

# Tyson B. Littenberg

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## Experience

### Education:

- May, 2009      Ph.D. in Physics – Montana State University – Bozeman  
Dissertation: *A Comprehensive Bayesian Approach to Gravitational Wave Astronomy*  
Thesis Advisor: Neil J. Cornish
- May, 2006      M.S. in Physics – Montana State University – Bozeman
- May, 2003      B.S. in Physics – State University of New York at Oswego  
Honors: Cum Laude

### Academic Positions:

- 2012-Present      Postdoctoral Research Assistant  
*Center for Interdisciplinary Exploration & Research in Astrophysics*  
Northwestern University  
Supervisor: Vicky Kalogera
- 2012-Present      Research Scientist  
*Center for Space Plasma & Aeronautics Research*  
University of Alabama Huntsville
- 2009-2012      Postdoctoral Researcher  
*Maryland Center for Fundamental Physics*  
University of Maryland College Park  
Supervisor: Alessandra Buonanno  
&  
*Gravitational Astrophysics Lab*  
NASA Goddard Space Flight Center  
Supervisor: John Baker

## Teaching

### Undergraduate Courses

- Physics By Inquiry (Conceptual physics for Elem. Ed. majors)  
Montana State University, Fall 2004, Spring 2005, Fall 2006.
- College Physics I (Algebra-based mechanics)  
Montana State University, Summer 2004 & Summer 2005

## Teacher Development Programs

Summer of Innovation Teacher Workshops at GSFC  
*Microgravity and Amusement Park Physics*  
 NASA Goddard Space Flight Center, July 2011, July 2012.

## Professional Activities

### Mentoring

Atul Adhikari, Claudeson Azurin, Scott Coughlin, Brian Klein, Brandon Miller, Leah Perri, Ben Sandeen, Jeremy Vollen, Michael Zevin

Summer Research Experience, Northwestern University, Summer 2014  
*LIGO/Virgo parameter estimation for precessing compact binary inspirals.*

Jose McKinnon, NASA Goddard Space Flight Center, Summer 2012  
*Distinguishing Galaxy models with low frequency gravitational wave data.*

Sabrina Reyes, NASA Goddard Space Flight Center, Summer 2012  
 NAROP summer internship program  
*Mapping the Galaxy using low-frequency gravitational wave detections.*

James Beam, NASA Goddard Space Flight Center, Summer 2011  
 BEST summer internship program  
*Applying fractional delay interpolation to construct time delay interferometry signals.*

Lily Sun, NASA Goddard Space Flight Center, Summer 2010.  
 National Space Club Scholar Summer Internship Program  
*Combining genetic algorithms with Markov chain Monte Carlo searches.*

### Outreach

Public Talks at Einstein Evenings  
 Dearborn Observatory, Northwestern University, 2015

Physics Day and Math and Science Day at Six Flags Theme Park  
 NASA Goddard Space Flight Center, May and June, 2012

co-Manager of the Space Public Outreach Team  
 Montana Spacegrant Consortium, Summer 2005–Summer 2008.

Stars Over Yellowstone Campfire Talk  
*Astronauts & Aliens*, June 2007  
*Mars 3D!*, August 2006  
 Yellowstone National Park.

Peaks and Potential Instructor  
*Exploration of the Solar System*  
 Montana State University, June 2006.

Exhibit Interpreter  
*Cosmic Questions*  
 Museum of the Rockies, Summer 2005.

Science Olympiad Captain  
*Experimental Design*  
 Montana State University, November 2004.

## Research

### Gravitational wave astrophysics

- Modeling data from GW detectors.
- Robust GW detection algorithms.
- White dwarf binary science.
- GWs as probes of General Relativity.
- Astrophysical constraints from GW catalogs.

### Bayesian inference

- High dimensional optimization problems.
- Markov Chain Monte Carlo algorithms.
- Bayesian model selection.

### Refereed Publications:

*Bayesian Inference for Spectral Estimation of Gravitational Wave Detector Noise*  
T.B. Littenberg and N.J. Cornish, *accepted by Phys. Rev. D*, 2015

*Parameter estimation for compact binaries with ground-based gravitational-wave observations using the LALInference software library*  
J. Veitch et al, *Phys. Rev. D* **91** 042003, 2015

*The Space Public Outreach Team (SPOT): Adapting a successful outreach program to a new region*  
K. Williamson, I. Grimberg, J. Key, S.A. Heatherly, T. B. Littenberg, A. Des Jardins, S. L. Larson, M. B. Larson, D. McKenzie, *CAPjournal*, **16**, 8, 2014.

*Basic Parameter Estimation of Binary Neutron Star Systems by the Advanced LIGO/Virgo Network*  
C.L. Rodriguez, B. Farr, V. Raymond, W.M. Farr, T.B. Littenberg, D. Fazi, V. Kalogera, *ApJ*, **784**, Issue 2, article id. 119, 13 pp. 2014.

*Systematic and statistical errors in a bayesian approach to the estimation of the neutron-star equation of state using advanced gravitational wave detectors*  
L. Wade, J. D. E. Creighton, E. Ochsner, B. D. Lackey, B. Farr, T. B. Littenberg, V. Raymond, *Phys. Rev. D* **89**, 103012, 2014.

*Fortifying the characterization of binary mergers in LIGO data*  
T. B. Littenberg, M. Coughlin, B. Farr, and W. M. Farr, *Phys. Rev. D* **88**, 084044, 2013.

*Systematic biases in parameter estimation of binary black-hole mergers*  
T.B. Littenberg, J.G. Baker, A. Buonanno, B.J. Kelly, *Phys. Rev. D* **87**, 104003, 2013.

*Prospects for observing ultra-compact binaries with space-based gravitational wave interferometers and optical telescopes*  
T.B. Littenberg, S.L. Larson, G. Nelemans, N.J. Cornish  
*MNRAS* first published online December 24, 2012 doi: 10.1093/mnras/sts507

*Astrophysical Model Selection in Gravitational Wave Astronomy*  
M.R. Adams, N.J. Cornish, T.B. Littenberg, *Phys. Rev. D* **86** 124032, 2012.

*A Detection Pipeline for Galactic Binaries in LISA Data*  
T.B. Littenberg, *Phys. Rev. D* **84** 063009, 2011.

*Separating Gravitational Wave Signals from Instrument Artifacts*  
T.B. Littenberg and N.J. Cornish, *Phys. Rev. D* **82** 103007, 2010.

*A Bayesian Approach to the Detection Problem in Gravitational Wave Astronomy*  
T.B. Littenberg and N.J. Cornish, *Phys. Rev. D* **80** 063007, 2009.

*Tests of Bayesian Model Selection Techniques for Gravitational Wave Astronomy*  
N.J. Cornish and T.B. Littenberg, *Phys. Rev. D* **76** 083006, 2007.

### Selected Collaborative Publications

*Testing General Relativity with Present and Future Astrophysical Observations*

E. Berti et al, arXiv preprint arXiv:1501.07274 (2015)

*Low-frequency gravitational-wave science with eLISA/NGO*

P. Amaro-Seoane et al, Class. Quantum Grav. **29** 124016, 2012

*eLISA: Astrophysics and cosmology in the millihertz regime*

Amaro-Seoane et al. Submitted to GW notes, 2011. arXiv:1201.3621

*Report on the Second Mock LISA Data Challenge*

S. Babak et al. Class. Quant. Grav. **25** 114037, 2008.

*Report on the first round of the Mock LISA Data Challenges*

K.A. Arnaud et al. Class. Quant. Grav. **24** S529, 2007.

### Scientific Software

*BayesWave – LIGO/Virgo Burst parameter estimation and glitch rejection pipeline*

Tyson Littenberg, Neil Cornish, Jonah Kanner

*LALInference – LIGO/Virgo CBC parameter estimation pipeline*

John Veitch et al

*MLDC Galactic Binary Generator*

Neil Cornish and Tyson Littenberg

*MLDC 2 Galactic Binary Assessment*

Neil Cornish, Jeff Crowder, and Tyson Littenberg

*Confusion noise estimator for LISA reformulation studies*

Neil Cornish and Tyson Littenberg

### Invited Talks/Presentations

*Computational Approaches in Gravitational Wave Data Analysis.*

APS April Meeting. Baltimore, MD April 2015.

*Going Out with a Bang: Gravitational Waves from Massive Black Hole Mergers*

AAS HEAD Meeting. Chicago, IL August 2014.

*Taking a stroll with eLISA through the mHz gravitational-wave zoo*

April APS Meeting. Denver, CO April 2013.

*Going Out with a Bang: Gravitational Waves from Coalescing SMBHs*

Galaxy mergers from the largest to smallest scales @ AAS 220. Anchorage, AK June 2012.

*mHz Gravitational Wave Science as a Function of Sensitivity.*

PhysPAG Meeting @ AAS 219. Austin, TX January 2012.

### Contributed Talks/Presentations

*Distinguishing neutron stars from black holes and probing the mass gap with Advanced LIGO/Virgo observations.*

APS April Meeting. Baltimore, MD April 2015.

*Bayesian Inference for Gravitational Wave Transients and Instrument Glitches: Applications.*

APS April Meeting. Savannah, GA April 2014.

*Characterizing systematic errors introduced by non-spinning Effective One Body templates.*

LISA Symposium 9. Paris, FRA May 2012.

*Galactic binary astronomy in the post-LISA era.*

JSI Mini-symposium. College Park, MD September 2011.

*Constraining the LISA orbits with time-delay interferometry*

LISA Symposium 8. Stanford, CA June 2010.

*Separating Gravitational Wave Signals from Instrument Artifacts*

American Physical Society Meeting. Washington, D.C. February 2010.

*Separating Gravitational Wave Signals from Instrument Artifacts*

American Astronomical Society Meeting. Washington, D.C. January 2010.

*A Comprehensive Bayesian Approach to Gravitational Wave Astronomy*

Amaldi 8. New York, NY June 2009.

*A Bayesian Solution to the Gravitational Wave Detection Problem*

Pacific Coast Gravity Meeting 25. Eugene, OR March 2009.

*Resolving Model Selection Problems in Gravitational Wave Astronomy*

Gravitational Wave Data Analysis Workshop 13. Cambridge, MA December 2007.

*A Model for Education/Public Outreach Success*

American Astronomical Society Meeting. Honolulu, HI May 2007.

*Bayesian Model Selection for Gravitational Wave Sources*

American Astronomical Society Meeting. Honolulu, HI May 2007.

*Automatic Model Selection for Low-Mass Binaries*

Pacific Coast Gravity Meeting 23. Pasadena, CA March 2007.

### **Seminars and Colloquia**

*Gravitational Wave Astronomy*

Space Science Seminar

NSSTC. Huntsville, AL January 2013.

*Good missions never die:*

*The future of space-based Gravitational Wave Astronomy*

Physics Department Colloquium

Montana State University. Bozeman, MT November 2011.

*“The Stars Make No Noise”*

*Gravitational Wave Astronomy with Galactic Binaries*

Physics Department Colloquium

Utah State University. Logan, UT March 2011.

*Model Selection and Gravitational Wave Data Analysis*

Institute for Strings Cosmology and Astroparticle Physics Seminar

Columbia University. New York, NY January 2011.

*Model Selection and Gravitational Wave Data Analysis*

Gravity Theory Seminar

University of Maryland. College Park, MD November 2010.

*Revealing Einstein’s Universe: The Gravitational Wave Detection Problem*

Physics Department Colloquium

Montana State University. Bozeman, MT September 2009.

### **Professional Memberships**

LIGO Scientific Collaboration

<http://www.ligo.org/>

Gravitational Wave Science Analysis Group

<http://pcos.gsfc.nasa.gov/sags/gwsag.php>

Mock LISA Data Challenge Task Force

<http://astrogravs.nasa.gov/docs/mldc/>

American Physical Society

## Honors & Awards

### Awards

Dean's List  
State University of New York at Oswego, 2001–2003.

Outstanding Teaching Assistant Award  
Montana State University Physics Department, 2005.

Nominee, Influential Educator  
Montana State University, 2005

## References

### *Teaching and Public Outreach References*

#### **Leslie Garrison**

*Manager, Education Resource Center*  
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#### **Angela Des Jardins**

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#### **Joey Key**

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*Center for Gravitational Wave Astronomy*  
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### *Primary Research References*

#### **Neil J. Cornish**

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#### **Vicky Kalogera**

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#### **Robin T. Stebbins**

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#### **Alessandra Buonanno**

*Professor of Physics*  
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*Additional Research References*

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