

CURRICULUM VITAE

BRENT M. LEDVINA

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AREAS OF INTEREST

Ionospheric physics; ionospheric irregularities and scintillations; space weather; GPS/GNSS receivers; spaced-receiver systems; remote sensing; software receivers; real-time systems; estimation and filtering.

EDUCATION

Ph.D. 2003 Electrical and Computer Engineering (emphasis in Space Plasma Physics),
Cornell University.
B.S. 1999 Electrical and Computer Engineering (honors), University of Wisconsin at
Madison.

EMPLOYMENT

2005–Present: University of Texas at Austin, Applied Research Laboratories;
Postdoctoral Associate.
2003–2005: Cornell University, School of Electrical and Computer Engineering;
Postdoctoral Associate.
2002: Cornell University, School of Electrical and Computer Engineering; Lecturer;
(8/15–12/31).
1999–2003: Cornell University, School of Electrical and Computer Engineering; Graduate
Research Assistant and Teaching Assistant.
1999: Wicab, Inc., Madison, WI; Chief Software Designer (5/1–8/15).

BRIEF HISTORY OF PRINCIPAL PROFESSIONAL ACTIVITIES

Brent Ledvina's professional career began in research on electromagnetic wave propagation in the ionosphere during his undergraduate studies at UW-Madison. This led him to apply to Cornell University's graduate program to continue on in plasma physics. At Cornell, Brent began to develop two distinct research paths. The first is centered on scintillations caused by ionospheric irregularities primarily in equatorial and midlatitude regions. The second area of research is on GPS and software receivers. As a graduate student at Cornell, Brent

co-developed an efficient implementation of a 12-channel GPS L1 software receiver. This work led to two patents for the bit-wise parallel signal processing algorithms used in the software receiver. This algorithm has recently been applied to a dual-frequency GPS civilian L1/L2 software receiver. Brent is also working on new techniques to estimate ionospheric irregularity dynamics using ground-based receivers.

AWARDS

NASA Graduate Space Grant Fellowship, 2002.

PATENTS

U.S. Patent Pending, Real-Time Software Receiver, January 10, 2003.

U.S. Patent Pending, Real-Time Oversampling of PRN Codes, January 10, 2003.

CONSULTING

Boeing, St. Louis, MO.

Developed real-time software receiver system (2005–present).

Wicab, Inc., Madison, WI.

Developed and maintained software for tactile imaging research projects. Advised on scientific research directions (1999-2004).

PROFESSIONAL ACTIVITY

ION (Institute of Navigation) Professional Member, 2004–present.

AGU (American Geophysical Union) Member, 2004–present

PERSONAL

Born November 9, 1976 in Green Bay, Wisconsin.

U.S. citizen.

Avid cyclist and runner.

PUBLICATIONS

REFEREED JOURNAL ARTICLES

A.P. Cerruti, B.M. Ledvina, and P.M. Kintner, “Measurements of Equatorial Scintillations on the WAAS Satellite Signal,” **Radio Sci.**, In Review.

K. Ohshima, A. Saito, P.M. Kintner, B.M. Ledvina, K. Hoshinoo, and K. Matsunaga, “Multi-Scale Study of Ionospheric Irregularities at Mid-Latitudes Induced by Geomagnetic Storms Using GPS Observation Systems,” **J. Geophys. Res.**, In Review.

R.H. Wiens, B.M. Ledvina, P.M. Kintner, M. Afewerki, and Z. Mulugheta, “Equatorial Plasma Bubbles in the Ionosphere over Eritrea: Occurrence and Drift Speed,” **J. Geophys Res.**, In Review.

B.M. Ledvina, M.L. Psiaki, P.M. Kintner, and Eurico R. de Paula, “Ionospheric Scattering Altitude Estimation Using Closely-Spaced GPS Receivers,” **Radio Sci.**, In Review.

B.M. Ledvina and J.J. Makela, “First Observations of GPS SBAS/WAAS Scintillations:

- Using Colocated Scintillation Measurements and All-sky Images to Study Equatorial Plasma Bubbles,” **Geophys. Res. Lett.**, 32(14), 10.1029/2004GL021954, July 2005.
- P.M. Kintner and B.M. Ledvina, “The Ionosphere, Radio Navigation, and Global Navigation Satellite Systems,” **Advances in Space Research**, 35, 2005
- P.M. Kintner, B.M. Ledvina, and E.R. de Paula, “An Amplitude Scintillation Test Pattern Standard for Evaluating GPS Receiver Performance,” **Space Weather**, 3, doi:10.1029/2003SW000025, March 2005.
- B.M. Ledvina, P.M. Kintner, and E.R. de Paula, “Understanding Spaced-Receiver Zonal Velocity Estimation,” **J. Geophys. Res.**, 109(A10), doi:10.1029/2004JA010489, October 2004.
- B.M. Ledvina, M.L. Psiaki, S.P. Powell, and P.M. Kintner, “Bit-Wise Parallel Algorithms for Efficient Software Correlation Applied to a GPS Software Receiver,” **IEEE Transactions on Wireless Communications**, 3(5), September 2004.
- J.J. Makela, B.M. Ledvina, M.C. Kelley, and P.M. Kintner, “Analysis of the Seasonal Variations of Equatorial Plasma Bubble Occurrence Observed from Haleakala, Hawaii,” **Annales Geophysicae**, 22(9), August 2004.
- P.M. Kintner, B.M. Ledvina, E.R. de Paula, and I.J. Kantor, “The Size, Shape, Orientation, Speed, and Duration of GPS Equatorial Anomaly Scintillations,” **Radio Science**, 39(2), doi:10.1029/2003RS002878, April 2004.
- B.M. Ledvina, J.J. Makela, and P.M. Kintner, “Temporal Scales of the GPS L1 Amplitude Scintillations at Midlatitude,” **Radio Science**, 39(1), doi:10.1029/2002RS002832, February 2004.
- E.R. de Paula, F.S. Rodrigues, K.N. Iyer, I.J. Kantor, M.A. Abdu, P.M. Kintner, B.M. Ledvina, and H. Kil “Equatorial Anomaly Effects on GPS Scintillations in Brazil,” **Advances in Space Research**, 31(3), February 2003.
- M.C. Kelley, J.J. Makela, B.M. Ledvina, and P.M. Kintner, “Observations of Equatorial Spread-F from Haleakala, Hawaii,” **Geophys. Res. Lett.**, 29(20), doi:10.1029/2002GL015509, October 2002.
- B.M. Ledvina, J.J. Makela, and P.M. Kintner, “First Observations of Intense GPS L1 Amplitude Scintillations at Midlatitude,” **Geophys. Res. Lett.**, 29, doi:10.1029/2002GL014770, July 2002.

THESIS

- B.M. Ledvina, “A Scintillation-Based Spaced-Receiver Analysis of Scattering Medium Dynamics in the Equatorial Ionosphere,” Ph.D. Dissertation, Cornell University, January 2004.

CONTRIBUTED CONFERENCE PAPERS

(excluding those that have appeared in or been submitted for publication in a journal)

- B.M. Ledvina, M.L. Psiaki, S.P. Powell, and P.M. Kintner, “Real-Time Software Receiver Tracking of GPS L2 Civilian Signals using Hardware-in-the-Loop Simulation,” **Proc. of the Institute of Navigation GNSS**, September 13–16, 2005, Long Beach, CA.

- T.E. Humphreys, M.L. Psiaki, B.M. Ledvina, and P.M. Kintner, "Performance of GPS Carrier Tracking Loops During Ionospheric Scintillations," **Proc. of the Institute of Navigation GNSS**, September 13–16, 2005, Long Beach, CA (**BEST PAPER IN SESSION AWARD**).
- T.E. Humphreys, M.L. Psiaki, B.M. Ledvina, and P.M. Kintner, "Performance of GPS Carrier Tracking Loops During Ionospheric Scintillations," **Proc. of the Ionospheric Effects Symposium**, May 3–5, 2005, Alexandria, VA.
- B.M. Ledvina, P.M. Kintner, C.N. Mitchell, and E.R. de Paula, "Temporal and Spatial Evolution of GPS L1 Amplitude Scintillations and Electron Density in Brazil," **Proc. of the Beacon Satellite Symposium**, October 18–22, 2004, Trieste, Italy.
- L.F.C. de Rezende, E.R. de Paula, I.J. Kantor, P. M. Kintner, B. M. Ledvina, and O. J. Branquinho, "Study of Lock Loss Duration and Amplitude Fading Statistics on GPS L1 Signal During Ionospheric Scintillation," **Proc. of the Beacon Satellite Symposium**, October 18–22, 2004, Trieste, Italy.
- I.J. Kantor, E.R. de Paula, E.A. Kherani, L.F.C. de Rezende, N. Reggiani, M. S. Canabarro, P.M. Kintner, and B.M. Ledvina "Magnetic Storm Effects Over GPS L1 Band Amplitude Scintillations," **Proc. of the Beacon Satellite Symposium**, October 18–22, 2004, Trieste, Italy.
- B.M. Ledvina, M.L. Psiaki, D.J. Sheinfeld, A.P. Cerruti, S.P. Powell, and P.M. Kintner, "A Real-Time GPS Civilian L1/L2 Software Receiver," **Proc. of the Institute of Navigation GNSS**, September 21–24, 2004, Long Beach, CA.
- T.E. Humphreys, B.M. Ledvina, M.L. Psiaki, A.P. Cerruti, and P.M. Kintner, "Analysis of Ionospheric Scintillations using Wideband GPS L1 C/A Signal Data," **Proc. of the Institute of Navigation GNSS**, September 21–24, 2004, Long Beach, CA.
- B.M. Ledvina, A.P. Cerutti, M.L. Psiaki, S.P. Powell, and P.M. Kintner, "Performance Tests of a Real-Time 12-Channel GPS L1 Software Receiver," **Proc. of the Institute of Navigation GPS**, September 10–12, 2003, Portland, OR.
- B.M. Ledvina, M.L. Psiaki, S.P. Powell, and P.M. Kintner, "A 12-Channel Real-Time GPS L1 Software Receiver," **Proc. of the Institute of Navigation National Technical Meeting**, January 22–24, 2003, Anaheim, CA.
- B. Ledvina, J. Makela, P. Kintner, "On the first observations of GPS L1 amplitude scintillations at midlatitude," **Proc. Ionospheric Effects Symp.**, 2002, Alexandria, VA.
- B.M. Ledvina, F. Mota, and P.M. Kintner, "A Coming of Age for GPS: A RTLinux GPS Receiver," **Proc. of the Workshop on Real Time Operating Systems and Applications and Second Real Time Linux Workshop (in conjunction with IEEE RTSS 2000)**, November 27–28, 2000, Orlando, FL.

INVITED PRESENTATIONS

- "GPS Software Receivers for Ionospheric Science," The Coupling, Energetics and Dynamics of Atmospheric Regions (CEDAR) Workshop, Santa Fe, NM, June 27–July 2 2004.
- "GPS Scintillation Data in the Americas," The Coupling, Energetics and Dynamics of Atmospheric Regions (CEDAR) Workshop, Longmont, CO, June 15–20 2003.

CONTRIBUTED CONFERENCE PRESENTATIONS

“Equatorial Imaging,” Makela, J.J., M.C. Kelley, B.M. Ledvina, and P.M. Kintner, CEDAR Workshop, June 15–20, 2003, Longmont, CO.

“Stormtime Ionospheric Irregularities in SPAS-Related Troughs: Causes of GPS Scintillations at Mid-Latitudes,” Mishin, E.V., W.J. Burke, S. Basu, S. Basu, P.M. Kintner, and B. Ledvina, AGU Fall Meeting, December 8–12, 2003, San Francisco, CA.

“The Advantages of Cheap, Connected, and Plentiful GNSS Observations,” Kintner, P.M., B. Ledvina, E. de Paula, J. Makela, and J. Sojka, AGU Fall Meeting, December 8–12, 2003, San Francisco, CA.

CONFERENCE SESSION CHAIR/CO-CHAIR

Institute of Navigation Annual Meeting, Co-chair of session, GNSS Software Receivers for Science and Navigation, June 27–29, 2005, Cambridge, MA.

COURSES TAUGHT

ECE/MAE 415 Global Positioning System: Senior level elective. Prerequisites: linear algebra and MATLAB programming. This lecture and laboratory course is an introduction to GPS with an emphasis on receiver design, culminating in a design project (Cumulative Design Experience). The course covers the GPS signal structure, the GPS observables, orbital mechanics, satellite position calculations, computation of the navigation solution, multipath, ionospheric errors, and differential GPS. Students develop a thorough understanding of GPS receivers all the way from the observables to the errors found in the navigation solution. Taught in Fall term 2002.