

Sean Michael Couch
Curriculum Vitae – February 2016

Current Address

Department of Physics and Astronomy
Michigan State University
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Education

May, 2010 **Ph.D.**, Astrophysics, The University of Texas at Austin
Advisors: J. Craig Wheeler & Milos Milosavljević

Aug, 2008 **M.A.**, Astrophysics, The University of Texas at Austin

May, 2006 **B.S. Magna Cum Laude**, Physics, Minor in Astronomy, Butler University

Appointments

2015 – **Assistant Professor**
Department of Physics and Astronomy
Department of Computational Mathematics, Science, and Engineering
National Superconducting Cyclotron Laboratory/Facility for Rare Isotope Beams
Michigan State University

2015 – **Senior Investigator**
Joint Institute for Nuclear Astrophysics
Michigan State University

2014 – 2015 **Senior Postdoctoral Scholar**
Theoretical AstroPhysics Including Relativity
California Institute of Technology, Sponsor: Christian D. Ott

2011 – 2014 **Hubble Fellow**
2010 – 2011 **Postdoctoral Scholar**
Flash Center for Computational Science, Department of Astronomy & Astrophysics
University of Chicago, Faculty contact: Donald Q. Lamb

Honors and Awards

2011 NASA Hubble Fellowship

2010 UT Astronomy Department Outstanding Dissertation Award

2010 AAS Chambliss Astronomy Achievement Student Award

2009 NASA Earth and Space Sciences Fellowship

2008 ACM-IEEE CS George Michael Memorial HPC Fellowship Honorable Mention

2008 McDonald Observatory Board of Visitors Outstanding Second-Year Oral Defense

2008	NSF Student Representative at Lindau Meeting of Nobel Laureates
2007	NSF Graduate Research Fellowship Honorable Mention
2006	UT Graduate Recruitment Fellowship

Professional Associations

American Astronomical Society
 American Physical Society

Synergistic Activities

Leader, VERACity code comparison project, <http://github.com/smcouch/veracity>
 Referee for Astrophysical Journal, Monthly Notices of the Royal Astronomical Society, Astronomy & Astrophysics, Journal of Cosmology and Astropartical Physics
 Expert Participant, Astronomy on Tap Lansing outreach effort
 Undergraduate Research Mentor, Michigan State University
 Developer, FLASH open-source simulation framework

Refereed Publications

[All publications on ADS](#)

22. 2015 E.P. O'Connor, **S.M. Couch**, "Two Dimensional Core-Collapse Supernova Explosions Aided by General Relativity with Multidimensional Neutrino Transport," submitted to ApJ, arXiv:1511.07443, [arXiv](#)
21. 2015 D. Radice, C.D. Ott, E. Abdikamalov, **S.M. Couch**, R. Haas, E. Schnetter, "Neutrino-Driven Convection in Core-Collapse Supernovae: High-Resolution Simulations," submitted to ApJ, arXiv:1510.05022, [arXiv](#)
20. 2015 V. Morozova, A.L. Piro, M. Renzo, C.D. Ott, D. Clausen, **S.M. Couch**, J. Ellis, L.F. Roberts, "Light Curves of Core-Collapse Supernovae with Substantial Mass Loss using the New Open-Source SuperNova Explosion Code (SNEC)," ApJ, 814, 63, [ADS](#)
19. 2015 **S.M. Couch**, E. Chatzopoulos, W.D. Arnett, F.X. Timmes, "The Three Dimensional Evolution to Core Collapse of a Massive Star," ApJL, 808, L21, [ADS](#)
18. 2015 D. Radice, **S.M. Couch**, C.D. Ott, "Implicit Large Eddy Simulations of Anisotropic Weakly Compressible Turbulence with Application to Core-Collapse Supernovae," CompAC, 2, 7, [arXiv](#)
17. 2015 **S.M. Couch**, C.D. Ott, "The Role of Turbulence in Neutrino-driven Core-collapse Supernova Explosions," ApJ, 799, 5, [ADS](#)
16. 2014 E. Chatzopoulos, C. Graziani, **S.M. Couch**, "Characterizing the Convective Velocity Fields in Massive Stars," ApJ, 795, 139, [ADS](#)
15. 2014 **S.M. Couch**, E.P. O'Connor, "High-resolution Three-dimensional Simulations of the Core-collapse Supernovae in Multiple Progenitors," ApJ785, 123, [ADS](#)

14. 2013 R.T. Wollaeger, D.R. van Rossum, C. Graziani, **S.M. Couch**, G.C. Jordan IV, D.Q. Lamb, G.A. Moses, “Radiation Transport for Explosive Outflows: A Multigroup Hybrid Monte Carlo Method,” *ApJS*, 209, 63, [ADS](#)
13. 2013 **S.M. Couch**, C. Graziani, N. Flocke, “An Improved Multipole Approximation for Self-gravity and Its Importance for Core-collapse Supernova Simulations,” *ApJ*, 778, 181, [ADS](#)
12. 2013 **S.M. Couch**, C.D. Ott, “Revival of the Stalled Core-collapse Supernova Shock Triggered by the Precollapse Asphericity in the Progenitor Star,” *ApJL*, 778, L7, [ADS](#)
11. 2013 E. Chatzopoulos, J.C. Wheeler, **S.M. Couch**, “Multi-dimensional Simulations of Rotating Pair-instability Supernovae,” *ApJ*, 776, 129, [ADS](#)
10. 2013 **S.M. Couch**, “On the Impact of Three Dimensions in Simulations of Neutrino-driven Core-collapse Supernova Explosions,” *ApJ*, 775, 35, [ADS](#)
9. 2013 **S.M. Couch**, “The Dependence of the Neutrino Mechanism of Core-collapse Supernovae on the Equation of State,” *ApJ*, 765, 29, [ADS](#)
8. 2011 **S.M. Couch**, D. Pooley, J.C. Wheeler, M. Milosavljević, “Aspherical Supernova Shock Breakout and the Observations of Supernova 2008D,” *ApJ*, 727, 104, [ADS](#)
7. 2010 H.N. Cohn, P.M. Lugger, **S.M. Couch**, J. Anderson, A.M. Cool, M. van den Berg, S. Bogdanov, C.O. Heinke, J.E. Grindlay, “Identification of Faint Chandra X-ray Sources in the Core-collapsed Globular Cluster NGC 6397: Evidence for a Bimodal Cataclysmic Variable Population,” *ApJ*, 722, 20, [ADS](#)
6. 2010 C.C. Lindner, M. Milosavljević, **S.M. Couch**, P. Kumar, “Collapsar Accretion and the Gamma-Ray Burst X-Ray Light Curve,” *ApJ*, 713, 800, [ADS](#)
5. 2009 M. Milosavljević, V. Bromm, **S.M. Couch**, S.P. Oh, “Accretion onto ”Seed” Black Holes in the First Galaxies,” *ApJ*, 698, 766, [ADS](#)
4. 2009 M. Milosavljević, **S.M. Couch**, V. Bromm, “Accretion Onto Intermediate-Mass Black Holes in Dense Protogalactic Clouds,” *ApJL*, 696, L146, [ADS](#)
3. 2009 **S.M. Couch**, J.C. Wheeler, M. Milosavljević, “Aspherical Core-Collapse Supernovae in Red Supergiants Powered by Nonrelativistic Jets,” *ApJ*, 696, 953, [ADS](#)
2. 2008 **S.M. Couch**, M. Milosavljević, E. Nakar, “Shock Vorticity Generation from Accelerated Ion Streaming in the Precursor of Ultrarelativistic Gamma-Ray Burst External Shocks,” *ApJ*, 688, 462, [ADS](#)
1. 2008 J.C. Wheeler, J.R. Maund, **S.M. Couch**, “The Shape of Cas A,” *ApJ*, 677, 1091, [ADS](#)

Conference Proceedings

18. 2015 V. Giryanskaya, C.D. Ott, A. Prio, M. Renzo, **S.M. Couch**, D. Clausen, J. Ellis, L. Roberts, “The Supernova Explosion Code (SNEC),” April meeting of the American Physical Society, E2.007, [ADS](#)
17. 2015 D. Radice, C.D. Ott, E. Abdikamalov, **S.M. Couch**, R. Haas, E. Schnetter, “Neutrino-driven turbulent convection in stalled supernova cores,” April meeting of the American Physical Society, E2.006, [ADS](#)

16. 2014 E. Chatzopoulos, J.C. Wheeler, **S.M. Couch**, “Multidimensional Simulations of Rotating Pair Instability Supernovae,” 223rd Meeting of the American Astronomical Society, 335.06, [ADS](#)
15. 2014 **S.M. Couch**, C.D. Ott, “Revival of The Stalled Core-Collapse Supernova Shock Triggered by Pre-collapse Asphericity in the Progenitor Star,” 223rd Meeting of the American Astronomical Society, 216.05, [ADS](#)
14. 2013 **S.M. Couch**, “Three-Dimensional Simulations of Core-Collapse Supernovae,” 222nd Meeting of the American Astronomical Society, 209.01, [ADS](#)
13. 2012 N. Flocke, J. Bachan, **S.M. Couch**, C. Daley, A. Dubey, M. Fatenejad, C. Graziani, D. Lamb, D. Lee, A. Scopatz, P. Tzeferacos, K. Weide, “Improvements to the FLASH Laser Energy Deposition Package,” 54th Annual Meeting of the American Physical Society Division of Plasma Physics, CP8.082, [ADS](#)
12. 2012 M. Fatenejad, J. Bachan, **S.M. Couch**, C. Daley, A. Dubey, N. Flocke, C. Graziani, D. Lamb, D. Lee, A. Scopatz, P. Tzeferacos, K. Weide, “Improvements to the FLASH Code for Simulating HEDP Experiments,” 54th Annual Meeting of the American Physical Society Division of Plasma Physics, CP8.081, [ADS](#)
11. 2012 **S.M. Couch**, “The Critical Neutrino Luminosity in Rotating Core-Collapse Supernovae,” 219th Meeting of the American Astronomical Society, 436.06, [ADS](#)
10. 2012 E. Chatzopoulos, J.C. Wheeler, J. Vinko, D.S.P. Dearborn, **S.M. Couch**, “Properties Of Superluminous Supernovae: Insights From Observations, Light Curve Modeling And Simulations,” 219th Meeting of the American Astronomical Society, 242.03, [ADS](#)
9. 2011 S. Kumar, J. Bachan, **S.M. Couch**, C. Daley, A. Dubey, M. Fatenejad, N. Flocke, C. Graziani, D.Q. Lamb, D. Lee, K. Weide, “Improvements to the High Energy Density Physics Capabilities in FLASH,” 53rd Annual Meeting of the American Physical Society Division of Plasma Physics, GP9.131, [ADS](#)
8. 2010 A. Dubey, E. Balaras, **S.M. Couch**, C. Daley, S. Gopal, C. Graziani, D. Lamb, D. Lee, M. Vanella, K. Weide, G. Xia, “FLASH Capabilities, Architecture, and Future Directions,” 52nd Annual Meeting of the American Physical Society Division of Plasma Physics, XP9.021, [ADS](#)
7. 2010 D.Q. Lamb, **S.M. Couch**, A. Dubey, S. Gopal, C. Graziani, D. Lee, K. Weide, G. Xia, “Making FLASH an Open Code for the Academic High-Energy Density Physics Community,” 52nd Annual Meeting of the American Physical Society Division of Plasma Physics, PO8.010, [ADS](#)
6. 2010 A. Dubey, **S.M. Couch**, “Implementation of Laser Energy Deposition in FLASH,” 52nd Annual Meeting of the American Physical Society Division of Plasma Physics, NP9.058, [ADS](#)
5. 2010 **S.M. Couch**, J.C. Wheeler, D. Pooley, M. Milosavljević, “Aspherical Supernova Shock Breakout and the Observations of Supernova 2008D,” 215th Meeting of the American Astronomical Society, 430.03, [ADS](#)
4. 2009 **S.M. Couch**, J.C. Wheeler, M. Milosavljević, “Simulations of Jet-Induced Supernovae and Comparison with Observations,” 213th Meeting of the American Astronomical Society, 490.08, [ADS](#)
3. 2008 **S.M. Couch**, J.C. Wheeler, M. Milosavljević, “Hydrodynamic Instabilities in Jet-Induced Supernovae: Results of 2D Simulations,” New Horizons in Astronomy: Frank N. Bash Symposium, ASP Conference Series, 393, 183, [ADS](#)

2. 2007 **S.M. Couch**, J.C. Wheeler, M. Milosavljević, “Hydrodynamic Instabilities in Jet-Induced Supernovae,” 211th Meeting of the American Astronomical Society, 105.18, [ADS](#)
1. 2005 **S.M. Couch**, H.N. Cohn, P.M. Lugger, A.M. Cool, J. Anderson, “Identification of Cataclysmic Variables in the Collapsed-Core Globular Cluster NGC 6397,” 207th Meeting of the American Astronomical Society, 70.03, [ADS](#)

Invited Talks

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| <i>December 2015</i> | “Simulations of Supernovae and Their Massive Star Progenitors in 3D,” Theoretical Physics Seminar, Technische Universität Darmstadt, Darmstadt, Germany |
| <i>November 2015</i> | “Simulations of Supernovae and Their Massive Star Progenitors in 3D,” Astronomy Seminar, University of Notre Dame, Notre Dame, IN |
| <i>October 2015</i> | “Core-collapse Supernovae as Nuclear Physics Laboratories,” Nuclear Science Seminar, National Superconducting Cyclotron Laboratory, East Lansing, MI |
| <i>September 2015</i> | “Simulations of Supernovae and Their Massive Star Progenitors in 3D,” Physics Seminar, Oak Ridge National Laboratory, Oak Ridge, TN |
| <i>April 2015</i> | “Turbulent Frontiers in Massive Stellar Death,” Astronomy Colloquium, California Institute of Technology, Pasadena, CA |
| <i>March 2015</i> | “Turbulent Frontiers in Massive Stellar Death,” Center for Astrophysics and Space Sciences Seminar, University of California San Diego, San Diego, CA |
| <i>February 2015</i> | “Turbulent Frontiers in Massive Stellar Death,” Astrophysics Seminar, Michigan State University, East Lansing, MI |
| <i>January 2015</i> | “Turbulent Frontiers in Massive Stellar Death,” Physics Colloquium, University of Washington, Seattle, WA |
| <i>January 2015</i> | “Turbulent Frontiers in Massive Stellar Death,” Physics Colloquium, North Carolina State University, Raleigh, NC |
| <i>November 2014</i> | “Supernovae Are Turbulent Beasts: The Crucial Role of Turbulence in Core-collapse Supernova Explosions,” F.L.A.S.H. Seminar, University of California Santa Cruz, Santa Cruz, CA |
| <i>November 2014</i> | “Supernovae Are Turbulent Beasts: The Crucial Role of Turbulence in Core-collapse Supernova Explosions,” Astrophysics Seminar, Lawrence Berkeley National Lab, Berkeley, CA |
| <i>October 2014</i> | “At the Edge of Explosion: Simulating the Violent Deaths of Massive Stars,” Physics Colloquium, Butler University, Indianapolis, IN |
| <i>February 2014</i> | “At the Edge of Explosion: Simulating the Violent Deaths of Massive Stars,” Theoretical Astrophysics Seminar, University of Arizona, Tucson, AZ |
| <i>January 2014</i> | “Towards Supernova Explosions,” Review Talk at GRB/SN/Magnetar Thinkshop, Bormio, Italy |
| <i>July 2013</i> | “Post-doctoral Petascale Computing or: How I Learned to Stop Worrying and Blow Up Stars,” Dinner Talk at Argonne Training Program in Extreme Scale Computing, St. Charles, IL |
| <i>May 2013</i> | “Three-Dimensional Core-collapse Supernovae,” Caltech TAPIR Seminar, Pasadena, CA |

- April 2013* “Three-Dimensional Core-collapse Supernovae,” Ohio State University CCAPP Seminar, Columbus, OH
- April 2013* “Three-Dimensional Core-collapse Supernovae,” Michigan State University Astronomy Seminar, East Lansing, MI
- February 2013* “Core-collapse Supernova Simulations,” University of Texas at Austin Astronomy Colloquium, Austin, TX

Teaching

- Spring 2016* Instructor, Graduate Stellar Astrophysics, Michigan State University
- August 2015* Lecturer, Argonne Training Program in Extreme Scale Computing
- August 2013* Lecturer, Argonne Training Program in Extreme Scale Computing
- July 2011* Lecturer, UC-HIPACC Summer School in Computational Explosive Astrophysics