

Bret Underwood

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EDUCATION

- Ph.D. Physics: Theoretical Physics** **August 2008**
University of Wisconsin-Madison, Madison, WI
Dissertation: *Warped String Phenomenology: Topics in Cosmology and Particle Physics*
Advisor: Associate Professor Gary Shiu
- Masters of Arts, Physics** **January 2006**
University of Wisconsin-Madison, Madison, WI
- Bachelor of Science: Physics** **June 2003**
The Ohio State University, Columbus, OH
Magna Cum Laude, With Honors in the Liberal Arts, With Distinction in Physics.
Undergraduate Research Thesis: *Renormalization of the n -dimensional delta function potential.*
Advisor: Professor Robert Perry

TEACHING EXPERIENCE

- Instructor, Statistical Mechanics:** McGill University **2011**
(Phys 362) Instructor for advanced undergraduate-level Statistical Mechanics course for the Winter 2011 term at McGill University.
- Instructor, Physics of the Very Early Universe:** McGill University **2010**
(Phys 743) Instructor for graduate-level course introducing the main ideas and themes of the physics of the early universe and cosmology. Used “*Just in Time Teaching*” to structure in-class discussions.
- Curriculum Development Project, “A Model Building Lesson,”** UW-Madison **2006-2008**
Led group of educators in applying curriculum development and instructional techniques including “backward design,” making student thinking visible, and rubric-based assessment of student work to develop a new lesson on model building for an introductory physics course.
- Laboratory Instructor, A Modern Introduction to Physics:** UW-Madison **2005**
(Phys 247) Taught laboratory sessions for calculus based, advanced introductory undergraduate physics course for approximately 150 physics majors.
- Recitation Instructor, The Ideas of Modern Physics:** UW-Madison **2004**
(Phys 107) Taught discussion sessions for writing-intensive algebra based introductory physics for approximately 150 non-science majors; used “Think-Pair-Share” and other small group problem solving techniques.

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| Laboratory and Recitation Instructor, General Physics I: UW-Madison (Phys 201) Taught discussion and laboratory sessions for first-semester calculus-based introductory physics for 2 sections of 30 students per section of engineering and science majors. Used “ <i>context rich</i> ” group problem solving. | 2004 |
| Laboratory and Recitation Instructor, General Physics I: UW-Madison (Phys 103) Taught discussion and laboratory sessions for first-semester non-calculus introductory physics for 3 sections of 30 students per section of bio-science and pre-medical majors. Used “ <i>context rich</i> ” group problem solving. | 2003 |
| Physics Instructor, Young Scholars Program: Ohio State University Taught two-week long introductory physics summer program for minority high school students from throughout Ohio emphasizing mathematical and graphical representations of motion through lab exercises. | 2003 |
| Undergraduate Teaching Fellow, NSF GK-12 program: Ohio State University Worked with interdisciplinary team of science students, elementary school teachers, and faculty to develop and teach active learning science lessons in inner-city schools. | 2001-2003 |
| Science Team Co-Explorer: COSI Columbus, OH Interacted with visitors to the science museum through inquiry-based engagement methods; designed and performed science shows for audiences. | 1999-2002 |

TEACHING DEVELOPMENT, SERVICE, AND OUTREACH

Development:

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| Speaker: “Addressing Diversity in Science Courses,” Workshop, Invited Talk. American Association for Physics Teachers 2008 Summer Meeting, Edmonton, AL. | July 2008 |
| Speaker: “Navigating the Landscape of Interdisciplinary Teaching,” Contributed Talk. 2008 Teaching and Learning Symposium, University of Wisconsin-Madison. | June 2008 |
| Active Participant, Delta Program, UW-Madison Attended regular meetings on teaching and learning topics, networked with other university educators, and attended a “College Classroom,” course on teaching and learning in the modern college science classroom. | 2006-2008 |
| Teaching Conferences Attended: American Association of Physics Teachers (AAPT) 2010 Summer Meeting Portland, OR. | July 2010 |
| American Association of Physics Teachers (AAPT) 2008 Summer Meeting Edmonton, AL (<i>Presenter</i>). | July 2008 |
| 2008 Teaching and Learning Symposium University of Wisconsin-Madison, Madison, WI (<i>Presenter</i>). | June 2008 |
| 2006 Teaching and Learning Symposium, University of Wisconsin-Madison, Madison, WI. | June 2006 |

Service:

- Organizer:** Physics Teaching Forum, UW-Madison 2006-2008
Created and led regularly meeting group of graduate students, scientists, and faculty from physics teaching community to discuss topics of interest and participate in exploratory activities in teaching.
- Co-Organizer:** GAANN Fellows Orientation Program, UW-Madison 2007
Designed a semester-long orientation and training program for Graduate Assistance in Areas of National Need (GAANN) Graduate Student Fellowship Program (U. S. Dept. of Education) on the teaching and outreach opportunities at UW-Madison.
- TA Trainer:** Physics Department, UW-Madison 2004-2006
Led TA training of small-group problem solving and presentation techniques.
- TA Trainer:** College of Engineering, UW-Madison 2006
Led TA training on "Motivating your Students" for Teaching Improvement Program.

Outreach:

- Wonders of Physics Theoretical Physics "Lab Tour":** UW-Madison 2006-2008
Designed public outreach presentation highlighting ideas in theoretical particle physics and cosmology for yearly department-wide Wonders of Physics outreach event.
- Mentoring:** High School Independent Research Project, Madison, WI 2007
Independent study with high school student on topics in knot theory.
- Science News:** UW-Madison 2006-2007
Helped science journalists David Shiga and Steve Nadis create science news for *New Scientist* *Space News* and *Astronomy* magazine based on my research.
- Producer, Director, Writer:** "Xperiment TV", Madison, WI 2004-2006
Led a team of graduate students in the creation of science and technology themed episodes for a cable-access TV program.
- Ohio Science Olympiad:** Ohio State University, Columbus, OH 2001-2003
Designed "Measurement and Estimation" events for State and National (2003) Science Olympiad.
- Wonders of Our World:** Ohio State University, Columbus, OH 2001-2002
Volunteer for hands-on science education program serving elementary schools in the Columbus, OH area. Explored science concepts like magnetism and sound with elementary school students using open-ended inquiry.

ACADEMIC HONORS, FELLOWSHIPS, AND AWARDS

- Institute for Particle Physics (IPP) Postdoctoral Fellowship 2008-2011
- McGill Lorne Trottier Fellowship 2008-2010
- Lesson Study Curriculum Development Grant, University of Wisconsin-La Crosse 2007
- "Exceptional Service" TA award (Campus-wide) at UW-Madison 2007
- Excellent* TA ratings (highest possible) for all four semesters of teaching 2003-2005
- Ohio State Arts and Sciences Award for Excellence in Scholarship 2003
- Smith Senior Alumni Award for Outstanding Senior Physics 2003
- Smith Research Scholarship for Promising Research 2002
- Smith Junior Award for Outstanding Junior Physics 2002

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| Sigma Pi Sigma Physics Honorary Society member | 2002 |
| Smith Sophomore Award for Outstanding Sophomore Physics | 2001 |
| Phi Beta Kappa Liberal Arts Society Member | 2001 |
| Helen Cowan Book Award for Outstanding Freshman Physics | 2000 |
| Alpha Lambda Delta Honor Society | 2000 |
| Phi Eta Sigma Honor Society | 2000 |
| National Society of Collegiate Scholars | 2000 |

RESEARCH EXPERIENCE AND SERVICE

Postdoctoral Research Fellow: McGill University 2008-2011
 Actively involved in theoretical cosmology and high energy physics research, organizer of weekly seminars on theoretical high energy physics, and mentoring of graduate students on research topics.

Seminar Organizer, High Energy Physics Group, McGill University 2009
 Invite and organize local and international speakers for weekly Theoretical High Energy Physics seminar.

Research Assistant: UW-Madison 2005-2008
 Actively involved in theoretical cosmology and high energy physics research for fulfillment of Ph. D.

Undergraduate Research Assistant: Ohio State University 2002-2003
 Applied ideas of renormalization to quantum mechanical scattering and bound state computations with “regularized” delta-function potentials.

Undergraduate Research Project: Green Bank Radio Observatory, Green Bank, WV 2002
 Undergraduate research project in astronomy (ERIRA) using a 40-foot radio telescope. Project included measuring the fading radio signal from the supernova remnant Cassiopeia A.

Referee for:
Physical Review D., Journal of High Energy Physics (JHEP), Journal of Cosmology and Astrophysics (JCAP), Classical and Quantum Gravity International Journal of Modern Physics A

Member, Professional & National Societies
 American Association of Physics Teachers (2009), Sigma Pi Sigma (2002), Phi Beta Kappa (2001)

Select International Conferences Attended:
 Aspen Summer Workshop: “Fingerprints of the Early Universe,” Aspen Center for Physics, Aspen, CO. June 2009.
 Phenomenology 2009, University of Wisconsin-Madison, Madison, WI. May 2009.
 Cosmo 2008, University of Wisconsin-Madison, Madison, WI. August 2008.
 Phenomenology 2008, University of Wisconsin-Madison, Madison, WI. May 2008.
 Particles, Strings, and Cosmology (PASCOS 07) Conference Imperial College, London, UK. July 2007.
 Phenomenology 2007, University of Wisconsin-Madison, Madison, WI. May 2007.
 Particles, Strings, and Cosmology (PASCOS 06) Conference, The Ohio State University, Columbus, OH. July 2006.
 Phenomenology 2006, University of Wisconsin-Madison, Madison, WI. May 2006.
 Phenomenology 2005, University of Wisconsin-Madison, Madison, WI. May 2005.
 String Phenomenology 2005, Perimeter Institute for Theoretical Physics, Waterloo, ON. April 2005.

PRESENTATIONS AND TALKS

Invited Talks

- "String Cosmology: Connecting the Physics of the Very-Big and the Very-Small," Pacific Lutheran University, Tacoma, WA. **March 2011**
- "String Cosmology: Connecting the Physics of the Very-Big and the Very-Small," University of Winnipeg, Winnipeg, Canada. **March 2011**
- "A Breathing Mode for Warped Compactifications," Seminar, Perimeter Institute, Waterloo, Canada. **March 2011**
- "A Breathing Mode for Warped Compactifications," Seminar, Universiteit Leiden, Leiden, Netherlands. **February 2011**
- "A Dynamical Landscape," Seminar, SPOCK Workshop, University of Cincinnati, Cincinnati, OH. **April 2010**
- "The Attractiveness of Higher Dimensional Kinetic Operators for Inflation," Seminar, Perimeter Institute, Waterloo, Canada. **December 2009**
- "The Attractiveness of Higher Dimensional Kinetic Operators for Inflation," Seminar, Cornell University, Ithaca, NY. **October 2009**
- "Effective Theories for Warped Compactifications," Seminar, Uppsala Universitat, Uppsala, Sweden. **August 2009**
- "A Warped/Minimal Understanding of String Vacua," Seminar, Michigan Center for Theoretical Physics, Ann Arbor, MI. **February 2009**
- "A Warped/Minimal Understanding of String Vacua," Seminar, McGill University, Montreal, QC. **January 2009**
- "String Phenomenology: Cosmology and Particle Physics," Seminar, McGill University, Montreal, QC. **December 2007**
- "String Phenomenology: Cosmology and Particle Physics," Seminar, Perimeter Institute for Theoretical Physics. **December 2007**
- "Geometry in Brane Inflation," Seminar, Columbia University. **March 2007**
- "Geometry in Brane Inflation," Seminar, University of Wisconsin-Madison. **February 2007**
- "Geometry in Brane Inflation," Seminar, University of Cincinnati. **January 2007**

Contributed Talks

- "A Breathing Mode for Warped Compactifications," String Vacuum Project The Ohio State University, Columbus, OH. **November 2010**
- "Aspects of Non-Canonical Inflation," Canadian Association of Physicists 2010, Toronto, ON **June 2010**
- "Minimal de Sitter Vacua," Phenomenology 2009, University of Wisconsin-Madison. **May 2009**
- "Warped Throats at the LHC", Particles, Strings, and Cosmology (PASCOS 07) Conference, Imperial College, London, UK. **July 2007**
- "Warped Throats at the LHC", Student Seminar, TASI 2007, University of Colorado, Boulder. **June 2007**
- "DBI Inflation in Warped Throats," Particle, Strings, and Cosmology (PASCOS 06) Conference, The Ohio State University. **May 2006**
- "Steps Towards Reheating in D-D-bar Inflation", Great Lakes String **April 2006**

Conference, University of Michigan.

“Renormalization of the n-dimensional delta function potential”, Denmark **May 2003**

Undergraduate Research Forum, The Ohio State University.

PUBLICATIONS

Note: It is common in Theoretical High Energy Physics research papers to list authors alphabetically, so the order of authorship does not correspond to the level of involvement in research.

- J. Karouby, B. Underwood, A. Vincent, "Preheating with the Brakes On: The Effects of a Speed Limit, *Physical Review* **D84** 043528 (2011), arXiv: 1105.3982 [hep-th].
- B. Underwood, "A Breathing Mode for Warped Compactifications," *Classical and Quantum Gravity* **28**, 195013 (2011), arXiv: 1009.4200 [hep-th].
- P. Franche, R. Gwyn, B. Underwood and A. Wissanji, "Initial Conditions for Non-Canonical Inflation," *Physical Review* **D82**, 063528 (2010), arXiv:1002.2639 [hep-th].
- P. Franche, R. Gwyn, B. Underwood and A. Wissanji, "Attractive Lagrangians for Non-Canonical Inflation," *Physical Review* **D81**, 123526 (2010), arXiv:0912.1857 [hep-th].
- S. Horibe and B. Underwood, "Making connections to the 'real world': a model building lesson," *Physics Education* **44** (2009) 633-638. The full lesson can be found online at <http://www.cfkeep.org/html/snapshot.php?id=40122035462523>.
- J. M. Cline, L. Hoi and B. Underwood, "Dynamical Fine Tuning in Brane Inflation," *Journal of High Energy Physics*, **0906**, 078 (2009), arXiv:0902.0339 [hep-th].
- A. R. Frey, G. Torroba, B. Underwood and M. R. Douglas, "The Universal Kahler Modulus in Warped Compactifications," *Journal of High Energy Physics*, **0901**, 036 (2009), arXiv:0810.5768 [hep-th].
- S. S. Haque, G. Shiu, B. Underwood and T. Van Riet, "Minimal simple de Sitter solutions," *Physical Review D* **79**, 086005 (2009), arXiv:0810.5328 [hep-th].
- G. Shiu, G. Torroba, B. Underwood and M. R. Douglas, "Dynamics of Warped Flux Compactifications," *Journal of High Energy Physics*, **0806**, 024 (2008), arXiv:0803.3068 [hep-th].
- B. Underwood, "Brane Inflation is Attractive," *Physical Review D* **78**, 023509 (2008), arXiv:0802.2117 [hep-th].
- M. Huang, G. Shiu, B. Underwood, "Multifield DBI Inflation and Non-Gaussianities," *Physical Review D* **77**, 023511 (2008), arXiv:0709.3299 [hep-th].
- G. Shiu, B. Underwood, D. Walker, K. Zurek, "Probing the Geometry of Warped String Compactifications at the LHC," *Physical Review Letters*, **100**, 031601 (2008), arXiv:0705.4097 [hep-th].
- O. DeWolfe, L. McAllister, G. Shiu, B. Underwood, "D3-brane Vacua in Stabilized Compactifications," *Journal of High Energy Physics*, **0709** 121 (2007), arXiv:hep-th/0703088.
- G. Shiu, B. Underwood, "Observing the Geometry of Warped Compactification via Cosmic Inflation," *Physical Review Letters*, **98**, 051301 (2007), arXiv:hep-th/0610151.
- S. Kecskemeti, J. Maiden, G. Shiu, B. Underwood, "DBI Inflation in the Tip Region of a Warped Throat," *Journal of High Energy Physics*, **0609**, 076 (2006), arXiv:hep-th/0605189.
- D. Chialva, G. Shiu, B. Underwood, "Warped Reheating in Multithroat Brane Inflation," *Journal of High Energy Physics*, **0601** 014 (2006), arXiv:hep-th/0508229.
- Undergraduate Senior Thesis: B. Underwood, "Renormalization of the n -dimensional delta function potential".