

Christopher Crowley

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Research experience

[4/2014 - 8/2022] **Graduate Research Assistant**, Pattern Formation and Control Lab, Georgia Institute of Technology (Georgia Tech).

Design, manufacture, and construction of a high-precision Taylor-Couette flow setup. In-house development of a time-resolved volumetric velocimetry system. Requirement for experimental data quality to be high enough for direct comparison of high-dimensional representations to numerical data. Data processing using MATLAB and Python codes.

[3/2007 - 7/2013] **Researcher**, Fluid Metrology Group, National Institute of Standards and Technology (NIST).

Developed physical models and uncertainty analysis for primary flow standards. Design and perform experiments in the wind tunnel facility. Maintained both liquid and air flow primary standard, and perform calibrations of transfer standards

Education

[2022] **Ph.D. in Physics**, Georgia Institute of Technology

Thesis title: *Evidence for the dynamical relevance of relative periodic orbits in turbulence*
Minor in Mechanical Engineering

[2015] **M.S in Physics**, Georgia Institute of Technology

[2013] **B.S. in Physics**, University of Maryland

Minor in Philosophy

Awards

- Georgia Tech VentureLab (\$10,000 + \$50,000) 2022
Venture capital to help determine the viability of an invention
- Amelio travel award (\$1,500) 2021
Travel award from the Amelio Endowment and Weatherly Fund
- School of Physics TA of the Year 2020
Awarded in recognition of being an outstanding TA for Nonlinear Dynamics & Chaos
- Amelio travel award (\$1,000) 2017
Travel award from the Amelio Endowment and Weatherly Fund

Patents

- P1. "A wearable device for regaining simultaneous eyelid closure for victims of partial facial paralysis via direct stimulation", U.S. application number 63/395,443, August 5, 2022.

Publications

Peer Reviewed Publications

- J1. **Christopher J. Crowley**, Joshua Pughe-Sanford, Wesley Toler, Michael C Krygier, Roman O Grigoriev, Michael F Schatz. *"Turbulence Tracks Recurrent Solutions"*. *Proceedings of the National Academy of Sciences* (In press).
- J2. Jimena G. Siles-Paredes, João Salinet, **Christopher J. Crowley**, Flavio H. Fenton, Neal Bhatia, Shahriar Iravanian, Italo Sandoval, Stefan Pollnow, Olaf Dössel, Ilija Uzelac. *"Circle Method for Robust Estimation of Local Conduction Velocity High-Density Maps From Optical Mapping Data: Characterization of Radiofrequency Ablation Sites."* *Frontiers in Physiology* (In press).
- J3. Ilija Uzelac, **Christopher J. Crowley**, Shahriar Iravanian, Tae Yun Kim, Hee Cheol Cho, Flavio H. Fenton. *"Methodology for cross-talk elimination in simultaneous voltage and calcium optical mapping measurements with semasbestic wavelengths"*. *Frontiers in Physiology* 13, February 2022.
- J4. **Christopher J. Crowley**, Michael C. Krygier, Daniel Borrero-Echeverry, Roman O. Grigoriev, Michael F. Schatz. *"A novel subcritical transition to turbulence in Taylor-Couette flow with counter-rotating cylinders."* *Journal of Fluid Mechanics* 892, April 2020, A12.
- J5. Daniel Borrero-Echeverry, **Christopher J. Crowley**, and Tyler P. Riddick. *"Rheoscopic fluids in a post-Kalliroscope world"*. *Physics of Fluids* 30, Pages 087103, August 2018.
- J6. Iosif I. Shinder, **Christopher J. Crowley**, B. James Filla, Michael R. Moldover. *"Improvements to NIST's air speed calibration service"*. *Flow Measurement and Instrumentation* 44, Pages 19-26, August 2015.
- J7. **Christopher J. Crowley**, Iosif I. Shinder, Michael R. Moldover. *"The effect of turbulence on a multi-hole Pitot calibration"*. *Flow Measurement and Instrumentation* 33, Pages 106-109, October 2013.
- J8. Aaron N. Johnson, **Christopher J. Crowley**, T.T. Yeh. *"Uncertainty Analysis of NIST's 20 L Hydrocarbon Liquid Flow Standard"*. *Journal of the Metrology Society of India*, 26(3), Pages 187–202, October 2011.

Conference Papers

- C1. Ilija Uzelac, **Christopher J. Crowley**, Flavio H. Fenton. *"Isosbestic point in optical mapping; theoretical and experimental determination with Di-4-ANBDQPQ transmembrane voltage sensitive dye"*. *Computing in Cardiology*, Singapore, 2019.
- C2. Aaron N. Johnson, Joey T. Boyd, Eric Harman, Mohammad M. Khalil, Jacob E. Ricker, **Christopher J. Crowley**, Rodney A. Bryant, Iosif I. Shinder. *"Design and Capabilities of NIST's Scale-Model Smokestack Simulator (SMSS)"*. Proceeding of the 9th International Symposium on Fluid Flow Measurement, Arlington, VA, 2015.
- C3. Jodie G. Pope, Aaron N. Johnson, James B. Filla, Joey T. Boyd, **Christopher J. Crowley**, and Vernon E. Bean. *"NIST's Fully Dynamic Gravimetric Liquid Flowmeter Standard"*. Proceeding of the International Symposium on Fluid Flow Measurement, Arlington, VA, 2015.
- C4. Jodie G. Pope, **Christopher J. Crowley**. *"Removing the Hydrocarbon Liquid from Hydrocarbon liquid Flow Standards"*. Proceedings of the 16th International Flow Measurement Conference FLOMEKO, 2013.
- C5. Iosif I. Shinder, **Christopher J. Crowley**, B. James Filla, Michael R. Moldover. *"Improvements To NIST's Air Speed Calibration Service"*. Proceeding of the Flomeko, Paris, France, 2013.

- C6. Hsin-Hung Lee, Iosif I. Shinder, **Christopher J. Crowley**, John D. Wright, Michael R. Moldover. *“Computer Simulation for Flow Hysteresis during Multi-hole Pitot Tube Calibration”*. Proceeding of the 20th National Computational Fluid Dynamics Conference, Nantou, Taiwan, 2013.
- C7. Iosif I. Shinder, **Christopher J. Crowley**, Michael R. Moldover. *“Calibrations of Multi-holed Pitot Tubes Depend on Turbulence”*. Proceeding of the Measurement Science Conference, Pasadena, California, 2012.
- C8. Aaron N. Johnson, Chunhui Li, John D. Wright, Gina M. Kline, and **Christopher J. Crowley**. *“Improved Nozzle Manifold for Gas Flow Calibrations”*. Proceeding of the International Symposium on Fluid Flow Measurement, Colorado Springs, CO, 2012.

Other Types of Publications

- S1. Jodie G. Pope, John D. Wright, Aaron N. Johnson, **Christopher J. Crowley**. *“Liquid Flow Meter Calibrations with the 0.1 L/s and 2.5 L/s Piston Provers”*. NIST Special Publication 250-1039r1.
- S2. John D. Wright, Aaron N. Johnson, Gina Kline, **Christopher J. Crowley**, et al. *“A Comparison of 12 US Liquid Hydrocarbon Flow Standards and the Transition to Safer Calibration Liquids”*. Cal Lab 2012; 19-2:30-38.

Talks

- *Evidence for the dynamical relevance of relative periodic orbits in turbulence*, Georgia Tech School of Physics, 2022, Atlanta, Georgia.
- *Experimental evidence that turbulent evolution can be approximated by recurrent flows*, Los Alamos National Lab - Applied and Fundamental Physics division, 2022, Los Alamos, New Mexico.
- *Time evolution of turbulent Taylor-Couette flow is robustly captured by Exact Coherent Structures*, APS - Division of Fluid Dynamics 2021, Phoenix, Arizona.
- *Identifying turbulent shadowing of 3D Exact Coherent Structures from measurements of 2D-2C velocity measurements in small-aspect-ratio Taylor-Couette flow*, APS - Division of Fluid Dynamics 2020, Chicago, Illinois (Virtual).
- *Experimental evidence of exact coherent structures in small-aspect-ratio Taylor-Couette flow*, APS - Division of Fluid Dynamics 2019, Seattle, Washington.
- *Experimental search for exact coherent structures in turbulent small-aspect-ratio Taylor-Couette flow*, APS - Division of Fluid Dynamics 2017, Atlanta, Georgia.
- *Understanding transitional turbulence with the aid of Exact Coherent Structures*, Invited talk at NIST, Gaithersburg, MD on May 15 2017.
- *The transition into turbulence in a rotating flow*, Georgia Tech Physics Forum on April 14 2017.
- *Rheoscopic fluids in a post-Kalliroscope world*, APS - Division of Fluid Dynamics 2016, Portland, Oregon.
- *Experimental and numerical study of direct laminar-turbulent transition in Taylor-Couette flow*, APS - Division of Fluid Dynamics 2016, Portland, Oregon.
- *Direct laminar-turbulent transition in counter-rotating Taylor-Couette flow: experiments and simulations*, Bifurcations and Instabilities in Fluid Dynamics 2015, Paris, France.

- *Experimental observations of direct laminar-turbulent transition in counter-rotating Taylor-Couette flow*, International Couette-Taylor Workshop 2015, Cottbus, Germany
- *A dynamical systems approach to understanding fluid turbulence*, Invited talk at NIST, Gaithersburg, MD on May 1 2015.
- *Experimental observations of direct laminar-turbulent transition in counter-rotating Taylor-Couette flow*, APS - Division of Fluid Dynamics 2015, Boston, Massachusetts.
- *Direct laminar-turbulent transition in Taylor-Couette flow: Experiments and simulations*, APS - Division of Fluid Dynamics 2014, San Francisco, California.
- *From SI to Customer Instrument. Practical Aspects of NIST Airspeed Calibration Traceability*, Measurement Science Conference 2013, Pasadena, California.

Mentoring

2013-2022 mentored 4 undergraduate researchers in the lab

2010-2019 High school science fair judge

Judged at 13 high school science fair in two states and five counties

2016 Mentored a 9th grade student working on science fair project

The student won both his school and county, then went on to get second place in the state competition.

Teaching experience

2013-2014; 2019-2022 Teaching Assistant, Georgia Tech

Phys 4267/6268 Nonlinear Dynamics & Chaos (**Awarded TA of the year in 2020**)

Phys 2213 Intro to Modern Physics

Phys 2211 Intro Physics I

Phys 2212 Intro Physics II

2015 Workshop Instructor, United Nations Abdus Salam International Center for Theoretical Physics (ICTP), Trieste, Italy.

Hands-On Research in Complex Systems School

2012 Workshop Instructor, National Institute of Standards and Technology (NIST) Summer Institute for high school teachers, Gaithersburg MD

Service

Professional

[2014 - 2017] **Founding President**, Graduate Association of Physicists at Georgia Tech

An organization that provides career development opportunities to physics PhD students, particularly those who do not intend on staying in academia after completing their PhD. This organization established relationships with several companies such as Boston Consulting Group, Proctor & Gamble, and Intel.

Community

[2015, 2016, and 2017] **Lead organizer**, Science of Beer

A community science outreach event hosted with more than 350 participants at SweetWater Brewing Company, Monday Night Brewing, and Orpheus Brewing in conjunction with the Atlanta Science Festival. Several news sources wrote stories about these events (e.g. [Atlanta Journal Constitution](#)).

Memberships and committees

- Graduate Association of Physicists, Founding President
- American Physical Society
- American Association for the Advancement of Science
- American Society of Mechanical Engineers