Norman M. Cao

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EDUCATION

Ph.D. in Applied Plasma Physics from Nuclear Science and Engineering Dept *June 2020*
- Massachusetts Institute of Technology, Cambridge, MA
- Graduate GPA of 4.9 out of 5.0

Bachelor of Science in Aerospace Engineering and Physics, Minor in Mathematics *June 2015*
- Massachusetts Institute of Technology, Cambridge, MA
- Undergraduate GPA of 4.9 out of 5.0

APPOINTMENTS HELD

Assistant Professor (Non-Tenure Track) / Courant Instructor / Simons Faculty Fellow in the Mathematics Department of the Courant Institute at New York University *Sep. 2020 – Current*
- Fellow in the Simons Collaboration on Wave Turbulence fostering interdisciplinary research on the wave kinetic equation and other wave turbulence problems
- Instructor for several undergraduate math courses

Research Assistant at the MIT Plasma Science and Fusion Center *August 2016 – June 2020*
- Member of the core transport group working to understand plasma turbulence at Alcator C-Mod and other magnetic confinement fusion experiments
- Maintained and developed software for HIREXSR, an x-ray imaging crystal spectrometer which provided ion temperature and rotation measurements critical to many publications

TEACHING POSITIONS

Courses Taught:
- NYU MATH-UA 140 (Linear Algebra), 148 (Honors Linear Algebra), 325 (Analysis).
- Sample syllabi available at https://maplenormandy.github.io/teaching/

Research Mentor for high school student Sander Miller *Oct 2020 – Nov 2021*
- Met monthly, involving the student in plasma physics research on Alcator C-Mod
- Project Title: "The Effects of Core-Edge Temperature Gradients on Intrinsic Rotation during H-Mode in Tokamak Reactors"

TA for MIT 22.63 (Engineering Principles for Fusion Reactors) *Sep – Dec 2018*

SELECTED PUBLICATIONS

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

Geophysical fluid dynamics / wave turbulence
- **Cao N M** Rossby waves past the breaking point in zonally-dominated turbulence *(submitted to J. Fluid Mech.)*

Turbulence bifurcations / confinement transitions in tokamaks
- **Cao N M**, Rice J E, Diamond P H, White A E, Chilenski M A, Ennever P C, Hughes J W, Irby J, Reinke M L and Rodriguez-Fernandez P 2020 Evidence and modeling of turbulence bifurcation in L-mode confinement transitions on Alcator C-Mod *Phys. Plasmas* **27** 052303
- **Cao N M**, Rice J E, Diamond P H, White A E, Baek S G, Chilenski M A, Hughes J W, Irby J, Reinke M L and Rodriguez-Fernandez P 2019 Hysteresis as a probe of turbulent bifurcation in intrinsic rotation reversals on Alcator C-Mod *Nucl. Fusion* 59 104001

Computational statistics / spectroscopy
- **Cao N M** and Sciortino F 2020 Bayesian Spectral Moment Estimation and Uncertainty Quantification *IEEE Trans. Plasma Sci.* **48** 22–30

Fusion Engineering
- Kuang A Q, **Cao N M**, Creely A J, Dennett C A, Hecla J, LaBombard B, Tinguely R A, Tolman E A, Hoffman H, Major M, Ruiz Ruiz J, Brunner D, Grover P, Laughman C, Sorbom B N and Whyte D G 2018

Conceptual design study for heat exhaust management in the ARC fusion pilot plant *Fusion Eng. Des.* **137** 221–42
(Note: This was a group paper from MIT 22.63 Engineering Principles for Fusion Reactors, Spring 2016)

SELECTED CONFERENCE PRESENTATIONS

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

- 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*
- Inducted into Sigma Pi Sigma and Phi Beta Kappa Society *Jun. 2015*

COMMUNITY ACTIVITIES

MIT Mystery Hunt *Jan. 2012 – Current*
- Help organize a team every January for MIT's famously challenging mystery hunt

MIT Plasma Science and Fusion Center Outreach *Sep. 2015 – June 2020*
- Regularly lead tours and engage in other fusion energy outreach activities

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

OTHER ENGINEERING EXPERIENCE

Project Engineer for KitCube, MIT 16.83 Space Systems Engineering *Feb. – May 2015*
- Acted as primary technical liaison between subsystems as project engineer for this capstone class
- Designed a $2 million CubeSat capable of entering and sending transmissions from lunar orbit
- KitCube later won **2nd place out of 13 teams** at NASA CubeSat Challenge Ground Tournament 1 https://news.mit.edu/2016/aeroastro-student-project-could-go-to-the-moon-0205

Mission Assurance Intern at SpaceX *June – Aug. 2014*
- Developed integrated probabilistic risk analyses (PRA) for Crew Dragon systems
- Assisted in investigations of major F9 anomalies
- Designed and implemented metrics for tracking component and system reliability
- Best Undergraduate Research Project in Computer Science in AeroAstro *Jun. 2015*