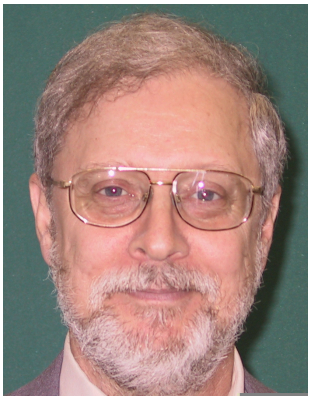

Michael Guidry

Personal Information

Name: Michael Wayne Guidry

Position: Professor of Physics and Astronomy, University of Tennessee;
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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 Califoria, 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, 5 published textbooks, and 1 textbook in advanced preparation that address topics in nuclear physics, computational science, advanced educational technology, astronomy, astrophysics, cosmology, general relativity, gravitational waves, 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 based on Lie algebras for understanding high-temperature superconductors and other strongly-correlated electron systems, and in developing new approaches to quantum Hall physics in graphene based on fermion dynamical symmetries. He is the founder and director of LightCone Interactive LLC, a company with a mission of developing advanced educational technology and supporting basic research in the physical and computational sciences. He has won various teaching awards and is responsible for many Web-based and conventional initiatives introducing and explaining science to the public.

Select Journal Publications

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 17F(p,gamma) reaction rate on nova nucleosynthesis, S. Parete-Koon, W.R. Hix, M.S. Smith, S. Starrfield, D.W. Bardayan, M.W. Guidry and 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. B73, 134519 (2006).

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

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).

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).

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).

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).

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).

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

SO(8) Fermion Dynamical Symmetry and Strongly-Correlated Quantum Hall States in Monolayer Graphene, L.-A. Wu, M. Murphy, and M. W. Guidry, Phys. Rev. B94, 115117 (2017).

Systematic study of multi-quasiparticle *K*-isomeric bands in tungsten isotopes by the extended projected shell model, X.-Y. Wu, S. K. Ghorui, L.-J. Wang, Y. Sun, M. W. Guidry, P. M. Walker, Phys. Rev. C95, 064314 (2017).

SO(8) fermion dynamical symmetry and quantum hall states for graphene in a strong magnetic field, Mike Guidry, Fortschritte der Physik 65, 1600057 (2017).

New and Views: The Promising Dawn of Multimessenger Astronomy, M. W. Guidry, Science Bulletin, 63, 2 (2018).

A Basic Introduction to the Physics of Solar Neutrinos, Mike Guidry and Jay Billings, arXiv:1812.00035

Quantum simulation of electron Coulomb interactions, D. W. Luo, M. Madugno, M. W. Guidry, J. Q. You, L.-A. Wu, European Physics Letters 130, 10001 (2020).

An anomaly in quantum phases induced by borders, J. Jing, M. W. Guidry, and L.-A. Wu, Scientific Reports 10, 6934 (2020).

Fermion dynamical symmetry and strongly-correlated electrons: a comprhensive model of high-temperature superconductivity, M. W. Guidry, Y. Sun, L.-A. Wu, and C.-L. Wu, Frontiers of Physics 15, 43301 (2020).

Select Invited Presentations

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 2015.

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.

A Multidisciplinary Approach to the Theory of Emergent States, M. W. Guidry, Invited presentation, Frontiers of Quantum and Mesoscopic Thermodynamics, Prague, 2017.

Emergence and Universality in Diverse Physical Systems, M. W. Guidry, Invited presentation, Fifth Conference on Nuclei and Mesoscopic Systems, Lansing, Michigan (2017).

Spontaneous Symmetry Breaking for Graphene in a Strong Magnetic Field, M. W. Guidry, Invited presentation, International Workshop on Quantum Information, Quantum Control, and Quantum Devices, Bilbao, Spain, 2017.

Solar Neutrino Flavor Oscillations and the MSW Resonance:, M. W. Guidry, Seminar presented at Xiamen University, Xiamen, China, 2019.

Fast, Scalable, Explicit Integration for a New Generation of Computational Astrophysics Applications, M. W. Guidry, seminar presented at Chinese National Observatories, Beijing, China 2019.

A Comprehensive Understanding of High-Temperature Superconductivity in Terms of Lie Algebras and Fermion Dynamical Symmetries, M. W. Guidry, seminar presented at T D Lee Institute, Shanghai, China, 2019.

On the Critical Temperature for the Superconducting Transition, M. W. Guidry, Invited Presentation, Frontiers of Quantum and Mesoscopic Thermodynamics, Prague, 2019.

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. Online book on mobile device programming, available 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

Stars and Stellar Processes, Mike Guidry, Cambridge University Press (2019)

Modern General Relativity: Black Holes, Gravitational Waves, and Cosmology, Mike Guidry, Cambridge University Press (2019)

Draft Textbooks in Advanced Stages of Preparation (Author)

Symmetry and Broken Symmetry: Groups, Algebras, and Topology in Modern Physics, Mike Guidry and Yang Sun (Cambridge University Press, 2022)

Published Textbooks (Technology Supervisor and Developer)

Online Journey through Astronomy (M. W. Guidry and M. Riedinger, authors), Brooks/Cole (2000, 2nd edition 2004), Lead Technology Developer as well as author.

Virtual Astronomy Labs (M. W. Guidry and K. Lee, authors), Brooks/Cole (2003), Lead Technology Developer, as well as author; 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 author and 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 author and developer), et al, Law Enforcement Innovation Center, U. Tennessee (2005)

Programming for the Android Platform: Developing Modern Wireless Mobile Applications, Mike Guidry, online book at http://eagle.phys.utk.edu/guidry/android/

Entrepreneurship

Founder, co-owner, and chief executive member of LightCone Interactive LLC. The company was founded in 1999 and has a mission of developing advanced educational technology and other educational material, and using profits from that to support basic research in the physical and computational sciences. The papers of my collaborators and me now routinely carry a funding acknowledgment from LightCone Interactive LLC.

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)