Christopher J Crowley

- Website: christophercrowley.com
- Google Scholar: scholar.christophercrowley.com
- Curriculum Vitae: cv.christophercrowley.com
- christopher.j.crowley@nist.gov
- (240) 672-6004
- Citizenship: USA

Research interests: experimental metrology; invention and development of measurement instruments; optical and acoustic diagnostics; nonlinear dynamics and complex systems

Research experience

[6/2023 - present] **Physicist**, Fluid Metrology Group, National Institute of Standards and Technology.

Develop airspeed and low-flow calibration standards, including a new ultra-low-speed primary standard and an optical-chopper method for calibrating laser Doppler anemometers.

[2/2025 - present] **Adjunct Assistant Professor**, Whiting School of Engineering, Johns Hopkins University.

Developed a novel time-of-flight image-velocimetry system for oceanic turbulence measurements.

[9/2022 - 6/2023] **Postdoctoral Fellow**, Fluid Transport Lab, Johns Hopkins University.

Designed and built a custom high-speed scanning dual stereo PIV–PLIF system for variable-density flow experiments. *Advisor*: Rui Ni

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

Built a novel Taylor–Couette apparatus and an in-house time-resolved volumetric velocimetry system; first experimental evidence that turbulence tracks recurrent solutions (*PNAS*). *Advisors*: Mike Schatz and Roman Grigoriev

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

Developed physical models and uncertainty analysis for primary flow standards; performed wind-tunnel experiments and calibrations of transfer standards.

Research funding

- NOAA – resolve issue with NOAA NDBC airspeed readings (PI) ($41,000) 2026
- NIST Cal Service Development – wind tunnel power system repairs (PI) ($100,000) 2026
- NIST On A Chip – density through acoustics feasibility study (Co-PI) ($124,000) 2026
- NIST Greenhouse Gas Measurements – landfill methane measurement (PI) ($180,000) 2025
- NIST Cal Service Development – development of new airspeed primary standard (PI) ($24,000) 2025
- NIST On A Chip – Gas flow meter development (Co-PI) ($124,000) 2025
- NIST Cal Service Development – Ultra Low Wind Tunnel (PI) ($150,000) 2024
- NIST Greenhouse Gas Measurements – landfill methane measurement (PI) ($150,000) 2024
- NIST Investment Equipment – Nd:YLF laser (PI) ($54,000) 2024
- Georgia Tech VentureLab startup funding for inventors ($10,000 + $50,000) 2022

Education

[2022] **Ph.D. in Physics**, Georgia Institute of Technology (Minor in Mechanical Engineering)

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

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

[2013] **B.S. in Physics**, University of Maryland (Minor in Philosophy; one class short of double major)

Patents

P1. Uzelac I & Crowley C. "A wearable device for regaining simultaneous eyelid closure for victims of partial facial paralysis via direct stimulation", U.S. application number 18/997,930, January 23, 2025 (provisional application 63/395,443 filed August 5, 2022).

Technical skills

Measurement & metrology	Precision measurement, calibration & SI traceability, measurement uncertainty (GUM), experimental design
Instrumentation & hardware	Instrument design & build, embedded systems (ESP32 / Teensy / Arduino), rapid prototyping & 3D printing, CAD, CNC & manual machining, DAQ
Diagnostics & sensing	Velocimetry — 2D–4D PIV/PTV, tomographic, STB; PLIF & fluorescence imaging (incl. biological); laser Doppler anemometry; acoustic & microwave resonance
Modeling & analysis	Signal & image-processing algorithm development, Fourier analysis, reduced-order & uncertainty-driven modeling, nonlinear dynamics, data analysis & visualization
Programming	MATLAB, Python, C++, embedded/low-level C, LaTeX
Leadership	R&D project leadership (PI), technical proposal writing, mentoring

Publications

Journal Publications

J1. **Christopher J. Crowley**, Iosif I Shinder, Michael R Moldover, Joey T Boyd, B James Filla, and Aaron N Johnson. *"Calibrating Laser Doppler Anemometers Utilizing an Optical Chopper"*. *Metrologia* 62, 025001, 2025.

J2. **Christopher J. Crowley**, Joshua Pughe-Sanford, Wesley Toler, Roman O Grigoriev, Michael F Schatz. *"Observing a dynamical skeleton of turbulence in Taylor–Couette flow experiments"*. *Phil. Trans. R. Soc. A* 20220137, January 2023.

J3. **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* 119 (34), August 2022.

J4. Jimena G. Siles-Paredes, **Christopher J. Crowley**, Flavio H. Fenton, Neal Bhatia, Shahriar Iravanian, Italo Sandoval, Stefan Pollnow, Olaf Dössel, João Salinet, 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* 13, August 2022.

J5. 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.

J6. **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.

J7. Daniel Borrero-Echeverry, **Christopher J. Crowley**, and Tyler P. Riddick. *"Rheoscopic fluids in a post-Kalliroscope world"*. *Physics of Fluids* 30, 087103, August 2018. **(Editor's Pick)**

J8. 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.

J9. **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.

J10. 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. Shiyong Tan, **Christopher J. Crowley**, Qianwen Wu, Rui Ni. *"Experimental measurement of vortex pair instability in a stratified fluid"*. Proceedings of the 36th Symposium on Naval Hydrodynamics, Korea, 2026.

C2. **Christopher J. Crowley**, Jeyadave Nuntha Kumar, Iosif I Shinder. *"Ultra-low-speed anemometer calibrations in a bench-top wind tunnel"*. Proceedings of the 20th International Flow Measurement Conference FLOMEKO, Japan, 2026. **(Peer Reviewed)**

C3. **Christopher J. Crowley**, Iosif I Shinder, Joey T Boyd, Fábio O Costa, Samuel Araújo. *"Bilateral Airspeed Comparison (2–20 m/s) Using Three Transfer Standards"*. Proceedings of the 20th International Flow Measurement Conference FLOMEKO, Japan, 2026. **(Peer Reviewed)**

C4. John D Wright, **Christopher J. Crowley**, Aaron N Johnson, Shinichiro Nakao. *"The Effect of Different Gases on Critical Flow Nozzles"*. Proceedings of the 20th International Flow Measurement Conference FLOMEKO, Japan, 2026. **(Peer Reviewed)**

C5. Keith A Gillis, Jodie G Pope, **Christopher J. Crowley**. *"New dynamic gas low flow standard based on acoustic and microwave resonances"*. Proceedings of the 20th International Flow Measurement Conference FLOMEKO, Japan, 2026. **(Peer Reviewed)**

C6. Aaron N Johnson, Jodie G Pope, Keith A Gillis, John D Wright, Max K Low, **Christopher J. Crowley**. *"A Non-Intrusive Analytic Temperature Model for Rate-of-Rise-Based Gas Flow Standards"*. Proceedings of the 20th International Flow Measurement Conference FLOMEKO, Japan, 2026. **(Peer Reviewed)**

C7. Jodie G Pope, **Christopher J. Crowley**, Max K Low, John D Wright, Aaron N Johnson. *"Accurate Volume Determination for Low Gas Flow Standards"*. Proceedings of the 20th International Flow Measurement Conference FLOMEKO, Japan, 2026. **(Peer Reviewed)**

C8. Jimena Siles, Joao Salinet, **Christopher J Crowley**, Flavio H Fenton, Neal Bhatia, Shahriar Iravanian, Ilija Uzelac. *"Cell Unexcitability and Electrotonic Coupling Phenomenon Analysis of Ablation-Created Lesions: A Study Case with Ablated Explanted Human Heart"*. *Computing in Cardiology*, Finland, 2022. **(Peer Reviewed)**

C9. 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. **(Peer Reviewed)**

C10. 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 NISTs Scale-Model Smokestack Simulator (SMSS)"*. Proceedings of the 9th International Symposium on Fluid Flow Measurement ISFFM, Arlington, VA, 2015. **(Peer Reviewed)**

C11. 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"*. Proceedings of the International Symposium on Fluid Flow Measurement ISFFM, Arlington, VA, 2015. **(Peer Reviewed)**

C12. 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. **(Peer Reviewed)**

C13. Iosif I. Shinder, **Christopher J. Crowley**, B. James Filla, Michael R. Moldover. *"Improvements To NIST's Air Speed Calibration Service".* Proceedings of the FLOMEKO, Paris, France, 2013. **(Peer Reviewed)**

C14. 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".* Proceedings of the 20th National Computational Fluid Dynamics Conference, Nantou, Taiwan, 2013.

C15. Iosif I. Shinder, **Christopher J. Crowley**, Michael R. Moldover. *"Calibrations of Multi-holed Pitot Tubes Depend on Turbulence".* Proceedings of the Measurement Science Conference, Pasadena, California, 2012.

C16. Aaron N. Johnson, Chunhui Li, John D. Wright, Gina M. Kline, and **Christopher J. Crowley**. *"Improved Nozzle Manifold for Gas Flow Calibrations".* Proceedings of the International Symposium on Fluid Flow Measurement ISFFM, Colorado Springs, CO, 2012. **(Peer Reviewed)**

C17. Aaron N. Johnson, **Christopher J. Crowley**, and T. T. Yeh. *"Description and uncertainty analysis of NIST's 20 liter hydrocarbon liquid flow standard (20 L HLFS)".* Proceedings of the 15th International Flow Measurement Conference FLOMEKO, Taipei, Taiwan, 2010. **(Peer Reviewed)**

Other Types of Publications

S1. Jodie G. Pope, Aaron N. Johnson, B. James Filla, Vern E. Bean, Michael R. Moldover, **Christopher J. Crowley**, Joey T. Boyd, Iosif I. Shinder, Keith A. Gillis, John D. Wright. *"Liquid Flow Meter Calibrations With NIST's 15 kg/s Water Flow Standard".* NIST Special Publication 250-98.

S2. 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.

S3. 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

T1. *Ultra-low-speed anemometer calibrations in a bench-top wind tunnel* FLOMEKO 2026, Nara, Japan.

T2. *Accurate Volume Determination for Low Gas Flow Standards* FLOMEKO 2026, Nara, Japan.

T3. *Bilateral Airspeed Comparison (2–20 m/s) Using Three Transfer Standards* FLOMEKO 2026, Nara, Japan.

T4. *A quick overview of how we're slowing down the airspeed* NIST Sensor Science Division seminar series, 2025, Gaithersburg, Maryland.

T5. *Experimental evidence that turbulent evolution can be approximated by recurrent flows,* Penn State FDRC Seminar Series, 2023, State College, Pennsylvania.

T6. *Turbulent evolution is captured by recurrent flows,* Johns Hopkins CEAFM Seminar Series, 2023, Baltimore, Maryland.

T7. *Evidence for the dynamical relevance of relative periodic orbits in turbulence,* Georgia Tech School of Physics, 2022, Atlanta, Georgia.

T8. *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.

T9. *Time evolution of turbulent Taylor-Couette flow is robustly captured by Exact Coherent Structures,* APS - Division of Fluid Dynamics 2021, Phoenix, Arizona.

T10. *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).

T11. *Experimental evidence of exact coherent structures in small-aspect-ratio Taylor-Couette flow,* APS - Division of Fluid Dynamics 2019, Seattle, Washington.

T12. *Experimental search for exact coherent structures in turbulent small-aspect-ratio Taylor-Couette flow,* APS - Division of Fluid Dynamics 2017, Atlanta, Georgia.

T13. *Understanding transitional turbulence with the aid of Exact Coherent Structures*, NIST Fluid Metrology Group, Gaithersburg, MD on May 15 2017.

T14. *The transition into turbulence in a rotating flow*, Georgia Tech Physics Forum on April 14 2017.

T15. *Rheoscopic fluids in a post-Kalliroscope world*, APS - Division of Fluid Dynamics 2016, Portland, Oregon.

T16. *Experimental and numerical study of direct laminar-turbulent transition in Taylor-Couette flow*, APS - Division of Fluid Dynamics 2016, Portland, Oregon.

T17. *Direct laminar-turbulent transition in counter-rotating Taylor-Couette flow: experiments and simulations*, Bifurcations and Instabilities in Fluid Dynamics 2015, Paris, France.

T18. *Experimental observations of direct laminar-turbulent transition in counter-rotating Taylor-Couette flow*, International Couette-Taylor Workshop 2015, Cottbus, Germany

T19. *A dynamical systems approach to understanding fluid turbulence*, Invited talk at NIST, Gaithersburg, MD on May 1 2015.

T20. *Experimental observations of direct laminar-turbulent transition in counter-rotating Taylor-Couette flow*, APS - Division of Fluid Dynamics 2015, Boston, Massachusetts.

T21. *Direct laminar-turbulent transition in Taylor-Couette flow: Experiments and simulations*, APS - Division of Fluid Dynamics 2014, San Francisco, California.

T22. *From SI to Customer Instrument. Practical Aspects of NIST Airspeed Calibration Traceability*, Measurement Science Conference 2013, Pasadena, California.

Academic service

Mentoring

2026-present Co-mentoring 1 postdoc

2025 Mentored 1 Summer Undergraduate Research Fellow and 1 high school summer intern

2022-2023 Mentored 3 PhD students and 3 undergraduate students

2013-2022 Mentored 4 undergraduate researchers in the lab

2010-2019 High school science fair judge

Judged at 13 high school science fairs 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 GA 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

Other 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, Procter & Gamble, and Intel. gap.physics.gatech.edu

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 at Georgia Tech, *Founding President*
- American Physical Society
- American Association for the Advancement of Science
- American Society of Mechanical Engineers