Exponent
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Timothy W. Chevalier, Ph.D.
Associate

Professional Profile

Dr. Timothy W. Chevalier is an Associate in Exponent's Electrical and Semiconductors practice. His area of expertise includes both theoretical and applied electromagnetics, plasma physics, numerical simulation techniques and software development. He has played a lead role in a large number of projects involving Very Low Frequency (VLF) electromagnetic wave propagation in the Earth's ionosphere and magnetosphere and VLF remote sensing. In addition, he has experience in the design, construction, and deployment of scientific instruments for operation in remote environments. The purpose of these instruments was for the acquisition of VLF signatures caused by man-made and natural sources such as lightning. Such equipment includes VLF receivers, photometric arrays and other sensitive optical equipment.

Dr. Chevalier's doctoral dissertation focused on near-field antenna-plasma interactions aboard spacecraft operating within the Earth's magnetosphere. This study characterized the nonlinear effects of the plasma on the tuning properties of these antennas. Dr. Chevalier specializes in the development of large scale simulation tools for analyzing electromagnetic wave propagation within complex media including both linear and nonlinear materials.

In addition, Dr. Chevalier has experience with Matlab, C, C++, and is familiar with both Windows and Linux operating systems.

Academic Credentials and Professional Honors

Ph.D., Electrical Engineering, Stanford University, 2008
M.S., Electrical Engineering, University of New Hampshire, 1998
B.S., Electrical Engineering, University of New Hampshire (*honors*), 1996

Young Scientist Award URSI General Assembly, Chicago, Illinois, 2008
National Science Foundation Antarctica Service Medal, Summer, 2002–2003
California Microwave Prize, 2000
TRW Fellowship, 1998
Member Tau Beta Pi Engineering Honor Society

Publications

Chevalier TW, Inan US, Bell TF. Fluid simulation of the collisionless plasma sheath surrounding an electric dipole antenna in the inner magnetosphere. Radio Sci 2010; 45:RS1010. doi:10.1029/2008RS003843.

Chevalier TW, Inan US, Bell TF. Terminal impedance and antenna current distribution of a VLF electric dipole in the inner magnetosphere. IEEE Transactions on Antennas and Propagation 2008; 56(8):2454–2468.

Payne JA, Inan US, Foust FR, Chevalier TW, Bell TF. HF modulated ionospheric currents. Geophys Res Lett 2007; 34:L23101. Epub: doi:10.1029/2007GL031724.

Chevalier TW. Near-field characteristics of electric dipole antennas in the inner magnetosphere. Doctoral Dissertation, Stanford University, 2007.

Chevalier TW, Inan US, Bell TF. Characterization of terminal impedance and radiation properties of a horizontal VLF antenna over Antarctic ice. Radio Sci 2006; 41:RS6001. Epub: doi:10.1029/2005RS003298.

Chevalier MW, Chevalier TW, Inan US. A PML utilizing k-vector information as applied to the whistler mode in a magnetized plasma. IEEE Transactions on Antennas and Propagation 2006; 54:2424–2429.

Bell T. F., Inan US, Chevalier TW, Current distribution of a VLF electric dipole antenna in the plasmasphere, Radio Sci., 41, RS2009, doi:10.1029/2005RS003260, 2006.

Chevalier TW. A computational method for computing the finite conductivity diffraction coefficient using Huygen sources. Master's Thesis, University of New Hampshire, 1998.

Presentations

Chevalier TW. Experimental validation of near-field antenna-plasma coupling. Workshop on the Remediation of Enhanced Radiation Belts, Stanford, CA, February 2009.

Chevalier TW. Linear mode coupling of whistler and lower hybrid waves. Workshop on the Remediation of Enhanced Radiation Belts, Stanford, CA, February 2009.

Chevalier TW, Inan US, Bell TF. VLF electromagnetic wave propagation over large distance using time-domain segmented long path technique. URSI General Assembly, Chicago, IL, August 2008.

Marshall RA, Inan US, Chevalier TW. Early VLF perturbations driven by lightning-EMP generated density perturbations in the ionosphere: Model results. URSI General Assembly, Chicago, IL, August 2008.

Chevalier TW. Antenna-in-plasma code development and laboratory verification. Workshop on the Remediation of Enhanced Radiation Belts, Lake Arrowhead, CA, March 2008.

Chevalier TW. Stanford VLF antenna modeling. Workshop on the Remediation of Enhanced Radiation Belts, Lake Arrowhead, CA, March 2008.

Chevalier TW, Inan US, Bell TF, Chevalier MW. Fluid model of the collisionless plasma sheath surrounding an electric dipole antenna. URSI North American Meeting, Ottawa, Canada, August 2007.

Chevalier TW, Inan US, Bell TF, Chevalier MW. Numerical simulation of electric dipole antennas in the inner magnetosphere. URSI National Meeting, Boulder, CO, January 2006.

Chevalier TW, Inan US, Bell TF. Injection of VLF waves using electric dipole antennas in the magnetosphere. URSI National Meeting, Boulder, CO, January 2004.

Chevalier TW. Controlled precipitation of radiation belt particles. GEM Workshop, Telluride, CO, June 2002.

Chevalier TW, Bell TF, Inan US, Reinisch BW. The characteristics of the long dipole antennas on IMAGE at VLF frequencies within the plasmasphere. AGU Fall Meeting San Francisco, CA, December 2000.

Prior Experience

Research Associate, Stanford University, 2007–2009
Research Assistant, Stanford University, 1999–2007
Teaching Assistant, Stanford University, 2004
Course: Fundamental Plasma Physics
Teaching Assistant, University of New Hampshire, 1998
Course: Advanced Electromagnetics
Research Assistant, University of New Hampshire, 1996–1998

Project Experience

Developed simulation tool for determination of antenna-plasma coupling behavior for antennas operating in collision-less magnetized plasma.

Developed new simulation based-methodology for determination of global coverage circles for submarine communication with VLF transmitters.

Designed, built, and deployed equipment for the photometric imaging of transient luminous events in the Earth's lower ionosphere.

Assisted in design and deployment portable VLF receiver units to study lightning induced electromagnetic interactions with underground structures.

Assisted in modifying remote geophysical observatories to run off of solar and wind power. The propane power systems in use prior to this expedition were not reliable.

Peer Reviewer

- *IEEE Transactions on Antennas and Propagation*
- *IEEE Antennas and Wireless Propagation Letters*
- *Radio Science*

Professional Affiliations

- Institute of Electrical and Electronics Engineers
- American Geophysical Union