



Michael Guidry

Personal Information

Name: Michael Wayne Guidry

Position: Professor of Physics and Astronomy, University of Tennessee;
Adjunct Staff Member (retired), Physics Division and Computer Science
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Educational Background

B. S. in Chemistry, McNeese State University (1970)
Doctorate in Chemistry, University of Tennessee (1974)

Employment History

Scientist in Residence, Lawrence Berkeley Lab, Univ. of California, Berkeley (1974-1976)
Faculty, Department of Physics and Astronomy, Univ. of Tennessee (1976 – present)
Adjunct Staff Member, Oak Ridge National Lab (1976 – 2014)
Visiting Professor, Niels Bohr Institute, Copenhagen (1979 – 1980)
Visiting Professor, University of Liverpool (Summer, 1983)
Visiting Professor, University of Basel (Summer, 1998)

Career Synopsis

Mike Guidry is the author of more than 200 journal publications and invited conference presentations, 3 published textbooks, and 3 textbooks in advanced preparation. These address topics in nuclear physics, computational science, advanced educational technology, astronomy, astrophysics, cosmology, general relativity, the mathematics of symmetry in physics, elementary particle physics, relativistic quantum field theory, and condensed matter physics. He has been the lead educational technology developer for a 7 major college textbooks (with multiple editions) in introductory physics, astronomy, biology, genetics, and microbiology, and in projects as diverse as training K-12 teachers to use educational technology effectively and explaining the science behind weapons of mass destruction for emergency first responders. He has developed an online course and conducted workshops in programming modern mobile devices for scientific and educational applications. His primary current research interests lie in development of new algorithms for solving large coupled sets of differential equations in scientific applications, understanding the mechanism for Type Ia supernovae, and developing new many-body techniques for understanding high-temperature superconductors and other strongly-correlated electron systems, and in developing new approaches to quantum Hall physics in graphene. He has won various teaching awards and is responsible for many Web-based and conventional initiatives introducing and explaining science to the public.

Selected Journal Publications

"SU(3) symmetry and scissors mode vibrations in nuclei", Yang Sun, Cheng-Li Wu, Kumar Bhatt and Mike Guidry, Nuclear Physics A 703 (1-2), 130 (2002).

"Microscopic description of band structure at very extended shapes in the A~110 mass region", C.-T. Lee, Y. Sun, J.-y. Zhang, M. Guidry, and C.-L. Wu, Phys. Rev. C 65, R041301 (2002)

"SO(5) as a critical dynamical symmetry in the SU(4) model of high-temperature superconductivity," L.-A. Wu, M. Guidry, Y. Sun, and C.-L. Wu, Phys. Rev. B 67, 014515 (2003)

"Impact of a new $^{17}\text{F}(p,\gamma)$ reaction rate on nova nucleosynthesis", S. Parete-Koon, W.R. Hix, M.S. Smith, S. Starrfield, D.W. Bardayan, M.W. Guidry & A. Mezzacappa, Astrophysical Journal 598, 1239-1245 (2003).

"Mott Insulators, No-Double-Occupancy, and Non-Abelian Superconductivity", M. W. Guidry, Y. Sun, and C.-L. Wu, Phys. Rev. B 70, 184501 (2004).

"Temperature-Dependent Gap Equations and Their Solutions in the SU(4) Model of High-Temperature Superconductivity", Y. Sun, M. W. Guidry, and C.-L. Wu, Phys. Rev. B 73, 134519 (2006).

"First experimental constraints on the interference of $(3/2)^+$ resonances in the $^{18}\text{F}(p,\alpha)^{15}\text{O}$ reaction", K.-Y. Chae, et al, Phys. Rev. C 74, 012801(R) (2006).

"New Approach to the Solution of Large Thermonuclear Networks", M. W. Guidry, Proc. Science, PoS (NIC-IX), 107 (2007).

"Pairing Gaps, Pseudogaps, and Phase Diagrams for Cuprate Superconductors", Y. Sun, M. W. Guidry, and C.-L. Wu, Phys. Rev. B75, 134511 (2007).

"k-dependent SU(4) model of high-temperature superconductivity and its coherent state solutions", Y. Sun, M. W. Guidry, and C.-L. Wu, Phys. Rev. B78, 174524 (2008)

"A New Family of High T_c Compounds---Stepping Stones Toward Understanding Unconventional Superconductivity", Y. Sun, M. W. Guidry, and C.-L. Wu, Chinese Science Bulletin, 53, 1617 (2009) [invited News and Views column]

"Strong anisotropy of cuprate pseudogap correlations: implications for Fermi arcs and Fermi pockets", M. W. Guidry, Y. Sun, and C.-L. Wu, New J. Phys. 11, 123023 (2009).

"A Unified Description of Cuprate and Iron Arsenide Superconductors", M. W. Guidry, Y. Sun, and C.-L. Wu, Front. Phys. China 4, 233 (2009) [invited contribution, special volume]

"Generalizing the Cooper Pair Instability to Doped Mott Insulators", Mike Guidry, Yang Sun, and Cheng-Li Wu, Front. Phys. China, 5(2), 171-175 (2010).

"Two-quasiparticle K-isomeric states in strongly-deformed; neutron-rich Nd and Sm isotopes: a projected shell model analysis", Ying-Chun Yang, Yang Sun, Sheng-Jiang Zhu, Mike Guidry, and Cheng-Li Wu, J. Phys. G 37, 085110 (2010).

"Constraints Imposed by Symmetry on Pairing Operators for the Pnictides", Xiaoyu Wang, Maria Daghofer, Andrew Nicholson, Adriana Moreo, Michael Guidry, and Elbio Dagotto, Phys. Rev. B81, 144509 (2010)

"Algebraic Stabilization of Explicit Numerical Integration for Extremely Stiff Reaction Networks", M. W. Guidry, J. Comp. Phys. 231, 5266-5288 (2012) ([arXiv:1112.4778](https://arxiv.org/abs/1112.4778)).

"Explicit Integration of Extremely-Stiff Reaction Networks: Asymptotic Methods", M. W. Guidry, R. Budiardja, E. Feger, J. J. Billings, W. R. Hix, O. E. B. Messer, K. J. Roche, E. McMahon, M. He, Comput. Sci. Disc. 6, 015001 (2013) ([arXiv:1112.4716](https://arxiv.org/abs/1112.4716)).

"Explicit Integration of Extremely-Stiff Reaction Networks: Quasi-Steady-State Methods", M. W. Guidry and J. A. Harris, Comput. Sci. Disc. 6, 015002 (2013) ([arXiv:1112.4750](https://arxiv.org/abs/1112.4750)).

"Explicit Integration of Extremely-Stiff Reaction Networks: Partial Equilibrium Methods ", M. W. Guidry, J. J. Billings, and W. R. Hix, Comput. Sci. Disc. 6, 015003 (2013) ([arXiv:1112.4738](https://arxiv.org/abs/1112.4738)).

Inhomogeneity, Dynamical Symmetry, and Complexity in High-Temperature Superconductors: Reconciling a Universal Phase Diagram with Rich Local Disorder, M. W. Guidry, Y. Sun, and C.-L. Wu, Chinese Science Bulletin, 56, 367-371 (2011).

Ash-detonation interactions in multi-dimensional simulation of Type Ia supernovae, S T Parete-Koon, C R Smith, M W Guidry, W R Hix, O E B Messer, refereed contribution to Conference On Computational Physics, Gatlinburg (Dec., 2011); published in J. Phys.: Conf. Ser. 402 012028 (2012).

The Physics and Astrophysics of Type Ia Supernovae (Editorial introduction and topic synopsis for special section), Mike Guidry and Bronson Messer, *Frontiers of Physics* 8, 111 (2013).

The Physics and Astrophysics of Type Ia Supernova Explosions, invited special section of *Frontiers of Physics* Volume 8, April, 2013, pp. 111-216, Mike Guidry and Bronson Messer, editors.

Superconductivity and Superfluidity as Universal Emergent Phenomena, Mike Guidry and Yang Sun, *Front. Phys.* 10, 107404 (2015).

Explicit Integration with GPU Acceleration for Large Kinetic Networks, Benjamin Brock, Andrew Belt, Jay Billings, and Mike Guidry, *J. Comp. Phys.* 302, 591 (2015). (arXiv:1409.5826).

The Ground State of Monolayer Graphene in a Strong Magnetic Field, Lian-Ao Wu and Mike Guidry, *Sci. Rep.* 6, 22423 (2016) (arXiv: 1508.03584).

Efficient GPU Acceleration for Integrating Large Thermonuclear Networks in Astrophysics. Mike Guidry, *EPJ Web of Conf.* 109, 06003 (2016).

SO(8) Fermion Dynamical Symmetry and Strongly-Correlated Quantum Hall States in Monolayer Graphene, L.-A. Wu, M. Murphy, and M. W. Guidry, submitted to *Phys. Rev. B* (2016).

Selected Invited Presentations

- *A New Approach to the Solution of Large Thermonuclear Burning Networks*, M. W. Guidry, Conference on Astronomy with Radioactivities V, Clemson S. C., Sept. 2005.
- *Application of Stochastic Methods to the Modeling of Nonlinear Relationships between Ocean Productivity, Ventilation, and Atmospheric Composition*, M. W. Guidry Jr., M. W. Guidry Sr., and R. Arvidson, Salt Lake City Annual Meeting of the Geological Society of America, Nov. 2005.
- *Instabilities of Doped Mott Insulators and the properties of High-Temperature Superconductors*, M. W. Guidry, Workshop on Nuclei and Mesoscopic Physics, East Lansing Michigan, Oct. 2007
- *Competing Antiferromagnetism and Superconductivity in Cuprate and Iron-Based Superconductors*, M. W. Guidry, Mini Workshop on FeAs-Based Superconductors, Knoxville TN, May 2008.
- *SU(4) Model of Competing Antiferromagnetism and Superconductivity in Cuprate and Iron-Based Superconductors*, M. W. Guidry, Workshop on High-Temperature Superconductors, Shanghai, China, June, 2008.
- *A Unified Description of Cuprate and Iron-Based Superconductors*, M. W. Guidry, Mini Workshop on FeAs-Based Superconductors, Beijing, China, June, 2008.

- *Core Collapse Supernovae and Neutron Star Mergers as Gravitational Wave Sources*, M. W. Guidry, Workshop on Computational Astrophysics, Shanghai, China, Nov. 2008.
- *Efficient Solution of Large Thermonuclear Reaction Networks Coupled to Multidimensional Hydrodynamics: Application to Type Ia Supernovae*, M. W. Guidry, Workshop on Computational Astrophysics, Shanghai, China, Nov. 2008.
- *Gamma-Ray Bursts: The Core-Collapse Supernova and Merging Neutron Star Connections*, M. W. Guidry, Workshop on Computational Astrophysics, Shanghai, China, Nov. 2008.
- *Bright Lights, Dark Energy, and a Quite Curious Coefficient: Thermonuclear Supernovae and the Equation of State for the Universe*, M. W. Guidry, Institute of Nuclear, Particle, Astrophysics, and Cosmology, Shanghai, China, Dec. 2009.
- *Modeling Type Ia Supernova Explosions*, M. W. Guidry, National Astronomical Observatories of China, Beijing, China, Dec. 2009.
- *Type Ia Supernova Explosions*, M. W. Guidry, Institute of Nuclear, Particle, Astrophysics, and Cosmology, Shanghai, China, Nov. 2010.
- *Understanding the Origins of Superconductivity: The Cooper Pairing Instability in the Presence of other Strongly Collective Modes*, M. W. Guidry, 3rd Workshop on Nuclei and Mesoscopic Physics, East Lansing, Michigan, March, 2011.
- *Programming Android for Mobile Applications*, M. W. Guidry, Pacific New Media, University of Hawaii, Honolulu, July, 2011.
- *Google Glass and the Future of Mobile Computing*, M. W. Guidry, Invited presentation, Y-12 National Security Complex, Oak Ridge TN, April 2014.
- *A Mobile, Multi-Player Strategy Game Approach to Global Threat Reduction Initiative Training*, M. W. Guidry, Invited presentation, Y-12 National Security Complex, Oak Ridge TN, April 2014.
- *Fast Integration of Extremely Stiff Reaction Networks for Nuclear Astrophysics*, M. W. Guidry, invited lectures (3 hours), Summer School in Nuclear Astrophysics, Shanghai, China, May, 2014.

- *Neutrino Cooling of the Highest Temperature Superconductors*, M. W. Guidry, invited presentation, Shanghai Particle Physics & Cosmology Symposium, Shanghai, China, May, 2014
- *Superconductivity and Superfluidity as a Universal Emergent Phenomenon*, M. W. Guidry, Invited presentation, Nordita program on Computational Challenges in Nuclear and Many-Body Physics, Stockholm, Sweden, Sept. 2014.
- *Superconductivity and Superfluidity as Universal Emergent Phenomena in Diverse Physical Systems*, M. W. Guidry, Invited presentation, Conference on Nuclei and Mesoscopic Physics, East Lansing, Michigan, May, 2014.
- *Efficient GPU Acceleration for Integrating Large Thermonuclear Networks in Astrophysics*, Invited presentation, Origin of Matter and Evolution of Galaxies (OMEG2015), Beijing, June 2016.
- *SO(8) Fermion Dynamical Symmetry and Quantum Hall States for Monolayer Graphene*, Invited paper, Frontiers of Quantum and Mesoscopic Thermodynamics, Prague, July 2015.
- *Gravitational Waves: A New Window on the Universe*, invited public lecture, Huzhou University, Huzhou, China, May 2016.
- *SO(8) Fermion Dynamical Symmetry and Quantum Hall States for Monolayer Graphene*, invited presentation, Workshop on Correlated Many-Body Systems, Shanghai, May, 2016.
- *Unconventional Superconductors as a Consequence of SU(4) Symmetry*, invited presentation, Workshop on Correlated Many-Body Systems, Shanghai, May, 2016.

Mobile Device Programming

Hands-On Workshop: Android Programming for Mobile Devices, one-day intensive workshop led by Mike Guidry, Computer Science and Mathematics Division, Oak Ridge National Laboratory, January, 2011.

Hands-On Workshop: Programming the Mobile Android Platform, one-day intensive workshop led by Mike Guidry, Pacific New Media, U. Hawaii, Honolulu, Sept., 2011.

Programming the Android Platform: Developing Mobile Applications for Android 6 with Android Studio. An online mobile device programming course at <http://eagle.phys.utk.edu/guidry/android/>

Published Textbooks (Author)

- *Gauge Field Theories: An Introduction with Applications*, M. W. Guidry, Wiley GBH (1992, reprinted 2005)
- *Online Journey through Astronomy*, Mike Guidry and Margaret Riedinger, Brooks/Cole (2000; 2nd edition 2004)
- *Virtual Astronomy Labs*, Mike Guidry and Kevin Lee, Brooks/Cole (2003); Version 2.0 published in October, 2011

Draft Textbooks in Advanced Stages of Preparation

- *Stellar Structure and Processes*, Mike Guidry; to be published, Cambridge University Press (2018)
- *Modern General Relativity: Black Holes, Gravitational Waves, and Cosmology*, Mike Guidry; to be published, Cambridge University Press (2018)
- *Symmetry and Broken Symmetry: Groups, Algebras, and Topologies in Modern Physics*, Mike Guidry

Published Textbooks (Technology Developer)

- *Online Journey through Astronomy* (M. W. Guidry and M. Riedinger, authors), Brooks/Cole (2000, 2004), Lead Technology Developer
- *Virtual Astronomy Labs* (M. W. Guidry and K. Lee, authors), Brooks/Cole (2003), Lead Technology Developer; Version 2.0 published October, 2011
- *Concepts of Genetics* (W. S. Klug and M. R. Cummings, authors), Prentice Hall (2000-2004), Lead Technology Developer
- *Essentials of Genetics* (W. S. Klug and M. R. Cummings, authors), Prentice Hall (2000-2004), Lead Technology Developer
- *Biology: A Guide to the Natural World* (D. Krogh, author), Prentice Hall (2000-2004), Lead Technology Developer

- *Brock: Biology of Microorganisms* (M. T. Madigan, J. M. Martinko, and J. Parker, authors) , Prentice Hall (2003), Lead Technology Developer
- *Physics for Scientists and Engineers* (R. A. Serway and J. W. Jewett, authors), Brooks/Cole (2003), Technology Developer and Project Supervisor for Worked Interactive Exercises.

Interactive and Web-Based Training Courses

- K-12 Education: *webTeacher*, Mike Guidry (lead developer), Jo Ann Guidry, and Wayne Kincaid, Last revision, 2002.
- WMD First Responders: *Weapons of Mass Destruction: Fundamentals for First Responders*, M. W. Guidry (lead developer), et al, Law Enforcement Innovation Center, U. Tennessee (2005)
- Programming for the Android Platform: *Developing Modern Wireless Mobile Applications*, Mike Guidry, <http://eagle.phys.utk.edu/guidry/android/>

Awards

- Chancellor's Award for Excellence in Educational Technology, University of Tennessee (1999)
- Teacher of the Year Award, Physics Department, University of Tennessee (2006)
- College of Arts and Sciences Senior Teaching Award, University of Tennessee (2006)