# Norman M. Cao

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## APPOINTMENTS HELD

Research Fellow, Institute for Fusion Studies, University of Texas at Austin *Sep 2023 – current*

Courant Instructor / Assistant Professor (Non-Tenure Track), New York University *Sep 2020 – Aug 2023*
***Joseph B. Keller Fellow (2022-23)**, Faculty Fellow in the Simons Collaboration on Wave Turbulence*

Research Assistant, MIT Plasma Science and Fusion Center *Aug 2016 – Jun 2020*

## EDUCATION

**Ph.D. in Applied Plasma Physics from Nuclear Science and Engineering Dept** *Jun 2020*
- Massachusetts Institute of Technology, Cambridge, MA
- Thesis title: *Characterization of a turbulence bifurcation underlying L-mode confinement transitions on Alcator C-Mod*

**Bachelor of Science in Aerospace Engineering and Physics, Minor in Mathematics** *Jun 2015*
- Massachusetts Institute of Technology, Cambridge, MA

## PUBLICATIONS

Complete bibliography available online: https://scholar.google.com/citations?user=WQRmB8MAAAAJ

**Turbulence in tokamak plasmas**

1. **N. M. Cao**, H. Zhu, G. C. Grime and T. Stoltzfus-Dueck, "Detecting Shearless Phase-Space Transport Barriers in Global Gyrokinetic Turbulence Simulations with Test Particle Map Models", (*accepted for publication in J. Plasma Phys.*)
2. **N. M. Cao**, J. E. Rice, P. H. Diamond, A. E. White, M. A. Chilenski, P. C. Ennever, J. W. Hughes, J. Irby, M. L. Reinke, and P. Rodriguez-Fernandez, "Evidence and modeling of turbulence bifurcation in L-mode confinement transitions on Alcator C-Mod", *Phys. Plasmas* **27**, 052303 (2020).
3. **N. M. Cao**, J. E. Rice, P. H. Diamond, A. E. White, S. G. Baek, M. A. Chilenski, J. W. Hughes, J. Irby, M. L. Reinke, and P. Rodriguez-Fernandez, "Hysteresis as a probe of turbulent bifurcation in intrinsic rotation reversals on Alcator C-Mod", *Nucl. Fusion* **59**, 104001 (2019).

**Uncertainty quantification**

4. **N. M. Cao**, D. R. Hatch, C. Michoski, T. A. Oliver, D. Eldon, A. O. Nelson, M. Waller, "Quantifying Resolution Limits in Pedestal Profile Measurements with Gaussian Process Regression", *Nucl. Fusion* **66**, 026016 (2026)
5. **N. M. Cao** and F. Sciortino, "Bayesian Spectral Moment Estimation and Uncertainty Quantification", *IEEE Trans. Plasma Sci.* **48**, 22 (2020).

**Basic fluid and plasma turbulence**

6. **N. M. Cao** and D. Qi, "The maintenance of coherent vortex topology by Lagrangian chaos in drift-Rossby wave turbulence", *Phys. Fluids* **36**, (2024).
7. **N. M. Cao** and D. Qi, "Nearly integrable flows and chaotic tangles in the Dimits shift regime of plasma edge turbulence", *Phys. Plasmas* **30**, (2023).
8. **N. M. Cao**, "Rossby waves past the breaking point in zonally-dominated turbulence", *J. Fluid Mech.* **958**, A28 (2023).

**Fusion reactor engineering**

9. A. Q. Kuang, **N. M. Cao**, A. J. Creely, C. A. Dennett, J. Hecla, B. LaBombard, R. A. Tinguely, E. A. Tolman, H. Hoffman, M. Major, J. Ruiz Ruiz, D. Brunner, P. Grover, C. Laughman, B. N. Sorbom, and D. G. Whyte, "Conceptual design study for heat exhaust management in the ARC fusion pilot plant", *Fusion Eng. Des.* **137**, 221 (2018).

## SELECTED PRESENTATIONS

- "Nearly-Laminar Flows and Coherent Structures in Fusion Plasma Turbulence", KAIST seminar; March 25, 2024; Daejeon, South Korea
- *Invited Talk:* "Hysteresis as a Probe of Turbulent Bifurcation in Intrinsic Rotation Reversals on Alcator C-Mod", 61st APS-DPP Meeting; October 21-25, 2019; Fort Lauderdale, Florida
- ***Best Student Poster Prize Winner:*** "Observation and Quasilinear Modeling of Rotation Reversal Hysteresis in Alcator C-Mod Plasmas", 24th Joint US-EU Transport Task Force Meeting; March 18-21, 2019; Austin, Texas
- *Invited Talk:* "Observation and Quasilinear Modeling of Rotation Reversal Hysteresis in Alcator C-Mod Plasmas", 2nd Asia-Pacific Conference on Plasma Physics; November 12-17, 2018; Kanazawa, Japan

## HONORS AND AWARDS

- Joseph B. Keller Postdoctoral Fellowship *Sep 2022*
- Promising Young Scientist Prize at 10th Festival de Théorie in Aix-en-Provence *Jul 2019*
- Best Student Poster Prize at 24th Joint US-EU Transport Task Force Meeting *Mar 2019*
- Student Festival Fellow at 9th Festival de Théorie in Aix-en-Provence *Jul 2017*
- U.S. NRC Nuclear Education Graduate Fellowship Recipient *Sep 2016*

## TEACHING

**Instructor of Record:**

- NYU Courant
  - MATH-UA 140 (Linear Algebra) *Fall 2020*
  - MATH-UA 148 (Honors Linear Algebra) *Spring 2022*
  - MATH-UA 325 (Analysis) *Spring 2021, Fall 2021, Fall 2022*
- NYU Tandon
  - MA-UY 4414 (Applied Partial Differential Equations) *Spring 2023*
- Sample syllabi available at https://maplenormandy.github.io/teaching/

**Teaching Assistantships:**

- TA for MIT 22.63 (Engineering Principles for Fusion Reactors) *Fall 2018*
- Lab Instructor for MIT 2.00b (Toy Product Design) *Spring 2018*

**Students Mentored:**

- Weiyu Lin (UT Austin undergrad. *Sep 2023 – Sep 2024): Using Computer Vision to find Wave-like Behavior in Fluids*
- Tanuj Sistla (NYU undergrad. *Jan – May 2023*): *Using Computer Vision to Track Coherent Vortices in Fusion Plasma Turbulence*
- Sander Miller (high school student. *Oct 2020 – Nov 2021*): *The Effects of Core-Edge Temperature Gradients on Intrinsic Rotation during H-Mode in Tokamak Reactors*

## ACADEMIC SERVICE AND COMMUNITY ACTIVITIES

**Number of Grant Proposals Reviewed:** 2

**MIT Plasma Science and Fusion Center Outreach** *Sep 2015 – Jun 2020*

- Regularly lead tours and engaged in other fusion energy outreach activities

**Attendee at APS-DPP Community Planning Workshop in Austin, TX** *Dec 2017*

- Participated in community workshop discussion sessions

**Teacher for MIT Educational Studies Program** *Jan 2012 – Nov 2019*

- Taught one- to two-hour courses on different topics in physics and math to middle and high schoolers