

CURRICULUM VITAE

MATTHEW TURK

CONTACT INFORMATION

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EDUCATION

- 08/2004–present **PhD candidate**, Department of Physics, Stanford University. Member, Kavli Institute for Particle Astrophysics and Cosmology.
Specialization: Computational Astrophysics with an emphasis on high-resolution studies of the formation and development of the first stars in the Universe.
Thesis: “Computational Studies of Primordial Protostar Formation”
Advisor: Prof. Tom Abel.
- 09/2003–08/2004 **PhD candidate**, Department of Astronomy and Astrophysics, Pennsylvania State University.
- 09/1999–06/2003 **BA in Math and Astrophysics**, Northwestern University, Evanston, Illinois.
Honors Thesis: *A Search for Small-Scale Structure in the Interstellar H₂ Gas Toward the HD206267 Multiple Star System.*
Supervisor: Prof. D. Meyer
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WORK EXPERIENCE

- 09/2004–present Graduate Research Assistant, Kavli Institute for Particle Astrophysics and Cosmology, Stanford University
- 09/2006–present Webmaster, Stanford Graduate Student Council.
- 09/2003–06/2004 Graduate Teaching Assistant, Penn State University
- 06/2002–09/2003 Systems developer for Gentoo Linux, Inc. Responsible for maintenance of L^AT_EX, T_EX, SGML, and other text-related packages.
- 01/2001–06/2003 Senior peer facilitator for the Department of Physics and Astronomy at Northwestern University. Hosted weekly sessions for undergraduate students of calculus-based introductory physics. Further responsibilities include worksheet authorship and program design.
- 01/1999–09/2001 Planetarium technician, Van Andel Museum Center, Grand Rapids, MI. Responsible for live show-running and show design and programming in the Roger B. Chaffee Planetarium.

PROFESSIONAL ACTIVITIES

- 10/2007 Visiting affiliate, Kavli Institute for Theoretical Physics, UC Santa Barbara
- 04/2007–09/2007 Visiting student at Los Alamos National Laboratory, Theoretical Astrophysics division, under Dr. Brian O’Shea and Dr. Alex Heger
- 08/2007 Stanford High Performance Computing Conference III
- 08/2007 Star Formation Through Cosmic Time Conference, Kavli Institute for Theoretical Physics, UC Santa Barbara
- 07/2007 First Stars III Conference, Santa Fe, New Mexico
- 07/2007 Santa Fe Cosmology Workshop, Santa Fe, New Mexico
- 10/2006 Radiation Backgrounds from the First Stars, Galaxies and Black Holes Conference, University of Maryland
- 06/2007–07/2007 Visiting affiliate, Institute for Nuclear Theory, Seattle, Washington
- 10/2005 Protostars and Planets V Conference, Kona, Hawaii
- 05/2005 Conference on Visualization of Astrophysical Data: Bringing Together Science, Art, & Education, Kavli Institute for Cosmological Physics, University of Chicago
- 03/2005–06/2005 Core participant, Institute for Pure and Applied Mathematics program on Problems in Computational Astrophysics, UCLA
- 04/2004 Gamma Ray Burst Science Before *Swift* Conference, Penn State University

HONORS AND AWARDS

- Braddock-Roberts Graduate Research Fellowship, 2003
- NASA Research Experience for Undergrads Summer, 2002
- National Society of Collegiate Scholars, 2000
- Dean’s List, Northwestern University, 2000-2003
- Alpha Lambda Delta Honor Society, 2002

PROFESSIONAL INTERESTS

- The formation of primordial stars
- Chemistry in the early universe, including metal-free and metal-poor cooling models
- Enrichment of the early intergalactic medium
- Transitioning between fundamental modes of star formation
- Generation of high-resolution cosmological initial conditions
- Bridging simulational and observation domains
- Analysis and scientific visualization of massive datasets using Python
- Generation of realistic observable quantities and images from simulation data
- Agile software development techniques applied to scientific computing
- Petascale computing platforms and algorithms

RESEARCH EXPERIENCE

Studying the formation of protogalaxies

Created primordial chemistry module to work from background densities through protostellar densities

Creator and maintainer of the Python-based yt toolkit for analysis of massive adaptive-mesh refinement datasets generated by both the Enzo and Orion codes. Have developed extensive network of plugins for analysis and visualization of multi-resolution data, and fostered the growth of a community of users and developers.
(<http://yt.enzotools.org/>)

Developing pipeline for generation of mock-observations from adaptive mesh refinement simulations

Developing in-line analysis and visualization tools for large scale physics codes such as Enzo

Extended Enzo Adaptive Mesh Refinement code to work over 42 levels of refinement

Member, Enzo 1.5 release team

OUTREACH EXPERIENCE

Experience designing and assembling stereoscopic visualization systems from commodity parts

Lead presenter, KIPAC Visualization Laboratory

Designed presentations for SLAC Kids' day, using 3D stereoscopic visualization system

Substantial experience interacting with and presenting astronomical concepts to elementary through high school age students

Substantial experience presenting astronomical concepts and visualizations to visiting guests and dignitaries

Designed and implemented real-time Gravitational Lensing software for education.
(<http://www.stanford.edu/~mturk/gloyd/index.html>)

PUBLICATIONS

O'Shea, B., Turk, M., & Abel, T., "The Effects of Magnetic Fields on Population III Star Formation," *Astrophysical Journal*, in preparation, January 2009 expected submission.

Turk, M., Clark, P., Glover, S.C.O., Greif, T., Abel, T., Klessen, R., "Effects of Varying 3-Body Molecular Hydrogen Formation Rate in Primordial Star Formation," *Astrophysical Journal*, in preparation, December 2008 expected submission.

Turk, M., & Abel, T., & O'Shea, B., "Disk Formation in High Resolution Simulations of Primordial Star Formation," *Astrophysical Journal*, in preparation, December 2008 expected submission.

Smith, S., Turk, M., Sigurdsson, S., O'Shea, B., Norman, M., "Three Modes of Metal-Enriched Star Formation in the Early Universe," *Astrophysical Journal* (accepted)

Matthew Turk

Turk, M., “Analysis and Visualization of Multi-Scale Astrophysical Simulations Using Python and NumPy,” In Proceedings of the 7th Python in Science Conference, 2008.

Turk, M., Abel, T., & O’Shea, B. “Toward Forming a Primordial Star in a Cosmological AMR Simulation,” In Proceedings of First Stars III, Eds. B. O’Shea, A. Heger & T. Abel, AIP conference proceedings series, 2007.

Wise, J., Turk, M., & Abel, T. 2007, “Resolving the Formation of Protogalaxies. II. Central Gravitational Collapse,” *The Astrophysical Journal*, Volume 682, Issue 2, pp. 745-757

INVITED TALKS

“Extremely High-Resolution Simulations of Early Universe Cosmological Phenomena,” *Stanford High Performance Computing Conference III*, August 2007.

Turk, M., “New results from high resolution AMR simulations of Pop III star formation,” *First Stars III Conference*, July 2007.

CONTRIBUTED TALKS AND POSTERS

Turk, M., “Extremely High Resolution AMR Simulations,” *Joint European and National Astronomy Meeting 2008*, September 2008.

Turk, M., “Analysis and Visualization of Multi-Scale Astrophysical Simulations using Python and NumPy,” *7th Annual Python in Science Conference*, August 2008.

Turk, M., & Abel, T., “Extending the Physical Model of Simulations of the First Stars,” *Radiation Backgrounds from the First Stars, Galaxies and Black Holes*, 2006.

Turk, M., & Abel, “Ab Initio Formation of Primordial Protostars,” *Proceedings of Protostars and Planets V*, 2005.

POPULAR PRESENTATIONS AND PUBLICATIONS

Provided visualizations, “The Secret Lives of Stars,” *symmetry Magazine*, September 2005

Provided visualizations, “A Star is Born,” *Discover Magazine*, December 2005