David Christopher Collins

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EDUCATION

University of California San Diego — PhD., Physics, 2009

Thesis: *Star Formation with Adaptive Mesh Refinement and Magnetohydrodynamics*

Advisors: Michael L. Norman, Paolo Padoan

University of California San Diego — M.S., Physics, 2004

University of Cincinnati — B.S., Physics, 2001

University of Cincinnati — B.A., Mathematics, 2001

Eastman School of Music — 1995-1997

EMPLOYMENT

Associate Professor, Florida State University — 2019-present

Assistant Professor, Florida State University — 2013-2019

Nicholas C. Metropolis Postdoctoral Fellow, Los Alamos National Lab — 2011-2013
Advisors: Hui Li, James H. Cooley

Postdoctoral Scholar, University of California, San Diego — 2009-2011
Advisor: Alexei G. Kritsuk

Graduate Research Assistant, UCSD — 2002-2009
Advisors: Michael L. Norman, Paolo Padoan

Breyer's Branches High School Tutoring — 2005-2006

Teaching Assistant Coordinator, UCSD — 2002-2005

Teaching Assistant, UCSD — 2002-2005
Physics 1A: Mechanics
Physics 1B: Electricity and Magnetism, Thermal Physics
Physics 1C: Optics, Nuclear Physics, Modern Physics

PUBLICATIONS

"Finite shock model of density in supersonic turbulence," Rabatin, Collins; MNRAS, 2023, 521, L64-L69

"Collapsing molecular clouds with tracer particles - I. What collapses?," Collins, Le, Jimenez Vela; MNRAS, 2023, 520, 4194-4208

"The driving mode of shock-driven turbulence," Dhawalikar, Federrath, Davidovits, Teyssier, Nagel, Remington, Collins; MNRAS, 2022, 514, 1782-1800

"Turbulence generation by shock interaction with a highly nonuniform medium," Davidovits, Federrath, Teyssier, Raman, Collins, Nagel; Physical Review E, 2022, 105, 065206

"Physics of Thermonuclear Explosions: Magnetic Field Effects on Deflagration Fronts and Observable Consequences," Hristov, Hoeflich, Collins; The Astrophysical Journal, 2021, 923, 210

"Measuring an Off-center Detonation through Infrared Line Profiles: The Peculiar Type Ia Supernova SN 2020qxp/ASASSN-20jq," Hoeflich, Ashall, Bose, Baron, Stritzinger, Davis, Shahbandeh, Anand, Baade, Burns, Collins, Diamond, Fisher, Galbany, Hristov, Hsiao, Phillips, Shappee, Suntzeff, Tucker; The Astrophysical Journal, 2021, 922, 186

"The Catalogue for Astrophysical Turbulence Simulations (CATS)," Burkhart, Appel, Bialy, Cho, Christensen, Collins, Federrath, Fielding, Finkbeiner, Hill, í, Krumholz, Lazarian, Li, Mocz, Mac Low, Naiman, Portillo, Shane, Slepian, Yuan; The Astrophysical Journal, 2020, 905, 14

"The Power Spectra of Polarized, Dusty Filaments," Huffenberger, Rotti, Collins; The Astrophysical Journal, 2020, 899, 31

"ENZO: An Adaptive Mesh Refinement Code for Astrophysics (Version 2.6)," Brummel-Smith, Bryan, Butsky, Corlies, Emerick, Forbes, Fujimoto, Goldbaum, Grete, Hummels, Kim, Koh, Li, Li, Li, OShea, Peeples, Regan, Salem, Schmidt, Simpson, Smith, Tumlinson, Turk, Wise, Abel, Bordner, Cen, Collins, Crosby, Edelmann, Hahn, Harkness, Harper-Clark, Kong, Kritsuk, Kuhlen, Larrue, Lee, Meece, Norman, Oishi, Paschos, Peruta, Razoumov, Reynolds, Silvia, Skillman, Skory, So, Tasker, Wagner, Wang, Xu, Zhao; The Journal of Open Source Software, 2019, 4, 1636

"The Impact of Enhanced Halo Resolution on the Simulated Circumgalactic Medium," Hummels, Smith, Hopkins, O'Shea, Silvia, Werk, Lehner, Wise, Collins, Butsky; The Astrophysical Journal, 2019, 882, 156

"Near-infrared Spectral Evolution of the Type Ia Supernova 2014J in the Nebular Phase: Implications for the Progenitor System," Diamond, Hoeflich, Hsiao, Sand, Sonneborn, Phillips, Hristov, Collins, Ashall, Marion, Stritzinger, Morrell, Gerardy, Penney; The Astrophysical Journal, 2018, 861, 119

"The Anatomy of the Column Density Probability Distribution Function (N-PDF)," Chen, Burkhart, Goodman, Collins; The Astrophysical Journal, 2018, 859, 162

"Magnetohydrodynamical Effects on Nuclear Deflagration Fronts in Type Ia Supernovae," Hristov, Collins, Hoeflich, Weatherford, Diamond; The Astrophysical Journal, 2018, 858, 13

"GMC Collisions as Triggers of Star Formation. III. Density and Magnetically Regulated Star Formation," Wu, Tan, Christie, Nakamura, Van Loo, Collins; The Astrophysical Journal, 2017, 841, 88

"GMC Collisions as Triggers of Star Formation. II. 3D Turbulent, Magnetized Simulations," Wu, Tan, Nakamura, Van Loo, Christie, Collins; The Astrophysical Journal, 2017, 835, 137

"The Razor's Edge of Collapse: The Transition Point from Lognormal to Power-Law Distributions in Molecular Clouds," Burkhart, Stalpes, Collins; The Astrophysical Journal Letters, 2017, 834, L1

"Matching dust emission structures and magnetic field in high-latitude cloud L1642: comparing Herschel and Planck maps," Malinen, Montier, Montillaud, Juvela, Ristorcelli, Clark, é, Bernard, Pelkonen, Collins; MNRAS, 2016, 460, 1934-1945

"Length Scales and Turbulent Properties of Magnetic Fields in Simulated Galaxy Clusters," Egan, O'Shea, Hallman, Burns, Xu, Collins, Li, Norman; arXiv e-prints, 2016, , arXiv:1601.05083

"Observational Diagnostics of Self-gravitating MHD Turbulence in Giant Molecular Clouds," Burkhart, Collins, Lazarian; The Astrophysical Journal, 2015, 808, 48

"Self-generated Turbulence in Magnetic Reconnection," Oishi, Mac Low, Collins, Tamura; The Astrophysical Journal Letters, 2015, 806, L12

"ENZO: An Adaptive Mesh Refinement Code for Astrophysics," Bryan, Norman, O'Shea, Abel, Wise, Turk, Reynolds, Collins, Wang, Skillman, Smith, Harkness, Bordner, Kim, Kuhlen, Xu, Goldbaum, Hummels, Kritsuk, Tasker, Skory, Simpson, Hahn, Oishi, So, Zhao, Cen, Li, Enzo Collaboration; The Astrophysical Journal Supplement, 2014, 211, 19

"Local support against gravity in magnetoturbulent fluids," Schmidt, Collins, Kritsuk; MNRAS, 2013, 431, 3196-3215

"Cosmological Magnetohydrodynamic Simulations of Galaxy Cluster Radio Relics: Insights and Warnings for Observations," Skillman, Xu, Hallman, O'Shea, Burns, Li, Collins, Norman; The Astrophysical Journal, 2013, 765, 21

"Comparisons of Cosmological Magnetohydrodynamic Galaxy Cluster Simulations to Radio Observations," Xu, Govoni, Murgia, Li, Collins, Norman, Cen, Feretti, Giovannini; The Astrophysical Journal, 2012, 759, 40

"The Two States of Star-forming Clouds," Collins, Kritsuk, Padoan, Li, Xu, Ustyugov, Norman; The Astrophysical Journal, 2012, 750, 13

"Evolution and Distribution of Magnetic Fields from Active Galactic Nuclei in Galaxy Clusters. II. The Effects of Cluster Size and Dynamical State," Xu, Li, Collins, Li, Norman; The Astrophysical Journal, 2011, 739, 77

"Comparing Numerical Methods for Isothermal Magnetized Supersonic Turbulence," Kritsuk, A, Collins, Padoan, Norman, Abel, Banerjee, Federrath, Flock, Lee, Li, ü, Teyssier, Ustyugov, Vogel, Xu; The Astrophysical Journal, 2011, 737, 13

"Accuracy of core mass estimates in simulated observations of dust emission," Malinen, Juvela, Collins, Lunttila, Padoan; Astronomy and Astrophysics, 2011, 530, A101

"Mass and Magnetic Distributions in Self-gravitating Super-Alfvénic Turbulence with Adaptive Mesh Refinement," Collins, Padoan, Norman, Xu; The Astrophysical Journal, 2011, 731, 59

"Evolution and Distribution of Magnetic Fields from Active Galactic Nuclei in Galaxy Clusters. I. The Effect of Injection Energy and Redshift," Xu, Li, Collins, Li, Norman; The Astrophysical Journal, 2010, 725, 2152-2165

"The Effect of Projection on Derived Mass-Size and Linewidth-Size Relationships," Shetty, Collins, Kauffmann, Goodman, Rosolowsky, Norman; The Astrophysical Journal, 2010, 712, 1049-1056

"Cosmological Adaptive Mesh Refinement Magnetohydrodynamics with Enzo," Collins, Xu, Norman, Li, Li; The Astrophysical Journal Supplement, 2010, 186, 308-333

"Turbulence and Dynamo in Galaxy Cluster Medium: Implications on the Origin of Cluster Magnetic Fields," Xu, Li, Collins, Li, Norman; The Astrophysical Journal Letters, 2009, 698, L14-L17

"The Biermann Battery in Cosmological MHD Simulations of Population III Star Formation," Xu, O'Shea, Collins, Norman, Li, Li; The Astrophysical Journal Letters, 2008, 688, L57

"Formation of X-Ray Cavities by the Magnetically Dominated Jet-Lobe System in a Galaxy Cluster," Xu, Li, Collins, Li, Norman; The Astrophysical Journal Letters, 2008, 681, L61

GRANTS

"CMB Polarization Foreground Effects on B-modes and Lensing", (Aug 2020-Jul 2023) NSF AAG-2009870, $533,715

"Signatures of Type Ia Supernovae Explosions and their Cosmological Implications" (Aug 2017-Aug 2020) NSF AAG-1715133 $421,215

"Modeling CMB Polarization Foregrounds and their Isotropy Violation" (Feb 2017-Dec 2021) NASA NNX17AF87G, $428,043

" A Study of Magnetic Fields in the Formation of Molecular Clouds and Stars" (Sep 2016-Aug 2022) NSF AAG-1616026, $319,928

Invited Presentations

"Star Formation and CMB Foregrounds", Enzo Workshop, UC San Diego, May 15 2023

"Star Formation and Other Bumps in the Night", FSU Physics department colloquium, Feb 28 2023

"Star Formation from Turbulent Clouds", FSU Astrophyscis Seminar, October 15 2022

"Let Your Anxiety Work For You: Lessons from Outer Space", North Florida Toastmasters, September 2021

"Interpreting CMB Foregrounds (Also a bit on Type IA)", *Big Apple Magnetic Fields*, Center for Computational Astrophysics Jan. 25, 2019

"Turbulent Space Magnets", FSU Departmet of Scientific Computing Colloquium, Feb 20 2019

"Turbulent Space Magnets", FSU Physics Colloquium Sept. 6, 2018

"Black Holes!" Quarknet 2018, FSU, July 21 2018.

"How to Break Enzo" Enzo New Users Workshop, Georgia Tech University, May 8 2018

"Astrophysical Turbulence with Magnetic Fields" Emory University Physics Colloquium, April 17 2018

"What's the Deal with Dark Matter?" FSU, *Society of Physics Students*, March 6, 2018

"What's the Deal with Dark Matter?" FSU, *Quarknet 2017*, July 25, 2017

"Rayleigh Taylor Instabilities in Magnetized Supernovae," FSU, 50^{th} *Anniversary of GFDI*, May 15, 2017

"What's the Deal with Dark Matter?" July 18, 2016, and informal presentation at the Mag Lab for the participants in the *Research Experience for Teachers* program.

"Astrophysical Turbulence: Nuclear Flame Propagation with Magnetic Fields," *Complex Interfaces in Geophysical and Astrophysical Fluid Dynamics*, April 29, 2016, FSU

"Magnetic Fields, Turbulence, Gravity, and Star Formation," FSU Department of Scientific Computing, October 27, 2015

"Stop Using Virial Theorem for Star Forming Clouds", *Institute for Theory and Computation Seminar*, Harvard Center for Astrophysics, April 8, 2015

"Turbulent Star Formation Theory", *Institute for Theory and Computation Pizza Lunch Series*, Harvard Center for Astrophysics, April 7, 2015

"Magnetic Fields, Turbulence, Gravity, and Star Formation", *Geophysical Fluid Dynamics Institute*, FSU, September 22, 2014

"Observational Diagnostics of Self Gravitating MHD Turbulence in GMCs", *Astrophysics Seminar*, FSU, September 16, 2014

"Magnetic Fields, Turbulence, Gravity and Star Formation," Invited Seminar, University of Florida, February 6, 2014

"Magnetic Fields, Turbulence, Gravity and Star Formation," Invited Seminar, Florida State University, February 5, 2013

"Magnetic Fields in Star Formation", NRAO, Socorro, New Mexico, October 31, 2012

"Turbulence, Magnetic Fields, and Self Gravity", *Second ICM Theory and Computation Workshop*, University of Michigan, August 30, 2012

"Taller de Enzo", lecture series on computational physics with Enzo, Ensenada, Mexico, July 24-27, 2012
"Intro to Enzo: What has Been Done, and What You Can Do"
"First Steps with Enzo"
"Five Minute Intro to Python"
"First Steps with YT"
"Enzo Algorithms and Computational Physics"
"Under the Hood: Modifying Enzo"
"The Two States of Star Formation"

"The Two States of Star Forming Clouds", University of Wisconsin, Madison, May 10, 2012

"Super Alfvénic, Supersonic Turbulence with Self Gravity", *Compressible Turbulence at the Intersection of Astrophysics and Engineering*, Santa Fe, NM, April 26, 2011

"MHD in Enzo", *Enzo User Workshop*, San Diego Supercomputer Center, June 29, 2010

"How Enzo Starts" , *Enzo User Workshop*, San Diego Supercomputer Center, June 28, 2010

"AMR Cosmological & Astrophysical Simulations with Enzo", University of Helsinki, July 7, 2007

Contributed Presentations

"EE- and BB- mode signatures of Single Phase Turbulence" UC San Diego, *CMB Foregrounds Workshop*, Nov. 28, 2017

"Properties of Molecular Cloud Column Densities," University of Florida, *Florida Star & Planet Formation Days*, May 17, 2017

"Magnetic and Density Statistics in Collapsing Molecular Clouds Cores with MHD," *Star Formation, Magnetic Fields, Diffuse Matter in the Galaxy*, University of Wisconsin, Madison, Wisconsin, May 25, 2016

"Magnetic Fields in Collapsing Molecular Clouds" *From Stars to Massive Stars*, University of Florida, Gainesville, FL April 6, 2016

"Line of Sight Contamination vs. Virial Parameters," *Florida Star & Planet Formation Days*, University of Florida, March 20, 2016

"Physical Process in Prestellar Cores", *Florida Star & Planet Formation Days*, University of Florida, March 13 2015

"Local support against gravity in magnetoturbulent fluids", *Midwest Magnetic Fields*, University of Wisconsin, Madison, April 29 2014

"What Turbulence Does", *Florida Star & Planet Formation Day*, University of Florida, March 14 2014

"Magnetic Field Distributions in Self-gravitating supersonic turbulence", *Midwest Magnetic Fields*, University of Wisconsin, Madison, May 1 2013

"Local support against gravity in magneto-turbulent fluids", *The low-metallicity ISM: Chemistry, turbulence and magnetic fields*, Goettingen, Germany, October 13, 2012

"The Two States of Star Forming Clouds", *Turbulence in Cosmic Structure Formation*, Arizona State University, March 6, 2012

"The Two States of Star Forming Clouds", *Center for Magnetic Self Organization*, University of New Hampshire, October 21, 2011

"An Introduction to Star Formation and Magnetic Fields", *Young CMSO*, University of New Hampshire, October 17, 2011

"The Two States of Star Forming Clouds", *Enzo Developers Workshop*, Columbia University, October 14, 2011

"Mass and Magnetic Distributions in Simulations of Supersonic, Super Alfvénic, Self Gravitating MHD Simulations", *The Future of Astro Computing*, San Diego Supercomputer Center, December 16, 2010

"Where's the Stuff? Mass and Magnetic Distributions in Simulations of Supersonic, Super Alfvénic, Self Gravitating MHD Simulations", *Theoretical Astrophysics in Southern California*, California Institute of Technology, October 29, 2010

"AMR MHD Simulations of Self Gravitating Super Alfvénic Turbulence", *From Stars to Galaxies*, University of Florida, April 2010