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William J. Capecchi

PhD Physicist with over 10 years in private industry and plasma fusion energy research. Strong background in data driven research, scientific diagnostic design, modeling, and statistics. Able to develop effective analytics on large datasets and make complex subjects relatable and actionable. Seeking to apply drive and dedication to provide innovative and robust data insights and solutions.



EDUCATION

UNIVERSITY OF WISCONSIN-
MADISON

Madison, Wisconsin

2017 Ph.D. Plasma Physics

Dissertation: *A Critical Fast Ion Beta in the Madison Symmetric Torus Reversed Field Pinch*

ST. JOHN'S UNIVERSITY

Collegeville, Minnesota

2009 B.A. Physics & Mathematics



EXPERIENCE

Present **Principal Investigator**

[Princeton Plasma Physics Lab, Lithium Tokamak Experiment- \$\beta\$ \(LTX- \$\beta\$ \)](#)

- Led research collaboration between UW Madison and PPPL, managing \$1.7M DOE Grant
- Coordinated hiring and managing of personnel including research intern on site at PPPL and students at UW
- Developed new scientific diagnostic from design through construction and testing to data analysis, filling crucial knowledge gap in performance of neutral beam, essential for research progress.
- Routinely writes up scientific findings for publication in scientific journals and at conferences

May

2023

Research Associate

[Princeton Plasma Physics Lab, Lithium Tokamak Experiment- \$\beta\$ \(LTX- \$\beta\$ \)](#)

- Optimized and implemented technical upgrades to 700 kW neutral beam injector (NBI) on LTX- β device leading to first measurement of beam heating in low-recycling plasmas
- Performed multi-model analysis, including a self-developed first principles code, of NBI in LTX- β leading to engineering upgrade that improved beam coupling by 100%
- Performed routine analysis of plasma discharge data to determine NBI performance and progress towards research objectives

Sept

2019

Sr. Simulation Engineer

[Donaldson Inc.](#)

- Technical lead on collaboration with University of MN project to develop liquid filtration model
- Completed work on dust loading diagnostic bench with laser distance transducer technology to provide experimental validation to dust loading algorithm improvement
- Developed first principles dust loading algorithm to improve accuracy of filter life model
- Improved physics of filtration efficiency modeling through simulation of particle trajectories in flow

Aug

2017

Freelance Data Scientist

[Upwork](#)

- Engineered machine-learning features reducing mean-square error 12% using Jupyter, Scikit-learn
- Optimized MACD time-series parameters resulting in 51.9% increase in ROI on out-sample data
- Built Python GUI for SQL database management and ETL functionality
- Developed interactive world map of air quality database using Python, d3.js, Mapbox
- Wrote Microsoft VBA macros to automate Excel spreadsheet processes

Jan

2017

PhD Candidate/Research Assistant

[UW Madison, Madison Symmetric Torus \(MST\) Group](#)

- Achieved first measurement of fast-ion pressure in an RFP through experimental concept development, prototyping, model validation, testing, and analysis of 72GB of experimental data

- Created custom 2D linear regression algorithm with chi-squared statistical analysis to improve agreement between Abel inverted data and modeled plasma pressure
- Coded Monte Carlo model to generate knowledge of neutron energy spectrum to assess product performance, validated against industry standard neutron model with confidence interval testing
- Developed fast-ion orbit model from first principles to give phase-space information to MST diagnostics, validated with existing experimental data, integrated into MST standard software
- Identified opportunity to improve data mining in MST group and developed a visualization program to search and intuitively display data from MST's 9 TB database, increasing scientist efficiency

May
2012

Research/Teaching Assistant

UW Madison, ECE & Columbia University, Applied Physics

- Developed optical lens with reversed chromatic aberration through full EM wave phase/attenuation modeling, using least-squares regression optimization and reduced chi-squared statistic
- Developed a team of researchers at Columbia University to move research into lab testing
- Led physics discussion and laboratory sessions, managing three classes of 24 students

Sept
2009

Team Leader/Infantryman

MN Army National Guard

- Led infantry team on 30+ missions on deployment in support of Operation Iraqi Freedom
- Decorated Bronze Star for service for effectively reducing hostile action in high conflict area of Iraq
- Awarded Army Commendation Medal for aid rendered to foreign military on deployment to Kosovo



SKILLS

- | | |
|------------------------|----------------------|
| Data Analysis | • Modeling |
| Python/SQL/VBA | • Team Management |
| Diagnostic Development | • Data Visualization |
| Problem Solving | • Statistics |
| Science Communication | • CAD Design |



HOBBIES

- | | |
|-----------------------------|------------------|
| Ultramarathons | • Triathlons |
| Backpacking/Hiking | • Rock Climbing |
| Road Cycling | • Canoe Building |
| Invasive Species Management | • Trail Building |



PRESENTATIONS & PUBLICATIONS



S. Banerjee, W. Capecchi, et al. "Investigating the role of edge neutrals in exciting tearing mode activity and achieving flat temperature profiles in LTX-B" Nucl. Fusion **64**, 046026 (2024).

W. Capecchi, et al. "A tensioned 2D wire calorimeter for neutral beam profile measurements on LTX-B" [poster] Proceedings of the 25th Topical Conference on High Temperature Plasma Diagnostics. Asheville, NC (2024).

W. Capecchi, et al. "Improved neutral beam injection and diagnostics on LTX-B" [poster] Proceedings of the 66th Annual Meeting of the APS Division of Plasma Physics Conference. Atlanta, GA (2024).

A Maan, W. Capecchi, et al. "Estimates of global recycling coefficients for LTX-B discharges" Phys. Plasmas **31**, 022505 (2024).

W. Capecchi, et al. "Status of neutral beam and supporting diagnostics on LTX-B" [poster] Proceedings of the 65th Annual Meeting of the APS Division of Plasma Physics Conference. Denver, CO (2023).

A. Maan, W. Capecchi, et al. "Improved neutral and plasma density control with increasing lithium wall coatings in the Lithium Tokamak Experiment-B (LTX-B)" Nuclear Materials and Energy **35**, 101408 (2023).

D.P. Boyle, W. Capecchi, et al. "Extending the low-recycling, flat temperature profile regime in the lithium tokamak experiment-B (LTX-B) with ohmic and neutral beam heating" Nucl. Fusion **63**, 056020 (2023).

W. Capecchi, et al. "Neutral beam heating of flat-temperature profile plasmas in LTX-B" [poster] Proceedings of the 64th Annual Meeting of the APS Division of Plasma Physics Conference. Spokane, WA (2022).

W. Capecchi, et al. "Neutral beam prompt loss in LTX-B" Nucl. Fusion **61**, 126014 (2021).

- W. Capecchi, et al. *“Neutral beam prompt loss in LTX- β ”* [poster] Proceedings of the 63rd Annual Meeting of the APS Division of Plasma Physics Conference. Pittsburgh, PA (2021).
- P.E. Hughes, W. Capecchi, et al. *“Toroidal plasma acceleration due to NBI fast ion losses in LTX- β ”* Plasma Phys. Control. Fusion **63**, 085020 (2021).
- W. Capecchi, et al. *“Optimized beam fueling in LTX- β ”* [poster] Proceedings of the 62nd Annual Meeting of the APS Division of Plasma Physics Conference. [Remote] (2020).
- W. Capecchi, et al. *“A Measure of Fast Ion Beta at Marginal Stability in the Reversed Field Pinch”* Nuclear Fusion **59**, 086026 (2019).
- W. Capecchi, et al. *“A neutral particle analyzer for fast ion physics studies in LTX- β ”* [poster] Proceedings of the 61st Annual Meeting of the APS Division of Plasma Physics Conference. Ft. Lauderdale, FL (2019).
- W. Capecchi, et al. *“A collimated neutron detector for RFP plasmas in MST”* Rev Sci Instrum **87**, 11D826 (2016).
- J.K. Anderson, W. Capecchi, et al. *“Dynamics of a reconnection-driven runaway ion tail in a reversed field pinch plasma”* Phys. Plasmas **23**, 055702 (2016).
- J. Kim, W. Capecchi, et al. *“Analysis techniques for diagnosing runaway ion distributions in the reversed field pinch”* Rev Sci Instrum **87** 11D819 (2016).
- P. J. Bonfiglio, W. Capecchi, et al. *“Development Toward a Fast Ion Loss Detector for the Reversed Field Pinch”* Rev. Sci. Instrum. **87**, 11D824 (2016).
- W. Capecchi, et al. *“Fast ion beta limit measurements by collimated neutron detection in MST”* [poster] Proceedings of the 57th Annual Meeting of the APS Division of Plasma Physics Conference. Savannah, GA (2015).
- J.K. Anderson, W. Capecchi, et al. *“Fast ion confinement in the three-dimensional helical reversed-field pinch”* Plasma Physics and Controlled Fusion **56** (9) 094006 (2014).
- L. Lin, W. Capecchi, et al. *“Energetic-particle-driven instabilities and induced fast-ion transport in the RFP”* Physics of Plasmas **21**, 056104 (2014).
- B.E. Chapman, W. Capecchi, et al. *“Micro- and Macro-Instability, and Large Density and β in Improved Confinement MST RFP Plasmas”* Proceedings of the 25th IAEA Fusion Energy Conference. St. Petersburg, Russia (2014).
- W. Capecchi, et al. *“Investigation of the fast ion beta limit in MST”* [poster] Proceedings of the 55th Annual Meeting of the APS Division of Plasma Physics Conference. Denver, CO (2013).
- K.C. Hammond, W. Capecchi, et al. *“Metamaterial lens of specifiable frequency-dependent focus and adjustable aperture for electron cyclotron emission in the DIII-D tokamak”* Journal of Infrared, Millimeter, and Terahertz Waves **34**, 437–455 (2013).
- W. Capecchi, et al. *“Reverse chromatic aberration and its numerical optimization in a metamaterial lens”* Optics Express **20** (8) pp. 8761-8769 (2012).
- W. Capecchi, et al. *“Multi-frequency reflectometer for edge density profile and fluctuation measurement on MST”* [poster] Proceedings of the 54th Annual Meeting of the APS Division of Plasma Physics Conference. Providence, RI (2012).
- W. Capecchi, T.Q. Sibley, *“When the trivial is nontrivial”* Pi Mu Epsilon Journal **13** (6) pp. 333-336