Dr. John A. ZuHone: Curriculum Vitae

Personal

Citizenship	United States of America
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Education

Ph. D. in Astronomy and Astrophysics, University of Chicago — 2009
- *Advisor:* Prof. Donald Q. Lamb, Dept. of Astronomy and Astrophysics
- *Thesis:* "Simulations of Binary Galaxy Cluster Mergers: Modeling Real Clusters and Exploring Parameter Spaces"

M. S. in Astronomy and Astrophysics, University of Chicago — 2004

B. S. in Physics, University of Illinois at Urbana-Champaign — 2002

Honors, Awards, and Named Fellowships

NASA Postdoctoral Program	2011-2014
Department of Energy Computational Science Graduate Fellowship	2004-2008
McCormick Fellowship, University of Chicago	2002-2003
Graduated With Highest Honors in Physics, University of Illinois	2002

Research Interests

Astrophysics

Cosmology; large-scale structure formation; galaxy clusters; intracluster medium; dark matter; X-ray astronomy

Computational Science

Developing numerical algorithms for computational physics; developing visualization and analysis techniques for large datasets; development of scientific software in the Python and Julia languages

Research Positions Held

Kavli Institute for Astrophysics, Massachusetts Institute of Technology
Postdoctoral Research Associate 2014-

Astrophysics Science Division, NASA/Goddard Space Flight Center
Postdoctoral Research Associate 2011-2014

High-Energy Astrophysics Division, Smithsonian Astrophysical Observatory
Postdoctoral Research Associate 2009-2011

National Center for Computational Sciences, Oak Ridge National Laboratory
Graduate Research Assistant 2006

Department of Astronomy and Astrophysics, University of Chicago
Graduate Research Assistant 2004-2009

Department of Astronomy and Astrophysics, University of Chicago
Undergraduate Research Assistant 2001

Department of Physics, University of Illinois at Urbana-Champaign
Undergraduate Research Assistant 2000

Teaching Experience

NASA/Goddard Space Flight Center, Volunteer Instructor 2014
Python Boot Camp
http://asd.gsfc.nasa.gov/conferences/pythonbootcamp/2014/

Trinity International University, Instructor
Physics 350, "Topics in Physical Science: Astronomy" 2007

University of Chicago, Graduate Teaching Assistant
PHSC 12000, "The Origin of the Universe and How We Know" 2003
PHSC 11900, "Stellar Astronomy and Astrophysics" 2003

University of Illinois at Urbana-Champaign, Undergraduate Teaching Assistant
PHYS 102, "College Physics: E&M & Modern" 2002
PHYS 111, "University Physics: Mechanics" 2002
PHYS 101, "College Physics: Mech & Heat" 2001
PHYS 111, "University Physics: Mechanics" 2001

Grants as Co-Investigator

National Aeronautics and Space Administration

ROSES-12: "Investigating Microphysics of Intracluster Medium with Advanced Hydrodynamic Simulations and X-Ray Observations", PI: Maxim Markevitch, 12-ATP12-0159 — 2012

Computing Allocations as Principal Investigator or Co-Investigator

National Aeronautics and Space Administration

"Studying the Detailed Physics of the Intracluster Medium in Mergers of Clusters of Galaxies" (Co-I)
NAS Pleiades SGI ICE system (8,355,847 core-hours) — 2011-

National Science Foundation

"Studying the Detailed Physics of the Intracluster Medium in Clusters of Galaxies with the FLASH Code" (PI)
NICS Cray XT5 (1,100,000 service units) — 2010-2011

"Exploring the Nature of Cold Fronts in Merging Clusters of Galaxies with the FLASH Code" (Co-I)
TACC Sun Constellation Cluster (1,000,000 service units) — 2009-2010

Professional Collaborations

Astro-H Science Working Group (http://astro-h.isas.jaxa.jp/) — 2014-
The yt Project (http://yt-project.org) — 2011-

Professional Service

Review Panel Member

Astrophysics Theory Proposal (NASA)
Chandra X-ray Observatory (NASA)

Conference Organizing Committees

yt Workshop 2012

Peer Review

The Astrophysical Journal
Monthly Notices of the Royal Astronomical Society
Proceedings of the Astronomical Society of Japan

Contributions to Scientific Software

FLASH (http://flash.uchicago.edu), co-developer
A multiphysics grid-based simulation code for astrophysics. Assisting in development of the particle, cosmology, multigrid gravity, and magnetohydrodynamic modules for FLASH3 and FLASH4

yt (http://yt-project.org), co-developer
A visualization and analysis software suite for astrophysical simulation data. Assisted in development of FLASH, Athena, and FITS data interfaces; improved capabilities for working with in-memory datasets; developed analysis modules for synthetic observations

YT (http://www.jzuhone.com/yt_julia), sole developer
A Julia (http://julialang.org) wrapper for yt. Used for exposing astrophysical simulation simulation data from a variety of different codes in the Julia technical programming language.

pywwt (http://www.jzuhone.com/pywwt), sole developer
A Python interface to the Microsoft World Wide Telescope (WWT) Windows client. Used for controlling WWT from Python.

Spectral Cube (http://spectral-cube.readthedocs.org/en/latest/), co-developer
A Python package for reading, writing, and analyzing radio "data cubes" in the FITS format. Developed an interface to the *yt* software package.

Computing Proficiency and Experience

Programmming Languages
fluent in: C, Fortran 77/90, Python
conversant in: IDL, Julia, C++

Simulation Codes
FLASH (http://flash.uchicago.edu)
Athena (http://www.astro.princeton.edu/~jstone/athena.html)
Enzo (http://enzo-project.org)

Software and Libraries
MPI (parallel computing library, http://www.mcs.anl.gov/research/projects/mpi/)
HDF5 (hierarchical data format, http://www.hdfgroup.org)
yt (analysis software for astrophysics simulations, http://yt-project.org)
MARX (*Chandra* X-ray telescope simulator, http://space.mit.edu/ASC/MARX/)
CIAO (Analysis tools for *Chandra* data, http://cxc.cfa.harvard.edu/ciao/)

High-Performance Computing Platforms

"Intrepid" BlueGene/P: Argonne National Laboratory / DOE
"Jaguar" Cray XT5: Oak Ridge National Laboratory / DOE
"Ranger" Sun Constellation: Texas Advanced Computing Center / XSEDE
"Pleiades" SGI ICE X: Ames Research Center / NASA
"Kraken" Cray XT5, National Institute for Computational Science / XSEDE

Recent Invited Colloquia and Conference Participation

"Chandra, Cold Fronts, and ICM Physics: The Importance of Magnetic Fields." Talk, 15 Years of Chandra Science Workshop, November 2014, Boston, MA

"The Physics of Gas Sloshing in Galaxy Clusters." Astrophysics Science Division Colloquium, NASA/Goddard Space Flight Center, August 2014, Greenbelt, MD

"Gas Sloshing: Simulations and Observations", Invited talk, ICM Inhomogeneities in the Intracluster Plasma Workshop, July 2014, Stanford, CA

"Simulating X-ray Observations with Python", Talk, Scientific Computing in Python 2014, July 2014, Austin, TX

"The Physics of Gas Sloshing in Galaxy Clusters." Theory Seminar, The Ohio State University, April 2014, Columbus, OH

"The Physics of Gas Sloshing in Galaxy Clusters." Colloquium, University of Illinois at Urbana-Champaign, February 2013, Urbana, IL

"Applications of Advanced Numerical Simulations and Analysis in Theoretical Astrophysics." Invited talk, Computational Research in Boston and Beyond, October 2013, Cambridge, MA

"The Physics of Gas Sloshing in Galaxy Clusters." Colloquium, Naval Research Laboratory, September 2013, Washington, DC

"Simulating Radio Mini-halos in Sloshing Galaxy Clusters." Invited talk, SnowCLUSTER 2013 Meeting, March 2013, Snowbird Lodge, UT

"Constraining the Transport Properties of the ICM with Cold Fronts." Talk, SnowCLUSTER 2013 Meeting, March 2013, Snowbird Lodge, UT

"The Physics of Gas Sloshing in Galaxy Clusters." Colloquium, Texas A&M University, February 2013, College Station, TX

"The Physics of Gas Sloshing in Galaxy Clusters." Theory Seminar, University of Texas at Austin, February 2013, Austin, TX

Publications

Journal articles (refereed and submitted)

ZuHone, J. A., Kunz., M. W., Markevitch, M., Stone, J. M., & Biffi, V. "The Effect of Anisotropic Viscosity on Cold Fronts in Galaxy Clusters." 2014, arXiv:1406.4031, accepted to ApJ

ZuHone, J., Brunetti, G., Giacintucci, S., & Markevitch, M. "Secondary Models for Radio Mini-Halos in Galaxy Clusters with MHD Simulations of Gas Sloshing." 2014, arXiv:1403.6743, submitted to ApJ

C. Schmid, T. Brand, H. Brunner, A. Finoguenov, **J. ZuHone**, G. Israel, G. Lamer, M. Oertel, R.K. Smith, M. Wille, J. Wilms. "The Generic X-ray Instrument Simulation Toolkit SIXTE." 2014, submitted to *Astronomy and Computing*

Komarov, S.V., Churazov, E.M., Schekochihin, A.A., & **ZuHone, J.A.** "Suppression of Local Heat Flux in a Turbulent Magnetized Intracluster Medium." 2014, MNRAS, 440, 2

Giacintucci, S., Markevitch, M., Brunetti, G., **ZuHone, J.**, Venturi, T., Mazzotta, P., Bourdin, H. "Mapping the Particle Acceleration in the Cool Core of the Galaxy Cluster RX J1720.1+2638." 2014, ApJ, 795, 73

Dubey, A., Antypas, K., Calder, A. C., Daley, C., Fryxell, B., Gallagher, J. B., Lamb, D. Q., Lee, D., Olson, K., Reid, L. B., Rich, P., Ricker, P. M., Riley, K. M., Rosner, R., Siegel, A., Taylor, N. T., Weide, K., Timmes, F. X., Vladimirova, N., & **ZuHone, J.** "Evolution of FLASH, a Multiphysics Scientific Simulation Code for High Performance Computing." 2014, *International Journal of High Performance Computing Applications*, 28, 2

Lal, D. V., Kraft, R. P., Randall, S. W., Forman, W. R., Nulsen, P. E. J., Roediger, E., **ZuHone, J. A.**, Hardcastle, M. J., Jones, C., & Croston, J. H. "Gas Sloshing and Radio Galaxy Dynamics in the Core of the 3C449 Group." 2013, ApJ, 764, 83

ZuHone, J. A., Markevitch, M., Brunetti, G., & Giacintucci, S. "Turbulence and Radio Mini-halos in the Sloshing Cores of Galaxy Clusters." 2013, ApJ, 762, 78

ZuHone, J. A., Markevitch, M., Ruszkowski, M., & Lee, D. "Cold Fronts and Gas Sloshing in Galaxy Clusters with Anisotropic Thermal Conduction." 2013, ApJ, 762, 69

Dubey, A., Daley, C., **ZuHone, J.**, Ricker, P., Weide, K., & Graziani, C. "Imposing a Lagrangian Particle Framework on an Eulerian Hydrodynamics Infrastructure in FLASH." 2012, ApJS, 201, 27

Johnson, R. E., **ZuHone, J. A.**, Jones, C., Forman, W., & Markevitch, M. "Sloshing Gas in the Core of the Most Luminous Galaxy Cluster RXJ 1347.5-1145." 2012, ApJ, 751, 95

Roediger, E., & **ZuHone, J. A.** "Fast Simulations of Gas Sloshing and Cold Front Formation." 2012, MNRAS, 419, 1338

ZuHone, J. A., Markevitch, M., & Lee, D. "Sloshing of the Magnetized Cool Gas in the Cores of Galaxy Clusters." 2011, ApJ, 743, 16

ZuHone, J. A. "A Parameter Space Exploration of Galaxy Cluster Mergers I: Gas Mixing and the Generation of Cluster Entropy." 2011, ApJ, 728, 54

ZuHone, J. A., Markevitch, M., & Johnson, R. E. "Stirring Up the Pot: Can Cooling Flows In Galaxy Clusters Be Quenched By Gas Sloshing?" 2010, ApJ, 717, 908

ZuHone, J. A., Ricker, P. M., Lamb, D. Q., & Yang, H. Y. "A Line-Of-Sight Galaxy Cluster Collision: Simulated X-Ray Observations." 2009, ApJ, 699, 1004

ZuHone, J. A., Lamb, D. Q., & Ricker, P. M. "Rings of Dark Matter in Collisions Between Clusters of Galaxies." 2009, ApJ, 696, 694
Zingale, M., Dursi, L. J., **ZuHone, J.**. Calder, A. C., Fryxell, B., Plewa, T., Truran, J. W., Caceres, A., Olson, K., Ricker, P. M., Riley, K., Rosner, R., Siegel, A., Timmes, F. X., & Vladimirova, N. "Mapping Initial Hydrostatic Models in Godunov Codes." 2002, ApJS, 143, 539

Conference proceedings

ZuHone, J. A., Biffi, V., Hallman, E. J., Randall, S. W., Foster, A. R., Schmidt, C. "Simulating X-ray Observations with Python." 2014, arXiv:1407.1783, accepted to the *Proceedings of the 13th Python in Science Conference*

ZuHone, J., Markevitch, M., & Brunetti, G. "Testing the Connection Between Radio Mini-halos and Core Gas Sloshing with MHD Simulations" 2011, in Non-thermal Phenomena in Colliding Galaxy Clusters, G. Ferrari, M. Brüggen, G. Brunetti, and T. Venturi, eds. (Pisa, Italy: Journal of the Italian Astronomical Society), 632

ZuHone, J., & Markevitch, M. "Cluster Core Heating from Merging Subclusters" 2009, in The Monster's Fiery Breath: Feedback in Galaxies, Groups, and Clusters, S. Heinz and E. Wilcots, eds. (Melville, NY: AIP Press), 383