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Education

Sc.D. (EE) 1983, Massachusetts Institute of Technology
M.S. (EE) 1979, Massachusetts Institute of Technology
B.S. (EE) 1978, Massachusetts Institute of Technology

Experience

Professor, Applied Physics, Columbia University, 1995 to present
Chairman, Dept. of Applied Physics and Applied Mathematics, 2000 to 2006
Visiting Scientist, Massachusetts Institute of Technology, 1999 to 2018
Visiting Scientist, General Atomics, San, Diego, July 1994 – December 1994
Associate Professor, Dept. of Applied Physics, Columbia University, July 1990 – July 1995
Assistant Professor, Dept. of Applied Physics, Columbia University, August 1985 – July 1990
Instructor, Dept. of Electrical Engineering, M. I. T., February 1984 – June 1984
Research Scientist, Plasma Fusion Center, M. I. T., October 1982 – July 1985

Honors and Awards

Leadership Award, Fusion Power Associates, 2020
Associate of the U.S. National Academies, 2020
Jefferson Science Fellow, National Academies, U.S. Dept. of State, 2006-2007
Certificate of Appreciation, U.S. Dept. of State, 2007
Rose Award for Excellence in Fusion Engineering, Fusion Power Associates, 2000
Fellow, American Physical Society, 1995
Teacher of the Year, 1994, elected by Columbia's School of Engineering Undergraduates
Certificate of Appreciation, U.S. Dept. of Energy, 1989
I.E.E.E. Fortesque Fellowship (1978 – 1979)
Guillemín Prize for undergraduate thesis in Electrical Engineering

University Service

Chair, FFSEAS Faculty Governance Committee, 2011 to 2013
Chairman, Dept. Applied Physics and Applied Mathematics, Columbia University, 2000-2006
Member, FFSEAS Board of Visitors, 2009 to 2013
Member, Faculty Task Force on CVN and Online Education, 2013 to 2014
Member, FFSEAS Strategic Planning Committee, 2010 to 2012
Member, Executive Committee, Graduate School Arts and Sciences, 2007 to 2011
Member, Provost's Tenure Advisory Committee, 2007 to 2011
Member, Science and Technology Policy Committee, 2007 to 2010
Member, Faculty Advisory Committee for NWC Building, 2007 to 2010

Chairman, Visiting Committee, University of Maryland, IREAP, 2010
 Visiting Committee, MIT Department of Nuclear Engineering, 2001-04
 Faculty Advisor, Tau Beta Pi, Columbia University Chapter, 1989-1999
 President, University Fusion Association, 1997-1998,
 Secretary/Treasurer, 1992 – 1996; Executive Committee, 1992-94, 2014-present
 Chairman, Selection Committee, National Fusion Energy Undergraduate Fellows, 1994-95, 1997
 Selection Committee, Presidential Faculty Teaching Award, 1995
 Selection Committee, Presidential Graduate Student Teaching Award, 1996, 1997 (Chair)
 Elected University Senator, 1986-88, 1995-98
 Member, School of Engineering, Strategic Planning Committee, 1992 to 1993.
 Member, School of Engineering Dean of Students Search Committee, 1991 to 1992.

Professional Society Service

Chair, APS Rosenbluth Dissertation Award Selection Committee, 2014; Vice-Chair, 2013
 Chair, APS Excellence in Plasma Physics Award Selection Committee, 2011; Vice-Chair 2010
 American Physical Society-DPP Program Committee, 2011, 2003, 2002 (Chair), 2001, 1997, 1990
 Member, Fellowship Committee, American Physical Society, 2006 to 2009
 Member, 50th Anniversary Program Committee for APS-DPP, 2007-2008
 Chair, APS James Maxwell Prize Selection Committee, 2007; Vice-Chair, 2006
 Chair, Division of Plasma Physics, American Physical Society, 2002-03
 Chair-Elect, Vice-Chair, Division of Plasma Physics, American Physical Society, 2001-02
 Chair, American Physical Society-DPP Fellowship Committee, 2001; Member, 1997, 2005-2007
 Member, Program Committee, European Physical Society Meeting, 2003
 Member, Executive Committee of the Div. of Plasma Physics of APS, 1989 - 1990

National and International Professional Experience

Co-Chair, NAS Committee “A Strategic Plan for U.S. Burning Plasma Research”, 2017-2019
 Member, NAS, Intelligence Science and Technology Expert Group (ISTEG), 2015-present
 Editor-in-Chief, *Physics of Plasmas*, 2016-present
 Associate Editor, *Physics of Plasmas*, 2003-2015
 Associate Editor, *Journal of Fusion Energy*, 2014-2015
 Guest Editor, *Special Issue: Strategic Opportunities in Fusion Energy, JOFE*, 2014-2015
 Guest Editor, *Special Issue: Mixing in Fusion Plasmas, Physica Scripta*, 2014.
 Associate Editor, *Physical Review Letters*, 1995-1998
 Chair, Plasma Science Committee, National Research Council; Member from 2007-2010, 2010-2012
 (Vice-Chair), 2012-2014 (Chair)
 Chair, U.S. Burning Plasma Council, 2010-2013; Member from 2009-2013
 Member, Natural Sciences and Engineering Research Council of Canada (NSERC), Physics
 Evaluation Group, 2012-2015
 Member NSF Basic Plasma Physics Selection Panel, 2003, 2005, 2021
 Plasma Physics Advisory Committees,
 PPPL NSTX 2004-Present; Chair 2007 to 2011
 MIT C-Mod 1999-2003, Chair 2002-03;
 HIF-VNL 2002-2007;
 VLT 1998-2001; DIII-D 1996-1998; PBX-M 1995-1996.
 Chair, U.S. ITER Forum, U. Maryland, May, 2003
 Co-Chair, 1999 Fusion Summer Study, Snowmass, CO, July 1999.

Member, US DOE FESAC Advisory Committees:

Fusion Major Facilities, 2012-2013
Fusion Priorities, 2003-2004; 2012-2013
Pathway to DEMO, 2007
Committee of Visitors, 2003, 2004;
Integrated Program Planning, 1999-2001;
Fusion Program and Balance Panel, 1999;
Fusion Materials Committee, 1997-1998;
FEAC Alternative Concepts Committee, 1996;
FEAC Strategic Planning Committee, 1995-96.

Member, DOE Fusion Science Center Selection Panel, 2004

Member, NSF Physics Frontiers Selection Panel, 2001, 2002

Member, U. S. Dept. of Energy, I.A.E.A. Paper Selection Review Panel, 1994, 1990.

Member, Program Committee, 2nd International Workshop on Interrelationship Between Plasma Experiments in Laboratory and Space, 1993

Member, Innovations in Tokamak Improvements and New Fusion Confinement Systems Evaluation Committee, U.S. Dept. of Energy, 1993

Consultant, Fusion Systems, Inc., Maryland, 1991

Member, Executive Committee of the Div. of Plasma Physics of APS, 1989 - 1990

Member, U. S. Dept. of Energy, TFTR D-T Fusion Review Panel, 1990

Member, NSF, Small Business Innovative Research Program Selection Committee, 1990

Consultant, NSF, Selection of Presidential Young Investigator Awards, 1989

Chairman, U. S. Dept. Energy, CDX-U Review Panel, 1989

Consultant, U. S. Congressional O. T. A., Fusion Energy Review Panel, November 1986

Consultant, Plasma Fusion Center, M. I. T., August 1985 – December 1986

Peer-Reviewed Publications

“Tangential extreme ultraviolet and soft x-ray diagnostic system for time-resolved temperature measurement on the HBT-EP tokamak,” Boting Li, J P Levesque, Yumou Wei, A R Saperstein, R N Chandra, G A Navratil, M E Mauel, and Christopher Hansen, submitted to *Rev Sci Instruments* (2023)

“MHD Mode Tracking Using High-Speed Cameras and Deep Learning,” Y Wei, J P Levesque, C Hansen, M E Mauel, G A Navratil, submitted to *PPCF*, (2023).

“Disruption halo current rotation scaling on Alcator C-Mod and HBT-EP”, A. R. Saperstein, R. A. Tinguely, R. S. Granetz, J. P. Levesque, M. E. Mauel, and G. A. Navratil, *Physics of Plasmas* **30**, 042506 (2023)

“An optical-input Maximum Likelihood Estimation feedback system demonstrated on tokamak horizontal equilibrium control,” Rian Chandra, Jeffrey Levesque, Yumou Wei, Boting Li, Alex Saperstein, Ian Stewart, Christopher Hansen, Michael Mauel, Gerald Navratil, *Fusion Engineering and Design* **191**, (2023), 113565

“Halo current rotation scaling in post-disruption plasmas,” A.R. Saperstein, J.P. Levesque, M.E. Mauel, and G.A. Navratil, *Nucl. Fusion* **62** 026044 (2022).

“A dimensionality reduction algorithm for mapping tokamak operational regimes using a variational autoencoder (VAE) neural network,” Y. Wei, J.P. Levesque, C.J. Hansen, M.E. Mauel and G.A. Navratil, *Nucl. Fusion* **61** 126063 (2021).

“Self-organized confinement in whole-device modeling of laboratory magnetospheres,” Bo Li, Lipeng Wang, Weike Ou, Zhenyu Zhou, Zhuoyi Li, Barrett N. Rogers, and M. E. Mauel, *Phys Plasmas* **28**, 102301 (2021).

“Suppression of MHD modes with active phase-control of probe-injected currents,” John Brooks, James Bialek, Jeffrey P. Levesque, Michael E. Mauel, Gerald A. Navratil, Alex Saperstein, and Ian G. Stewart, *Nuclear Fusion*, **61**, 096017, 2021.

“Suppression of ITG turbulence due to spectral shift during biasing induced H-mode on HBT-EP,” I.G. Stewart, J.W. Brooks, J.P. Levesque, M.E. Mauel, and G.A. Navratil, *Physics of Plasmas*, **28**, 052506, 2021.

“Observation of weakly damped modes using high resolution measurement of turbulence in a dipole confined plasma,” Qian, T. M.; Mauel, M. E., *Phys Plasmas*, **27**, 014501, (2020).

“Mode rotation control in a tokamak with a feedback-driven biased electrode,” Brooks, JW; Stewart, IG; Boyer, MD; Levesque, JP; Mauel, ME; Navratil, GA, *Rev. Sci. Instruments*, **90**(2), 023503, (2019).

“Shaping effects on toroidal magnetohydrodynamic modes in the presence of plasma and wall resistivity,” Dov J. Rhodes, A. J. Cole, D. P. Brennan, J. M. Finn, M. Li, R. Fitzpatrick, M. E. Mauel, and G. A. Navratil, *Phys Plasmas*, **25**, 012517 (2018).

“Measurement of scrape-off-layer current dynamics during MHD activity and disruptions in HBT-EP,” J.P. Levesque, J.W. Brooks, M.C. Abler, J. Bialek, P.J. Byrne, C.J. Hansen, P.E. Hughes, M.E. Mauel, G.A. Navratil, D.J. Rhodes, *Nuc. Fusion*, **57**, 086035 (2017).

“Turbulent fluctuations during pellet injection into a dipole confined plasma torus,” D. T. Garnier, M. E. Mauel, T. M. Roberts, J. Kesner, P. P. Woskov, *Physics of Plasmas* **24**, 012506 (2017).

“Improved feedback control of wall stabilized kink modes with different plasma-wall couplings and mode rotation,” Peng, Q, Levesque, JP, Stoafer, CC, Bialek, J, Byrne, P, Hughes, PE, Mauel, ME, Navratil, GA, Rhodes, DJ, *Plasma Physics and Controlled Fusion*, **58**(4), 045001 (2016).

“Preface to the Special Issue: Strategic Opportunities for Fusion Energy,” Mauel, ME, Greenwald, M, Ryutov, D, Zarnstorff, M, *J. Fusion Energy*, **35**(1), 1 (2016).

“Imaging free-falling particles for multipoint measurement of plasma fluctuations,” Roberts, TM, Mauel, ME, Abler, MC, Makansi, BK, *Rev. Scientific Instr.*, **86**(8) 083510 (2015).

“Design and Installation of a Ferromagnetic Wall in Tokamak Geometry,” Paul Hughes, Jeffrey Levesque, Nicholas Rivera, Michael Mauel, and Gerald Navratil, *Rev. Sci. Instr.* **86**, 103504 (2015)

“Local Regulation of Interchange Turbulence in a Dipole-Confined Plasma Torus using Current-Collection Feedback,” T. M. Roberts, M. E. Mauel, and M. W. Worstell, *Physics of Plasmas*, **22** 055702 (2015).

“Active and passive kink mode studies in a tokamak with a movable ferromagnetic wall,” J.P. Levesque, P.E. Hughes, J. Bialek, P.J. Byrne, M.E. Mauel, G.A. Navratil, Q. Peng, D.J. Rhodes and C.C. Stoafer, *Phys. of Plasmas*, **22** 056102 (2015).

“High-Speed Imaging of the Plasma Response to Resonant Magnetic Perturbations in HBT-EP,” Sarah M. Angelini, Jeffrey P. Levesque, Michael E. Mauel, Gerald A. Navratil, *Rev. Sci. Instr.*, **57**, 045008, (2015)

“Pressure profiles of plasmas confined in the field of a magnetic dipole”, M.S. Davis, M.E. Mauel, D.T. Garnier, and J. Kesner, *Plasma Physics and Control Fusion*, **56**(9), 095021, (2014).

“Fast, Multi-Channel Real-Time Processing of Signals with Microsecond Latency using GPU Computing”, N. Rath, S. Kato, J.P. Levesque, M.E. Mauel, G.A. Navratil, and Q. Peng, *Rev. Sci. Instruments*, **85**(4) 045114 (2014).

“Measurement of 3D plasma response to external magnetic perturbations in the presence of a rotating external kink,” D Shiraki, Sarah Angelini, J. Bialek, P J Byrne, B DeBono, P. Hughes, J P Levesque, M E Mauel, N Rath, G A Navratil, Q. Peng, D. Rhodes, and C. Stoafer, *Physics of Plasmas* **20** (10), 102503 (2013).

“Adaptive Control of Rotating Magnetic Perturbations in HBT-EP using GPU Processing,” N Rath, S. Angelini, J. Bialek, P J Byrne, B DeBono, J P Levesque, M E Mauel, G A Navratil, Q. Peng, D. Rhodes, and C. Stoafer, *Plasma Phys and Controlled Fusion* **55** (8), 084003 (2013).

“Adaptive feedback control of rotating external kink modes in HBT-EP”, N Rath, S. Angelini, J. Bialek, P J Byrne, B DeBono, J P Levesque, M E Mauel, G A Navratil, Q. Peng, D. Rhodes, and C. Stoafer, *Nuclear Fusion* **53** (7), 073052 (2013).

“Multimode observations and 3D magnetic control of the boundary of a tokamak plasma,” J P Levesque, N Rath, D Shiraki, Sarah Angelini, J. Bialek, P J Byrne, B DeBono, P. Hughes, M E Mauel, G A Navratil, Q. Peng, D. Rhodes, and C. Stoafer, *Nuclear Fusion* **53** (7), 073037 (2013).

“In-Situ ‘Artificial Plasma’ Calibration of Tokamak Magnetic Sensors,” D Shiraki, J P Levesque, J. Bialek, P J Byrne, B DeBono, M E Mauel, D. Maurer, G A Navratil, T.S. Pedersen, and N. Rath, *Rev Scientific Instruments*, **84** (6) 063502 (2013).

“High-speed, multi-input, multi-output control using GPU processing in the HBT-EP tokamak,” N Rath, J. Bialek, P J Byrne, B DeBono, J P Levesque, M E Mauel, D A Maurer, G A Navratil, and D Shiraki, *Fus. Engineering and Design*, **87** 1895 (2012).

“High resolution detection and excitation of resonant magnetic perturbations in a wall-stabilized tokamak,” D A Maurer, D Shiraki, J P Levesque, J. Bialek, Sarah Angelini, P J Byrne, B DeBono, P. Hughes, M E Mauel, G A Navratil, Q. Peng, D. Rhodes, N Rath, and C. Stoafer, *Phys. Plasmas*, **19**, 056123 (2012).

“Fluctuation Driven Transport and Stationary Profiles,” J. Kesner, D.T. Garnier, and M.E. Mauel, *Phys. of Plasmas*, **18**, 050703 (2011).

“The high beta tokamak-extended pulse magnetohydrodynamic mode control research program,” D A Maurer, J Bialek, P J Byrne, B De Bono, J P Levesque, B Q Li, M E Mauel, G A Navratil, T S Pedersen, N Rath and D Shiraki, *Plasma Physics and Contr. Fusion*, **53**, 074016 (2011).

“A high-power spatial filter for Thomson scattering stray light reduction,” J. P. Levesque, K. D. Litzner, M. E. Mauel, D. A. Maurer, G. A. Navratil, and T. S. Pedersen, *Rev. Sci. Instr.*, **82**, 033501 (2011).

“Transport Induced by Large Scale Convective Structures in a Dipole-Confined Plasma,” Grierson, B.A.; Mauel, M.E.; Worstell, M.W.; Klassen, M., *Physical Review Letters*, **105**, 205004 (2010).

“Stationary density profiles in the levitated dipole experiment: toward fusion without tritium fuel,” Kesner, J.; Davis, M.S.; Ellsworth, J.L.; Garnier, D.T.; Kahn, J.; Mauel, M.E.; Michael, P.; Wilson, B.; Woskov, P.P., *Plasma Physics and Controlled Fusion*, **52**, 124036 (2010).

“Millimeter-wave radiometer diagnostics of harmonic electron cyclotron emission in the Levitated Dipole Experiment,” Woskov, P.P.; Kesner, J.; Garnier, D.T.; Mauel, M.E., *Review of Scientific Instruments*, **81**, 10D910 (2010).

“28 GHz Gyrotron ECRH on LDX”, P. P. Woskov, J. Kesner, P. C. Michael, D. T. Garnier, and M. E. Mauel, *Journal of Fusion Energy*, **29**, 588-591 (2010).

“Turbulent inward pinch of plasma confined by a levitated dipole magnet”, Boxer, A. C. Bergmann, R. Ellsworth, J. L. Garnier, D. T. Kesner, J., Mauel, M. E. Woskov, P., *Nature-Physics*, **6**, pp. 207-212 (2010).

“Observations and modeling of the electron cyclotron emission background in the Levitated Dipole Experiment,” Woskov, P.P.; Kesner, J.; Garnier, D.T.; Mauel, M.E.; Nogami, S.H. *Journal of Physics: Conference Series*, **227**, 012021 (2010).

“137 and 165 GHz radiometer measurements of hot electrons in LDX”, Garnier, D.T., Kesner, J.; Mauel, M.E.; Woskov, P., *IEEE 36th International Conference on Plasma Science (ICOPS)*, (2009).

“A Kalman filter for feedback control of rotating external kink instabilities in the presence of noise”. J. M. Hanson, B. De Bono, J. Levesque, M. E. Mauel, A. Maurer, G. A. Navratil, T. S. Pedersen, D, Shiraki, R. James, *Phys Plasmas* **16** (2009).

“Global and local characterization of turbulent and chaotic structures in a dipole-confined plasma.” B. A. Grierson, M. W. Worstell, and M. E. Mauel, *Phys Plasmas* **16** (2009) 055902.

“Confinement Improvement with Magnetic Levitation of Superconducting Dipole,” D. T. Garnier, A.C. Boxer, J.L. Ellsworth, J. Kesner, and M. E. Mauel, *Nuclear Fusion*, **49** (2009) 055023.

“Multichannel microwave interferometer for the levitated dipole experiment,” Boxer A, Garnier D, Mauel M, *Rev Sci Instrum*, **80** (2009) 043502.

“A digital control system for external magnetohydrodynamic modes in tokamak plasmas. J. M. Hanson, A. Klien, M. E. Mauel, A. Maurer, G. A. Navratil, T. S. Pedersen, *Rev Sci Instrum* **80** (2009) 043503.

“Feedback suppression of rotating external kink instabilities in the presence of noise.” Hanson J, De Bono B, James R, Levesque J, Mauel M, Maurer D, Navratil G, Pedersen T, Shiraki D, *Phys Plasmas* **15** (2008) 080704

“Control of External Kink Modes Near the Ideal Wall Limit Using Kalman Filtering and Optimal Control Techniques,” D. A. Maurer, J. Bialek, A. H. Boozer, B. Debono, J. M. Hanson, R. James, J. P. Levesque, O. Katsuro-Hopkins, M. E. Mauel, G. A. Navratil, T. S. Pedersen and D. Shiarki, 22nd IAEA Conference of Plasma Physics and Controlled Nuclear Fusion, (2008).

“Experiments and Modeling of External Kink Mode Control Using Modular Internal Feedback Coils,” T. Sunn Pederson, D. A. Maurer, J. Bialek, O. Katsuro-Hopkins, J. Hansen, M. E. Mauel, R. James, A. Klien, Y. Liu, and G. A. Navratil, *Nuclear Fusion* **47** (2007) 1293.

“Density profiles in the levitated dipole experiment,” Boxer, A.C., Garnier, D.T.; Ellsworth, J.L.; Kesner, J.; Mauel, M.E., *Journal of Fusion Energy*, **27**, p 11-15, (2008)

“Stabilization of Low Frequency Instability in a Dipole Plasma,” D. T. Garnier, A. K. Hansen, M. E. Mauel, E. E. Ortiz, A. C. Bozer, J. L. Ellsworth, I. Karim, and J. Kesner, *J. Plasma Phys*, **74** (2008) 737.

“Equilibrium Reconstruction of Anisotropic Pressure Profile in the Levitated Dipole Experiment,” I. Karin, M. Mauel, J. Ellsworth, A. Boxer, D. Garnier, A. Hansen, J. Kesner, E. Ortiz, *J. Fusion Energy*, **26** (2007) 99.

“Effects of the Hot Electron Interchange Instability on a Plasma Confined in a Dipolar Magnetic Field,” E. Ortiz, A. Boxer, J. Ellsworth, D. Garnier, A. Hansen, J. Kesner, M. Mauel, *J. Fusion Energy*, **26** (2007) 139.

“Varying Electron Cyclotron Resonance Heating on the Levitated Dipole Experiment,” A. Hansen, A. Boxer, J. Ellsworth, D. Garnier, J. Kesner, M. Mauel, E. Ortiz, *J. Fusion Energy*, **26** (2007) 57.

“Quench detection for the levitated dipole experiment (LDX) charging coil,” P. C. Michael and D. T. Garnier and A. Radovsky and I. Rodin and V. Ivkin and M. E. Mauel and V. Korsunsky and S. Egorov and A. Zhukovsky and J. Kesner, *IEEE Trans. Appl. Supercond.* **17** (2007) 2482.

“Design and initial operation of the LDX facility,” Garnier, D.T., Hansen, A.K.; Kesner, J.; Mauel, M.E.; Michael, P.C.; Minervini, J.V.; Radovsky, A.; Zhukovsky, A.; Boxer, A.; Ellsworth, J.L.; Karim, I.; Ortiz, E.E. *Fusion Engineering and Design*, **81**, (2006), p 2371-2380

“Production and Study of High-Beta Plasma Confined by a Superconducting Dipole Magnet,” Garnier, A. Hansen, M. Mauel, E. Ortiz, A. Boxer, I. Karin, J. Kesner, S. Mahar, A. Roach, *Physics of Plasmas*, **13** (2006) 056111.

“First integrated test of the superconducting magnet systems for the Levitated Dipole Experiment (LDX),” Zhukovsky, A., Michael, P.C.; Schultz, J.H.; Smith, B.A.; Minervini, J.V.; Kesner, J.; Radovsky, A.; Garnier, D.; Mauel, M. *Fusion Engineering and Design*, **75-79**, (2005), p 29-32

“Suppression of rotating external kink instabilities using optimized mode control feedback,” A. Klein, D. Maurer, T. Pedersen, M. Mauel, G. A. Navratil, C. Cates, M. Shilov, Y. Liu, N. Stillits and J. Bialek, *Phys. Plasmas*, **12** (2005), 40703.

“Excitation of Centrifugally Driven Interchange Instabilities in a Plasma Confined by a Magnetic Dipole,” B. Levitt, D. Maslovsky, M. Mauel, J. Waksman, *Phys. Plasmas*, **12**, (2005), 55703.

“Observation of Centrifugally Driven Interchange Instabilities in a Plasma Confined by a Magnetic Dipole,” B. Levitt, D. Maslovsky, M. Mauel, *Phys. Rev. Lett.* , **94**, (2005), 175002.

“Dynamics and control of resistive wall modes with magnetic feedback control coils: experiment and theory,” M.E. Mauel, J. Bialek, A.H. Boozer, C. Cates, R. James, O. Katsuro-Hopkins, A. Klein, Y. Liu, D.A. Maurer, D. Maslovsky, G.A. Navratil, T.S. Pedersen, M. Shilov and N. Stillits, *Nuc. Fusion*, **45** (2005) 285.

“Magnetic field perturbations in closed-field-line systems with zero toroidal magnetic field,” D. Ryutov, J. Kesner, M. Mauel, *Phys. Plasmas* **11**, (2004) 2318.

“Dynamical plasma response of resistive wall modes to changing external magnetic perturbations,” M. Shilov, C. Cates, R. James, A. Klein, O. Katsuro-Hopkins, Y. Liu, M. Mauel, D. Maurer, G. A. Navratil, T. Pedersen, and N. Stillits, *Phys. Plasmas* **11**, (2004) 2573.

“Helium Catalyzed D-D Fusion in a Levitated Dipole,” J. Kesner, D. Garnier, A. Hansen, M. Mauel, L. Bromberg, *Nuc. Fusion* **44**, 193 (2004).

“High-speed optical diagnostic that uses interference filters to measure Doppler shifts,” S. Paul, C. Cates, M. Mauel, D. Maurer, G. A. Navratil, R. Paul, T. Pedersen, and M. Shilov, *Rev. Sci. Instr.* **75** (2004) 4077.

“Observation of nonlinear frequency-sweeping suppression with RF diffusion,” D. Maslovsky, B. Levitt, M. E. Mauel, *Phys. Rev. Lett.* **90**, 185001-1 (2003).

“Suppression of nonlinear frequency sweeping of resonant interchange modes in a magnetic dipole with applied radio frequency fields,” D. Maslovsky, B. Levitt, M. E. Mauel, *Phys. Plasmas* **10**, 1549-1555 (2003).

“Measurement of the Global Structure of Interchange Modes Driven by Energetic Electrons Trapped in a Magnetic Dipole,” B. Levitt, D. Maslovsky, M. E. Mauel, *Phys. Plasmas*, **9**, 2507-2517 (2002).

“Advanced technology paths to global climate stability: Energy for a greenhouse planet,” Hoffert, M.I., Caldeira, K., Benford, G., Criswell, D.R., Green, C., Herzog, H., Jain, A.K., Khesghi, H.S., Lackner, K.S., Lewis, J.S., Lightfoot, H.D., Manheimer, W., Mankins, J.C., Mauel, M.E., Perkins, L.J., Schlesinger, M.E., Volk, T., Wigley, T.M.L., *Science*, pp. 981-987, **298** (2002)

“Numerical Simulation of Phase-Space Flows in the Collisionless Terrella Experiment,” D. Maslovsky, M. Mauel, B. Levitt, *IEEE Trans. Plasma Science* **30** pp. 8-9 (2002).

“Effect of Magnetic Islands on the Local Plasma Behavior in the HBT-EP Tokamak,” E. D. Taylor, C. Cates, M. E. Mauel, D. A. Maurer, D. Nadle, G. A. Navratil, M. Shilov, *Phys. Plasmas* **9**, 3938 (2002).

“Status of the floating coil of the levitated dipole experiment,” Zhukovsky, A., Garnier, D., Gung, C., Kesner, J., Mauel, M., Michael, P., Minervini, J., Morgan, M., Pedersen, T.S., Radovinsky, A., Schultz, J., *IEEE Transactions On Applied Superconductivity*, p. 666-669 **4** (2002).

“Design, fabrication and test of the react and wind, Nb₃Sn, LDX floating coil,” Smith, B.A.; Schultz, J.H.; Zhukovsky, A.; Radovinsky, A.; Gung, C.; Michael, P.C.; Minervini, J.V.; Kesner, J.; Garnier, D.; Mauel, M.; Naumovich, G.; Kocher, R., *IEEE Trans. Applied Superconductivity* **11**(2001) 2010.

“High temperature superconducting levitation coil for the Levitated Dipole Experiment (LDX),” Schultz, J.H.; Driscoll, G.; Garnier, D.; Kesner, J.; Mauel, M.; Minervini, J.V.; Smith, B.; Radovinsky, A.; Snitchler, G.; Zhukovsky, A., *IEEE Trans. Applied Superconductivity* **11** (2001) 2004.

“Modeling of active control of external magnetohydrodynamic instabilities,” J. Bialek, A. Boozer, M. E. Mauel, G. A. Navratil, *Phys. Plasmas* **8** (2001) 2170.

“Real-time measurement of toroidal rotation,” Paul, S.F., Cates, C., Mauel, M., Maurer, D., Navratil, G., Shilov, M., *Review of Scientific Instruments* **72** (2001) 966.

“Dipole Equilibrium And Stability,” Kesner, J. and Simakov, A.N. and Garnier, D.T. and Catto, P.J. and Hastie, R.J. and Krasheninnikov, S.I. and Mauel, M.E. and Sunn Pedersen, T. and Ramos, J.J., *Nuclear Fusion*, **41** (2001) pp. 301-8.

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Selected Invited Presentations and Articles

“Laboratory-Space Experiments Reveal Wave-Particle Processes in Magnetospheres,” Michael Mauel, in Radiation Belts in Space Physics (RBSP), Feb 25, 2022.

“ITER Science Contributions to a Pilot Plant,” M.E. Mauel, in U.S. DOE Fusion Energy Science, Research Needs Workshop, US ITER Workshop Kickoff Meeting, Feb 9, 2022.

“A second pathway for the future of nuclear energy.” M. E. Mauel, in United Nations Association – UK (UNA-UK). www.una.org.uk (2020), *Climate 2020*, ISBN: 978-1-9998451-5-5.

“Perspectives and Opportunities from the NAS Burning Plasma Strategy Report,” 40th Annual Meeting of the Fusion Power Associates December 3, 2019 — Washington, DC; and 19th International Conference on Fusion Reactor Materials October 30, 2019 — La Jolla, CA

“Understanding Plasmas Turbulence and Transport using the Laboratory Magnetosphere,” presented at the 10th International Nonlinear Wave and Chaos Workshop – NWCW17 March 20-24, 2017 (La Jolla, CA).

“Advancements of Basic Plasma Physics enabling Progress in Magnetic Fusion Energy,” presented at the 20th Anniversary Workshop for the NSF/DOE Partnership in Basic Plasma Science and Engineering (January 9-11, 2017).

“Exploring the Physics of the Laboratory Magnetosphere,” presentation to the Plasma Physics Division, NRL (May 11, 2016).

“Exploring the Physics of the Laboratory Magnetosphere,” presentation at SWG for the Van Allen Probes, JHU/APL (April 13-15, 2016).

“The Physics of the Laboratory Magnetosphere,” Invited Review Talk at 57th Annual Meeting of the APS Division of Plasma Physics, Savannah, GA. (November 2015)

“Exploring Plasma Dynamics with Laboratory Magnetospheres”, University of Michigan, Michigan Institute of Plasma Science and Engineering (MIPSE), Ann Arbor, MI. (Feb 2014)

“Exploring Plasma Dynamics with Laboratory Magnetospheres”, Culham Science Centre, Abingdon, Oxford, UK (Feb 2014)

“Fusion Turbulence without a Toroidal Field”, Session *Mixing in Fusion Plasma*, 55th Annual Meeting of the APS Division of Plasma Physics, Denver, CO. (Nov 2013)

“Turbulent Pinch, Laboratory Magnetospheres, and the Economic Viability of Fusion”, Princeton Plasma Physics Laboratory, Princeton University, (May 2013)

“Controlled Space Physics Experiments using Laboratory Magnetospheres”, DTRA Workshop on Physics, Modeling and Simulation of Nuclear Detonation (JOWOG 43), Washington, D.C. (June 2013)

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“Inward Turbulent Diffusion of Plasma in a Levitated Dipole,” presented at University of Wisconsin, University of New Hampshire, Princeton Plasma Physics Laboratory, 2009-2010

“Introduction to Magnetic Fusion Research,” presented to National Fusion Science Undergraduate Fellows, Princeton, 2009, 2010, 2012, 2014.

“Levitated Magnet Brings Physics of Space to the Laboratory,” 50th Anniversary Meeting of the APS Division of Plasma Physics, Dallas, 2008

“Clean Energy: Crossing the Divide,” CERA Executive Conference; East Meets West: New Frontiers of Energy Security, Istanbul, Turkey 2007

“Fusion Energy; Progress towards an Unlimited Energy Source,” U.S. Department of State, Washington, DC, 2007.

“The Levitated Dipole Experiment for Plasma Confinement,” XII Seminario Enzo Levi, Sociedad Mexicana de Fisica, 2005

“Fusion Energy in a Non CO₂ Emitting Energy Portfolio,” AAAS Annual Meeting, Washington, DC, 2005

“The Dipole Fusion Concept” and “Interchange Bubbles,” at the IPP, Griefswald, Germany, 2002.

“The Search for Optimum Confinement Configurations for Fusion Applications,” at the APS Centennial Meeting, Atlanta, GA, 1999.

“Achieving High Fusion Reactivity in High Poloidal Beta Discharges in TFTR” at the 14th International Conference on Plasma Physics and Controlled Nuclear Fusion, Würzburg, Germany, October, 1992.

Serial Journal Abstracts, and Research Reports:

Over 350 Serial Journal Abstracts, and Research Reports.

Thesis Supervision:

- 2 Undergraduate Thesis Projects (MIT)
- 12 Undergraduate Research Projects (Columbia)
- 30 Ph.D. Students Graduated (Columbia)
- 4 Ph.D. Students presently under supervision or co-supervision (Columbia)

Postdoctoral Supervision:

B. Grierson, D. Garner, A. Hansen, P. Hughes, T. Ivers, J. Levesque, D. Maurer, T. Pederson, V. Sankar, M. Shilov, H. Warren, M. Worstell

Courses taught:

Courses include “Introduction to Digital Electronics”, “Electrodynamics”, “Introduction to Computational Physics and Mathematics”, “Applied Physics Laboratory”, “Applied Classical Mechanics,” “Introduction to Plasma Physics”, “Special Topics in Applied Mathematics”, “Introduction to FORTRAN”, “Programming Methods for Scientists and Engineers”, “Introduction to Nuclear Science”, “Physics of Plasmas I”, “Physics of Plasmas II”, created the annual “Applied Physics Undergraduate Seminar”.

Short Biography

MICHAEL MAUEL builds experiments to study high-temperature ionized gas, called plasma, and explores how strong magnetic fields guide plasma motion in the space surrounding Earth, at the surfaces of stars, and inside the cores of fusion energy reactors that may someday produce cleaner, healthier, and nearly unlimited power. Plasma within these experiments have very high temperatures, more than 10 million degrees, and can become hotter than the centers of stars. Together with his students and collaborators, Mauel uses real-time systems to control how plasma mixes within the containment vessels, shapes magnetic bottles to better confine high pressure plasma, launches electromagnetic waves to generate electrons that move through the plasma at speeds near the speed of light, and identifies, images, and controls the instabilities that may destroy plasma confinement and inhibit fusion energy production.

Mauel's current research interest include nonlinear turbulent transport in magnetized plasma, energetic particle modes, the relationship between laboratory and space plasma physics, and feedback techniques to control instabilities in advanced tokamak operating regimes. He injects currents, waves, magnetic fields to reveal the processes that transform energy within the plasma, move particles across magnetic flux tubes, and generate flows.

Mauel received his B.S and Sc.D. from MIT in 1983 and joined the SEAS faculty in 1985. He a fellow for the American Physical Society and served as a Jefferson Science Fellow in the U.S. Department of State. He received the Rose Award for Excellence in Fusion Engineering, Leadership Award from the Fusion Power Associates, the Teacher of the Year award from Columbia University's School of Engineering and Applied Science, and Certificates of Appreciation from the U.S. Department of Energy and the U.S. Department of State. He served as chair of the Division of Plasma Physics of the American Physical Society, chair of the Department of Applied Physics an Applied Math at Columbia University, chair of the U.S. Burning Plasma Council, and as chair of the NRC Plasma Science Committee. He has also served as member and chair of numerous other physics and policy advisory committees addressing issues concerning fusion energy science, plasma physics research and education. Mauel co-chaired the National Academics of Sciences Committee for a Strategic Plan for U.S. Burning Plasma Research (2019) and currently serves as the Editor-in-Chief of the *Physics of Plasmas*. In 2020, Mauel was named a lifetime Associate of the U.S. National Academies.

RESEARCH INTERESTS

Controlling high-temperature matter in the laboratory, understanding the behavior of magnetized plasma to predict space weather, and achieving cost-effective fusion power for a cleaner and healthier climate.

RESEARCH AREAS

Devices, sensing, imaging, modeling, and simulation.