, *Simultaneous Interfacial Rheology and Visualization of Densely Packed Aggregated Particle Laden Interfaces*. Accepted, Langmuir.
3. Zhang, Z., Barman, S., and G. Christopher, *The Role of Protein Content on The Steady and Oscillatory Shear Rheology of Model Synovial Fluids*. Soft Matter, 2014. Online.
4. Zhang, Z., Barman, S., and G. Christopher, *Effect of Interfacial Viscoelasticity on the Bulk Linear Viscoelastic Moduli of Flobular Protein Solutions*. Physical Review E, 2014 89(5): p. 052306-052310

5. Kenney, S., K. Poper, G. Chapagain, and G. Christopher, *Large Deborah number flows around confined microfluidic cylinders*. *Rheologica Acta*, 2013. **52**(5): p. 485-497.
6. Christopher, G F, Yoo, J M, *et al.* "Development of a MEMS based dynamic rheometer." *LOC 2010*. 10 (20): p.2749-2757
7. Christopher, G F and Anna, S L "Passive breakup of viscoelastic droplets and filament self-thinning at a microfluidic T-junction." *J. Rheol.* 2009. 53 (3): p 663-683
8. Christopher, G F, Bergstein, J, *et al.* "Coalescence and splitting of confined droplets at microfluidic junctions." *LOC 2009*. 8 (9): p1102-1109
9. Christopher, G F, Noharuddin N, *et al.* "Experimental observations of the squeezing-to dripping transition in T-shaped microfluidic junctions." *Phys. Rev. E*, 2008.78 (3) *
10. Christopher, G F and Anna, S L "Microfluidic methods for generating continuous droplet streams." *J.Phys. D: Appl. Phys*, 2007.40 (19):p R319-R336

* Republished: September 29, 2008 in Virtual Journal of Nanoscale Science & Technology

Conference Publications

1. Anna, S L, Christopher, G F and Noharuddin, N "Droplet breakup in shear and elongational dominated flows in microfluidic devices." ASME International Mechanical Engineering Congress and Exposition, Orlando, FL, 2005

Conference Presentations

1. Snoeyink, C. and G.F. Christopher*, "Measurement of particle adsorption and diffusion on an oil/water interface using Bessel beam microscopy." 2014 AIChE Annual Meeting, Atlanta, GA, November 2014
2. Zhang, Z., Barman, S. and G.F. Christopher*, "Interfacial Rheology's role on the measurement of the bulk rheology of biological solutions." 86th Annual Meeting of the Society of Rheology, Philadelphia, PA, October 2014
3. Zhang, Z.* and G.F. Christopher "Large Amplitude Oscillatory Shear of Model Synovial Fluids." 86th Annual Meeting of the Society of Rheology, Philadelphia, PA, October 2014
4. Barman, S.* and G.F. Christopher "Interfacial rheology and dynamics mesostructure measurements of densely aggregated particle laden interfaces." 86th Annual Meeting of the Society of Rheology, Philadelphia, PA, October 2014
5. Shi, X.* and G.F. Christopher "Role of geometry on large mach number instabilities around confined cylinders." 86th Annual Meeting of the Society of Rheology, Philadelphia, PA, October 2014
6. Shi, X.* and G.F. Christopher "Microfluidic Generation of Pickering Drops With Independently Controlled Drop Volume and Particle Surface Concentration." 2013 AIChE Annual Meeting, San Francisco, California, November 2013
7. Kenney, S., Poper, K., Chapagain, G. and G.F. Christopher* "Viscoelastic flow around microfluidic confined cylinders at low and moderate reynolds and Deborah numbers." 2013 AIChE Annual Meeting, San Francisco, California, November 2013
8. Kenney, S., Poper, K., Chapagain, G. and G.F. Christopher* "Viscoelastic flow around microfluidic confined cylinders at low and moderate reynolds and Deborah numbers." 85th Annual Meeting of the Society of Rheology, Montreal, Canada, October 2013
9. Barman, S.* and G.F. Christopher "Simultaneous Interfacial Rheology and Mesostructure Measurement of Particle Laden Interface using a Modified Double Wall Ring Interfacial Rheometer." 85th Annual Meeting of the Society of Rheology, Montreal, Canada, October 2013
10. Zhang, Z.*, Chapagain, G. and GF Chrsitopher *et al* "Role of Secondary Protein Content in Synovial Fluid Rheology." 85th Annual Meeting of the Society of Rheology, Montreal, Canada, October 2013
11. Barman, S. and G.F. Christopher* "The effects of polydisperse particle populations on the shear rheology of solid stabilized interfaces." 2012 AIChE Annual Meeting, Pittsburgh, Pennsylvania, October 2012

12. Kenney, S., Poper, K., Chapagain, G. and G.F. Christopher* "Viscoelastic flow around microfluidic confined cylinders at low and moderate reynolds and Deborah numbers." XVIth International Congress on Rheology, Lisbon, Portugal, August 2012
13. Christopher, G F*, *et al* "MEMS parallel plate rheometer for oscillatory shear micro rheology measurements." 82nd Annual Meeting of the Society of Rheology, Santa Fe, New Mexico, October 2010
14. Christopher, G F*, *et al* "MEMS parallel plate rheometer for oscillatory shear micro rheology measurements." Gordon Research Conference: Colloidal, Macromolecular and Polyelectrolyte solutions, Ventura, California, February 2010
15. Christopher, G F and Anna, S L* "Passive breakup of viscoelastic droplets and filament self-thinning at a microfluidic T-junction." 2009 Annual Meeting of the American Institute of Chemical Engineers, Nashville, Tennessee, November 2009
16. Christopher, G F* and Anna, S L "Passive breakup of viscoelastic droplets and filament self-thinning at a microfluidic T-junction." 81st Annual Meeting of the Society of Rheology, Madison, Wisconsin, October 2009.
17. Christopher, G F* *et al* "MEMS parallel-plate rheometer for small amplitude oscillatory shear micro rheology measurements." Poster Presentation, 81st Annual Meeting of the Society of Rheology, Madison, Wisconsin, October 2009.
18. Christopher, G F* and Anna, S L "Dynamics of microfluidic droplet breakup of viscoelastic polyelectrolyte solutions." 79th Annual Meeting of the Society of Rheology, Salt Lake City, Utah, October 2007.
19. Christopher, G F* *et al* "Control of droplet breakup and coalescence at microfluidic junctions." 59th American Physical Society Division of Fluid Dynamics, Tampa Bay, Florida, November 2006.
20. Noharuddin N*, Christopher, G F and Anna, S L. "The effects of channel geometry on microfluidic drop breakup." 59th American Physical Society Division of Fluid Dynamics, Tampa Bay, Florida, November 2006.
21. Christopher, G F* and Anna, S L "Physical properties of shear gel particles created with microfluidic channels." 78th Annual Meeting of the Society of Rheology, Portland, Maine, October 2006.
22. Christopher, G F* and Anna, S L "Droplet breakup dynamics in a microfluidic T-junction." 58th American Physical Society Division of Fluid Dynamics, Chicago, Illinois, November 2005.
23. Christopher, G F* and Anna, S L "Formation of microparticles using a heat sensitive gel in a microfluidic device." 77th Annual Meeting of the Society of Rheology, Vancouver, British Columbia, Canada, October 2005.

* Author presented at conference.