THOMAS MAXIMILLIAN ROBERTS

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EDUCATION

Columbia University *New York, NY, 2009-2015*
Ph.D. in Applied Physics
M.S. in Applied Physics

Worcester Polytechnic Institute *Worcester, MA, 2005-2009*
B.S. in Physics, Minor in Mathematics

RESEARCH EXPERIENCE

Lynch Rocket Laboratory, Dartmouth College 2015 - Present
Postdoctoral Researcher *Hanover, NH*

· Assisting in design and analysis of a sounding rocket mission where four payloads are simultaneously deployed for synchronized, multipoint measurement of ionospheric plasma.
· Design and testing of telemetry system between main payload and ejected payloads, including bandwidth/data rate concerns, measurement cadence and synchronization.
· Development of libraries for spacecraft-borne microcontrollers used for data acquisition and telemetry.
· Development of an attitude determination algorithm for ejected spacecraft using low-cost IMU data.
· Designed control system to automate laboratory plasma experiments, integrating stepper motor driven motion table, various data acquisition systems, and controllable power supplies with a simple GUI.
· Design and perform calibration methods for space-based devices using a laboratory plasma source.
· Preliminary mission planning for an orbital, small-satellite swarm to measure ionospheric conductivity.

Columbia University Plasma Lab 2009 - 2015
Graduate Research Student *New York, NY*

· Designed and conducted experiments related to the study of turbulent plasmas in the CTX device.
· Analyzed and interpreted experimental data. Created robust Python libraries for analyses on CTX.
· Designed and fabricated electronic hardware for experiments including feedback control circuits and control systems for laboratory automation and digitization.
· Managed diagnostics/assisted running experiments on the Levitated Dipole Experiment at MIT.
· Maintained and repaired the experimental equipment including vacuum pumps and microwave sources.
· Gyrofluid modeling of dipole confined plasmas studying interchange and entropy modes.
· Performed gyrokinetic simulations which recreates the plasma dynamics we measure experimentally.

LANL Computational Physics Workshop Summer, 2013
Student Fellowship *Los Alamos, NM*

· Worked in a team with a LANL mentor to improve methods used for the numerical study of heat transfer on Eulerian meshes containing mixed material cells.
· Developed algorithms to improve computational efficiency for specific arrangements of varying conductivity material. Also received multiple daily lectures on various topics in computational physics.

MIT Langer Labs Summer 2008
Research Assistant *Cambridge, MA*

· Conducted experiments with nano-fiber fabrication as means of drug release as well as design of core/shell fiber extrusion. Worked on design of micro-particle fabrication.
· Received training and hours of experience with scanning electron microscopy.

TEACHING EXPERIENCE

Columbia University, *Teaching Assistant*

· Introduction to Linear Algebra (undergraduate), Assistant Prof. Pierre Gentine, Fall 2009

· Quantum Mechanics (undergraduate), Prof. Thomas S. Pedersen, Spring 2010

Columbia University, *Machine Shop Instructor*

· Taught mandatory class in machine shop methods and safety. 2011-2012

TECHNICAL SKILLS

Proficient Computer Languages: Python, C/C++, Swift

Additional Languages: Java, HTML, CSS, PHP

App Development: iOS, macOS, Android

Electronics: AVR, analog/digital circuit design, soldering, SMD pick/place and oven

Laboratory: Vacuum equipment, microwave sources, data acquisition

Mechanical: Welding, mill/lathe, metal fabrication, 3D printing

PUBLICATIONS

T.M. Roberts, M. E. Mauel, and M. W. Worstell
"Local Regulation of Interchange Turbulence in a Dipole Confined Plasma Torus Using Current Collection Feedback"
Phys. Plasmas 22, 055702 (2015); http://dx.doi.org/10.1063/1.4918352

T.M. Roberts, M. E. Mauel, M. C. Abler, and B. K. Makansi
"Imaging free-falling particles for multipoint measurement of plasma fluctuations"
Review of Scientific Instruments, 86(8), 083510 (2015); http://dx.doi.org/10.1063/1.4929407

D. Garnier, M. E. Mauel, T. M. Roberts, J. Kesner, and P. Woskov
"Turbulent Fluctuations During Pellet Injection into a Dipole Confined Plasma Torus"
Physics of Plasmas, (accepted)

T.M. Roberts, K. A. Lynch, R. E. Clayton, J. Weiss, D. L. Hampton
"A Small Spacecraft for Multipoint Measurement of Ionospheric Plasma"
Review of Scientific Instruments, (in review)

T.M. Roberts, K. A. Lynch, R. E. Clayton, M. E. Disbrow, C. J. Hansen
"Magnetometer-Based Attitude Determination for Deployed, Spin-Stabilized Spacecraft"
Journal of Guidance, Control, and Dynamics, (in review)

TALKS

2016 Columbia University, New York, NY
Plasma Colloquium: "Design and Testing of a New Low-Resource, Multipoint Diagnostic for Measurement of Auroral Plasma Gradients"

2016 Capital One Labs, New York, NY
Capital One Labs Speaker Series: "Measuring Aurora Borealis with Rockets: Design and Testing of a New Diagnostic for Plasma in the Ionosphere"

2015 Dartmouth College, Hanover, NH
Invited Talk: "Local Regulation of Interchange Turbulence in a Dipole Confined Plasma Torus Using Current Collection Feedback"

2015 Columbia University, New York, NY
Plasma Colloquium: "Imaging Inserted Particles for Local Measurement of Plasma Dynamics and Structure"

2014 APS Division of Plasma Physics, New Orleans, LA
Invited Talk: "Local Regulation of Interchange Turbulence in a Dipole Confined Plasma Torus Using Current Collection Feedback"

2013 LANL Computational Physics Student Summer Workshop, Los Alamos, NM
Final Report Presentation: "Numerical Study for Diffusion in Material Mixtures"

2012 Columbia Applied Physics Applied Mathematics, New York, NY
Morning Research Talk: "Reduction of Turbulence via Feedback in a Dipole Confined Plasma"

CONFERENCE PRESENTATIONS

2016 APS Division of Plasma Physics, San Jose, CA
Contributed Poster: "A Low-Resource, Deployed Spacecraft for Multipoint Measurement of Ionospheric Plasma"

2014 APS Division of Plasma Physics, New Orleans, LA
Contributed Poster: "Bounce Averaged Gyrokinetic Simulations of Current Collection Feedback in a Laboratory Magnetosphere"

2013 APS Division of Plasma Physics, Denver, CO
Contributed Poster: "Electrostatic Feedback in a Dipole Confined Interchange Turbulent Plasma"

2012 APS Division of Plasma Physics, Providence, RI
Contributed Poster: "Active Feedback Control of Interchange Turbulence in Laboratory Magnetosphere"

2011 APS Division of Plasma Physics, Salt Lake, UT
Contributed Poster: "Observation and Measurement of Turbulent Radial Transport in a Dipole"

2010 APS Division of Plasma Physics, Chicago, IL
Contributed Poster: "Observation of Plasma Flows through the Insertion and Imaging of Dust"