

Thomas Joseph Loredo

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Date of birth: 7 May 1962
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Education

S.B. Physics, MIT, 1984; Senior Thesis Advisor: Prof. Saul A. Rappaport.

Ph. D. Astronomy, University of Chicago. Thesis defended August 1990; degree officially granted June 1995 upon submission of thesis article for publication. Advisor: Prof. Don Q. Lamb.

Research & Teaching Appointments

Senior Research Associate, Dept. of Astronomy, Cornell University June 1997 to present.

Visiting Research Associate and Group Leader of Surveys and Population Studies Working Group, 2006 Astrostatistics Program, Statistical and Mathematical Sciences Institute (SAMSI), Research Technology Park, NC, Jan-May 2006

Research Associate and Postdoctoral Fellow, Dept. of Astronomy, Cornell University; September 1990 to 1996. Sponsor: Prof. Ira Wasserman.

Instructor, single semester appointments in Physics and Applied & Engineering Physics Departments, Cornell U., Spring 2004 & 2005 (Intermediate Mechanics), Fall 2002 (Computer Instrumentation Lab), Fall 1994 (Intermediate Electromagnetism).

Summer Research Assistant, Los Alamos Scientific Laboratory, Los Alamos, New Mexico, 1985 and 1986. Sponsor: Dr. Richard Epstein.

Fellowships & Major Grants Awarded

NSF Astronomy-Statistics Collaborative Research Grant, Adaptive Experimental Design for Astronomical Exploration, 2005–2008

NASA Applied Information Software Systems grant, Astrostatistical Tools in Python (PI), 2002–2005

NASA Space Interferometry Mission Key Project Grant (Co-I on Extrasolar Planet Interferometric Survey project; PIs Michael Shao and Shri Kulkarni), 2001–2009

NASA Long-Term Space Astrophysics Grant, October 1996 to September 2001

NASA Compton Gamma Ray Observatory Fellow, October 1991 to September 1994

William R. Harper Fellow, University of Chicago, October 1989 to September 1990

NASA Graduate Student Traineeship, Grant NGT-50189, July 1987 to June 1990

McCormick Fellow, University of Chicago, September 1984 to June 1987

Farr Fellow, University of Chicago, September 1984 to December 1986

Major Publications (• indicates TJJ as principal author)

- 1. Analyzing Data From Astronomical Surveys: Issues and Directions (T. J. Loredo), in *Statistical Challenges in Modern Astronomy IV*, ed. E. Feigelson and J. Babu, in press (2006).
2. The Kuiper Belt’s luminosity function from $m_R=22-25$ (J.-M. Petit, M. J. Holman, B. Gladman, JJ Kavelaars, H. Scholl, T. J. Loredo), *M.N.R.A.S.*, **365**, 429–438 (2006).
- 3. Accounting for Uncertainties in Analyses of Astronomical Survey Data (T. J. Loredo), in *Bayesian Inference And Maximum Entropy Methods In Science And Engineering: 24th International Workshop; Garching, Germany, 2004*, ed. V. Dose et al. (AIP Conference Proceedings series) 12pp., in press.
- 4. Bayesian Adaptive Exploration (T. J. Loredo), in *Bayesian Inference And Maximum Entropy Methods In Science And Engineering: 23rd International Workshop; Jackson Hole, Wyoming, 2003*, ed. G. J. Erickson and Y. Zhai (AIP Conference Proceedings 707) 330–346 (2004).
5. Search for High-Frequency Periodicities in BATSE TTE Data From Gamma-Ray Bursts and Soft Gamma Repeaters (A. Kruger, T. J. Loredo and I. M. Wasserman), *Ap. J.* **576**, 932–941 (2002) (astro-ph/0112192).
- 6. Bayesian Analysis of Neutrinos from Supernova SN 1987A (T. J. Loredo and D. Q. Lamb), *Phys. Rev. D* **65**, 063002, 39 pp. (2002) (astro-ph/0107260).
- 7. Bayesian Harmonic Analysis for Audio Testing and Measurement (T. J. Loredo), to appear in proceedings of the 111th Convention of the Audio Engineering Society (<http://www.museweb.com/bha.pdf>).
8. The Structure of the Kuiper Belt: Size Distribution and Radial Extent (B. Gladman, JJ Kavelaars, J.-M. Petit, A. Morbidelli, M. J. Holman, T. J. Loredo), *Astron. J.*, **122**, 1051–1066 (2001).
9. Type Ia Supernovae, Evolution, and the Cosmological Constant (P. S. Drell, T. J. Loredo, and I. M. Wasserman), *Ap. J.*, **530**, 593–617 (2000).
- 10. Computational Technology for Bayesian Inference (T. J. Loredo), in ASP Conference Series, Vol. 172, *Astronomical Data Analysis Software and Systems VIII*, ed. D. M.

- Mehring, R. L. Plante, and D. A. Roberts (San Francisco: Astronomical Society of the Pacific), 297–306 (1999).
- 11. Bayesian Analysis of the Polarization of Distant Radio Sources: Limits on Cosmological Birefringence (T. J. Loredo, E. E. Flanagan, and I. M. Wasserman), *Phys. Rev.*, **D56**, 7507–7512 (1997).
 - 12. Inferring the Spatial and Energy Distribution of Gamma-Ray Burst Sources. III. Anisotropic Models (T. J. Loredo and I. M. Wasserman), *Ap. J.*, **502**, 108–129 (1998).
 - 13. Inferring the Spatial and Energy Distribution of Gamma-Ray Burst Sources. II. Isotropic Models (T. J. Loredo and I. M. Wasserman), *Ap. J.*, **502**, 75–107 (1998).
 - 14. The Return of the Prodigal: Bayesian Inference for Astrophysics (T. J. Loredo), invited review article for *Statistical Science*, (as yet unpublished; 37 page preliminary version printed in preliminary proceedings of *Bayesian Statistics 5*, ed. J. Bernardo, 1994).
 - 15. Inferring the Spatial and Energy Distribution of Gamma-Ray Burst Sources. I. Methodology (T. J. Loredo and I. M. Wasserman), *Ap. J. Suppl.*, **96**, 261–301 (1995).
 - 16. A New Method for the Detection of a Periodic Signal of Unknown Shape and Period (P. C. Gregory and T. J. Loredo), *Ap. J.*, **398**, 146–168 (1992).
 - 17. The Promise of Bayesian Inference for Astrophysics (with Discussion) (T. J. Loredo) in *Statistical Challenges in Modern Astronomy*, ed. E.D. Feigelson and G.J. Babu (New York: Springer-Verlag) pp. 275–297 (1992).
 - 18. From Laplace to Supernova SN 1987A: Bayesian Inference in Astrophysics (T. J. Loredo) in *Maximum-Entropy and Bayesian Methods, Dartmouth, 1989*, ed. P. Fougère (Dordrecht, The Netherlands: Kluwer Academic Publishers) pp. 81–142 (1990).
 - 19. Cyclotron Resonant Scattering in the Spectra of Gamma-Ray Bursts (J. C. L. Wang, D. Q. Lamb, T. J. Loredo, I. M. Wasserman, E. E. Salpeter, J. P. Conner, R. I. Epstein, R. W. Klebesadel, J. G. Laros, A. Yoshida, M. Fujii, K. Hayashida, M. Itoh, T. Murakami, J. Nishimura, T. Yamagami, I. Kondo, and N. Kawai) *Phys. Rev. Lett.*, **63**, 1550–1553 (1989).
 - 20. Cyclotron Resonant Scattering in the Spectra of Gamma-Ray Bursts (D. Q. Lamb, J. C. L. Wang, T. J. Loredo, I. Wasserman, and E. E. Fenimore) in *Proceedings of the Fourteenth Texas Symposium on Relativistic Astrophysics*, ed. E. Fenyves, *Ann. N. Y. Acad. Sci.*, **571**, 460–481 (1989).
 - 21. Neutrinos from SN 1987A: Implications for Cooling of the Nascent Neutron Star and the Mass of the Electron Antineutrino (T. J. Loredo and D. Q. Lamb) in *Proceedings of the Fourteenth Texas Symposium on Relativistic Astrophysics*, ed. E. Fenyves, *Ann. N. Y. Acad. Sci.*, **571**, 601–630 (1989).
 - 22. Analyzing Gamma-Ray Burst Spectral Data (T. J. Loredo and R. I. Epstein) *Ap. J.*, **336**, 896–919 (1989).
 - 23. Optical Observations of the Millisecond Pulsars PSR 1937+214 and PSR 1953+29 (T. J. Loredo, G. R. Ricker, S. A. Rappaport, and J. Middleditch) in *Birth and Evolution of Neutron Stars: Issues Raised by Millisecond Pulsars*, ed. S. P. Reynolds and D. R. Stinebring (Green Bank, WV: NRAO), pp. 48–58 (1984).

Additional Publications

1. Bayesian Adaptive Exploration in a Nutshell (T. J. Loredo), in *Statistical Problems in Particle Physics, Astrophysics, and Cosmology*, ed. L. Lyons, R. Mount & R. Reitmeyer (Stanford: SLAC eCONF C030908, SLAC-R-703) 162–165 (2004).
2. Bayesian Adaptive Exploration (T. J. Loredo and D. F. Chernoff), in *Statistical Challenges in Astronomy*, ed. E.D. Feigelson and G.J. Babu (New York: Springer-Verlag) pp. 57–69 (2003).
3. Resonant Cyclotron Radiation Transfer Model Fits to Spectra from Gamma-Ray Burst GRB870303 (P. E. Freeman, D. Q. Lamb, J. C. L. Wang, I. Wasserman, T. J. Loredo, E. E. Fenimore, T. Murakami, A. Yoshida), *Ap. J.*, **524**, 772–793 (1999).
4. Statistical Analysis of Spectral Line Candidates in Gamma-Ray Burst GRB870303 (P. E. Freeman, C. Graziani, D. Q. Lamb, T. J. Loredo, E. E. Fenimore, T. Murakami, A. Yoshida), *Ap. J.*, **524**, 753–771 (1999).
5. Pencil-Beam Surveys for Faint Trans-Neptunian Objects (B. Gladman, JJ Kavelaars, P. D. Nicholson, T. J. Loredo, and J. A. Burns), *Astron. J.*, **116**, 2042–2054 (1998).
6. Bayesian Periodic Signal Detection: Analysis of ROSAT Observations of PSR 0540-693 (P. C. Gregory and T. J. Loredo), *Ap. J.*, **473**, 1059–1066 (1996).
7. Likelihood Analysis of GRB Repetition (S. Luo, T. J. Loredo, and I. M. Wasserman), in *Gamma-Ray Bursts, 3rd Huntsville Symposium*, ed. C. Kouveliotou, M. F. Briggs, and G. J. Fishman (New York: American Institute of Physics), pp. 477–481 (1996).
8. New Techniques in the Fitting of Gamma-Ray Burst Cyclotron Lines (P. E. Freeman, C. Graziani, D. Q. Lamb, and T. J. Loredo), in *Gamma-Ray Bursts, Second Workshop, Huntsville, AL 1993*, ed. G. J. Fishman, J. J. Brainerd, and K. Hurley (New York: American Institute of Physics), pp. 677–681.
9. Establishing the Existence of Harmonically-Spaced Lines in Gamma-Ray Burst Spectra Using Bayesian Inference (C. Graziani, D. Q. Lamb, T. J. Loredo, E. E. Fenimore, T. Murakami, and A. Yoshida), in *Compton Gamma Ray Observatory, St. Lous, MO 1992* (ibid), pp. 897–901 (1993).
10. Sensitivity of the BATSE Spectroscopy Detector to Gamma-Ray Burst Spectral Lines Like Those Seen In Ginga (P. E. Freeman, D. Q. Lamb, E. E. Fenimore, and T. J. Loredo), in *Compton Gamma Ray Observatory, St. Lous, MO 1992* (ibid), pp. 922–926 (1993).
11. Inferring the Spatial and Energy Distribution of Burst Sources From Peak Count Rate Data (T. J. Loredo and I. M. Wasserman), in *Compton Gamma Ray Observatory, St. Lous, MO 1992*, ed. M. Friedlander, N. Gehrels, and D.J. Macomb (New York: American Institute of Physics), pp. 749–753 (1993).
12. Establishing the Existence of Lines in γ -Ray Bursts (T. J. Loredo and D. Q. Lamb) in *Gamma-Ray Bursts, Huntsville, AL 1991*, ed. W.S. Paciesas and G.J. Fishman (New York: American Institute of Physics), pp. 414–415 (1992).
13. Cyclotron Resonant Scattering in Gamma-Ray Bursts: Further Analysis of GB880205 (P. E. Freeman, D. Q. Lamb, J. C. L. Wang, T. J. Loredo, E. E. Fenimore, T. Murakami, A. Yoshida), in *Gamma-Ray Bursts, Huntsville, AL 1991*, ed. W.S. Paciesas and G.J. Fishman (New York: American Institute of Physics), pp. 216–220 (1992).
14. Line Strength Variations in Gamma-Ray Burst GB870303: Possible Evidence of Neutron Star Rotation (C. Graziani, E. E. Fenimore, T. Murakami, A. Yoshida, D. Q. Lamb, J. C. L. Wang, and T. J. Loredo), in *Gamma-Ray Bursts, Huntsville, AL 1991*,

- ed. W.S. Paciesas and G.J. Fishman (New York: American Institute of Physics), pp. 211–215 (1992).
15. Cyclotron Line Strength Variations in Gamma-Ray Burst GB870303: Possible Evidence of Neutron Star Rotation (C. Graziani, E. E. Fenimore, T. Murakami, A. Yoshida, D. Q. Lamb, J. C. L. Wang, and T. J. Loredo), in *Gamma-Ray Bursts: Observations, Analyses and Theories*, ed. C. Ho, R.I. Epstein, and E.E. Fenimore (Cambridge: Cambridge University Press), pp. 407–414 (1992).
 16. A Bayesian Method for the Detection of a Unknown Periodic and Nonperiodic Signals in Binned Time Series (P. C. Gregory and T. J. Loredo), in *Maximum Entropy and Bayesian Methods, Paris, France, 1992*, ed. A. Mohammad-Djafari and G. Demoment (Dordrecht, The Netherlands: Kluwer Academic Publishers), 225–232 (1993).
 17. A Bayesian Method for the Detection of a Periodic Signal of Unknown Shape and Period (P. C. Gregory and T. J. Loredo), in *Maximum Entropy and Bayesian Methods, Seattle, 1991*, ed. C. R. Smith, G. J. Erickson and P. O. Neudorfer (Dordrecht, The Netherlands: Kluwer Academic Publishers), 79–103 (1992).
 18. Implications of the SN 1987A Neutrinos for Supernova Theory and the Mass of $\bar{\nu}_e$ (T. J. Loredo and D. Q. Lamb) in *Supernovae: The Tenth Santa Cruz Summer Workshop in Astronomy and Astrophysics*, ed. S. E. Woosley (New York: Springer-Verlag) pp. 405–407 (1991).
 19. New Tools for Gamma-Ray Burst Data Analysis (D. Hartmann, G. R. Blumenthal, R. I. Epstein, J. J. Gonzalez, K. Hurley, T. J. Loredo, and S. E. Woosley) in *Proceedings of the Gamma Ray Observatory Science Workshop*, ed. W. Neil Johnson (Washington, D.C.: Naval Research Laboratory) pp. 4-427 – 4-435 (1990).
 20. Neutrinos from SN 1987A and Cooling of the Nascent Neutron Star (D. Q. Lamb, F. Melia, and T. J. Loredo) in *Supernova 1987A in the Large Magellanic Cloud* (Proceedings of the George Mason Workshop, 11-14 October, 1987), ed. M. Kafatos (Cambridge: Cambridge U. Press), pp. 204-207 (1988).

Popular Articles

Entries for “Data Analysis,” “Experimental Errors,” “Random Errors,” and “Systematic Errors” in the *Macmillan Encyclopedia of Physics*, J. S. Rigden (ed.), Macmillan Publishing Company (1997).

‘What are Gamma-Ray Bursters?’, first prize essay in 1987 McDonald Observatory Astronomy Essay Contest, published in *Star Date*, **16**, No. 5, July/August 1988, p. 16.

Selected Professional Talks

- ‘Analyzing Data From Astronomical Surveys: Issues and Directions,’ invited talk, Statistical Challenges in Modern Astronomy IV, Penn State U. (June 2006).
- ‘Bayesian Astrostatistics,’ invited review talk, Dark Matter 2005 (interdisciplinary workshop between astronomers, statisticians, and philosophers of science), U. of Michigan (October 2005).
- ‘The Perils & Promise of Statistics With Large Data Sets & Complicated Models,’ invited talk, GravStat: Statistics for Gravitational Wave Data Analysis (May 2005), and Center for Astrostatistics Summer School, Penn State U. (June 2005).
- ‘The Statistics of the Future,’ invited talk on the occasion of the retirement of Volker Dose, Director, Max Planck Inst. for Plasma Physics, Garching, Germany (Feb 2005).
- ‘Inference at the Edge of the Solar System: Bayesian Analysis of Astronomical Survey Data,’ invited talk, 23rd International Workshop on Maximum Entropy and Bayesian Methods, Max Planck Inst. for Plasma Physics, Garching, Germany (August 2004).
- ‘Bayesian Computation: A Tutorial,’ invited talk, 23rd International Workshop on Maximum Entropy and Bayesian Methods, Jackson Hole, WY (August 2003).
- ‘Bayesian Inference in Astronomy and Astrophysics: A Short Course,’ invited lecture series at Max Planck Inst. for Plasma Physics (5 1-1/2 hour lectures), Garching, Germany (October 2002).
- ‘Bayesian Inference for Astrophysical Poisson Processes,’ invited talk, Joint Statistical Meetings, Atlanta, GA (August 2001).
- ‘Bayesian Adaptive Exploration,’ invited talk, Statistical Challenges in Modern Astronomy III, Penn State U. (July 2001).
- ‘Bayesian Inference: A Practical Primer,’ opening talk, International Workshop on Maximum Entropy and Bayesian Methods, CNRS, Gif-sur-Yvette, France (July 2000).
- ‘How Many σ ’s are Enough? A Bayesian Look at Signal Detection,’ Dept. of Astronomy colloquium, Cornell University, Ithaca, NY (February 2000).
- ‘Bayesian Inference: What’s the Difference?’, physics colloquium, Wayne State University, Detroit, MI (September 1999).
- ‘Bayesian Inference: A Developer’s Perspective,’ invited talk, Astronomical Data Analysis and Software Systems (ADASS VIII) conference, University of Illinois, Urbana (November 1998).
- ‘Systematic Errors in Supernova Cosmology: Indications for Evolution?’ Type Ia Supernovae Workshop, University of Chicago, (October 1998).
- ‘The Intuitive Appeal of Bayesian Inference,’ Edwin T. Jaynes memorial symposium, Washington University, St. Louis, MO (October 1998).
- ‘Bayesian Basics,’ seminar at AAS High Energy Astrophysics Division (HEAD) meeting, Estes Park, CO (October 1997).
- ‘The Screwy Statistics of Screwy Light,’ invited introductory talk, and ‘Do Gamma Ray Bursts Repeat,’ contributed talk, International Workshop on Maximum Entropy and Bayesian Methods, Boise State University, Boise, Idaho (August 1997).
- ‘Learning How To Count: The Statistics of Gamma-Ray Bursts,’ Astrophysics Colloquium, University of North Carolina (February 1995); University of Rochester (November 1995); Center for Astrophysics, Cambridge, MA (September 1996).

- ‘Inference With the Poisson Distribution: Astrophysical Problems, Bayesian Solutions,’ joint Dept. of Statistics/Physics Dept. colloquium, Carnegie-Mellon University, Pittsburgh, PA, October 1994.
- ‘The Return of the Prodigal: Bayesian Inference for Astrophysics,’ invited talk at Fifth Valencia meeting on Bayesian Statistics, Alicante, Spain, 5–9 June 1994.
- ‘Bayesian Inference for Astrophysics,’ invited talk at 1st annual meeting of the International Society for Bayesian Analysis, San Francisco, CA, August 1993.
- ‘Inference With the Poisson Distribution’ and ‘What (Where) are Gamma-Ray Bursters?’, invited talks, 13th International Workshop on Maximum Entropy and Bayesian Methods, Santa Barbara, CA, August 1993.
- ‘Bayesian Inference in Astrophysics’ (Division seminar) and ‘Bayesian Inference With the Poisson Distribution’ (3hr group seminar), Marshall Space Flight Center, Huntsville, AL, April 1993.
- ‘Bayesian Inference in Astrophysics,’ Department of Statistics Colloquium, Perdue University, 1992.
- ‘Hot Compton Reflection and the X-Ray Paucity Constraint,’ contributed talk at the Gamma-Ray Burst Workshop, Huntsville, AL, October 1991.
- ‘The Promise of Bayesian Inference for Astrophysics,’ invited talk at the Statistical Challenges in Modern Astronomy conference, Penn State University, July 1991.
- ‘Probability, Frequency, and Entropy: Relationships and Distinctions’ (3hr tutorial) and ‘Inference with the Poisson Distribution,’ invited talks at the 11th International Workshop on Maximum Entropy and Bayesian Methods, Seattle University, June 1991.
- ‘Supernova Neutrinos and Probability Theory,’ Physics Colloquium, and ‘Statistical Techniques for the Analysis of Experimental Data,’ (two tutorial lectures), Arizona State University, November 1990.
- ‘Supernova Neutrinos and Probability Theory,’ Theory Seminar, Physics Dept., University of British Columbia, November 1990.
- ‘The Promise of Bayesian Inference for Astrophysics,’ invited talk at the 10th International Workshop on Maximum Entropy and Bayesian Methods, University of Wyoming, August 1990.
- ‘The Supernova Neutrinos: Lessons in Physics, Lessons in Statistics,’ seminar at the Institute for Advanced Study, Princeton, November 1989.
- ‘Supernova Neutrinos and Probability Theory: The Case for Bayesian Inference in Astrophysics,’ contributed talk at the 9th International Workshop on Maximum Entropy and Bayesian Methods, Dartmouth College, August 1989.
- ‘Neutrinos from SN 1987A: Present and Future Implications for Neutrino Masses,’ invited talk at the UCLA Symposium on the Next Supernova, Santa Monica, CA, February 1989.
- ‘Analyzing Gamma-Ray Burst Spectral Data,’ Astronomy Seminar, Northwestern University, June 1988.
- ‘The Direct Inversion of Gamma-Ray Spectra,’ invited seminar as a Special Consultant to the University of Alabama/Marshall Space Flight Center Gamma Ray Observatory collaboration (contact: Dr. Gerald Fishman), MSFC, Huntsville, AL, October 1986.
- ‘Optical Observations of the Millisecond Pulsars,’ contributed talk at the NRAO conference, *Birth and Evolution of Neutron Stars: Issues Raised by Millisecond Pulsars*, Green Bank, WV, June 1984.