Brian D Farris

Contact Information

New York University
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Interests

High energy theoretical astrophysics, numerical relativity, general relativistic magnetohydrodynamics, radiative transfer, binary black hole mergers in gaseous environments.

Education

2005-2012	Ph. D., Physics, University of Illinois at Urbana-Champaign (UIUC)
2000-2004	B. S., University of California, Berkeley, Physics (with honors and distinction)

Awards

2009-2012	NASA Earth and Space Science Fellowship
2008	Topical Group in Gravitation Travel Grant
2005-2006	Carver Fellowship for Outstanding Incoming Doctoral Student
2003	UC Berkeley Pomerantz Scholarship for Outstanding Physics Student
2002-2004	UC Berkeley Undergraduate Research Scholar
2000-2004	UC Berkeley Alumni Scholarship
2000-2004	UC Berkeley Chancellors Scholarship
2000-2004	UC Berkeley Drake Scholarship

Research Experience

2012-present — Postdoctoral research fellow at New York University and Columbia University. Performed 2D Newtonian simulations of black hole mergers in disk-like gaseous environments using *DISCO*, a finite-volume, moving-mesh code for viscous hydrodynamics. Studied characteristic time variability signatures in accretion rate and luminosity, dependence on binary mass-ratio, spectral signatures, and decoupling dynamics prior to merger.
Advisors: Andrew MacFadyen and Zoltan Haiman

2011-2012 — Performed fully general relativistic simulations of black hole mergers in disk-like gaseous environments. Calculated luminosity of electromagnetic radiation emitted, investigating possible mechanism for simultaneous detection of gravitational and electromagnetic signatures from merging supermassive black holes.
UIUC. Advisor: Stuart L Shapiro

2008-2010 — Performed fully general-relativistic hydrodynamic simulations of merging black hole binaries embedded in spherical Bondi-like accretion environments.
UIUC. Advisor: Stuart L Shapiro

2005-2007 — Wrote and tested a fully general relativistic code which evolves Magnetohydrodynamic fluids and radiation in dynamical spacetimes. The code solves the Einstein-Maxwell-MHD-Radiation system of coupled equations in axisymmetry and in full $3 + 1$ dimensions.
UIUC. Advisor: Stuart L Shapiro

2004-2005 — Worked as full time researcher with the Supernova Cosmology Project to generate lightcurves for the '99 Nearby Supernova Campaign.
Supernova Cosmology Project, LBNL. Advisor: Saul Perlmutter

2004 — Completed senior thesis entitled "Lightcurves of Nearby Supernovae".
Nearby Supernova Factory, UC Berkeley. Advisor: Gerson Goldhaber

2002-2004 — Participated in Berkeley Undergraduate Research Scholars Program, conducting research in collaboration with Professor G. Goldhaber and S. Perlmutter with the Supernova Cosmology Project. Work included scanning for new nearby supernovae, simulating illumination of telescope domes in order to asses dome flat procedure, simulating asteroid orbits in order to predict and eliminate asteroids as false supernova candidates, and generating supernova lightcurves.

Nearby Supernova Factory, UC Berkeley. Advisor: Gerson Goldhaber

Teaching Experience

2011	Teaching Assistant: Physics of Compact Objects (UIUC)
2009	Teaching Assistant: Physics of Compact Objects (UIUC)
2008	Teaching Assistant: Computational Physics and Astrophysics (UIUC)
2007-2008	Teaching Assistant: General Relativity (2 semester sequence) (UIUC)
2002-2004	Math and Physics Tutor: Residence Hall Program (UC Berkeley)

Conference Talks

2014	Simulations of Disk Accretion onto Black Hole Binaries *International LISA Symposium, Gainesville*
2013	Simulations of Disk Accretion onto Black Hole Binaries *Astro-GR meeting, Atlanta*
2012	Simulations of Binary Black Hole Mergers in Magnetized Gaseous Disks *APS April meeting, Atlanta*
2011	Simulations of Binary Black Hole Mergers in Gaseous Disks *21st Midwest Relativity Meeting, University of Illinois*
2011	Simulations of Binary Black Hole Mergers in Gaseous Disks *APS April meeting, Anaheim*
2010	General Relativistic Simulations of Binary Black Hole Mergers in Gaseous Environments *20th Midwest Relativity Meeting, University of Guelph*
2010	General Relativistic Simulations of Binary Black Hole Mergers in Gaseous Environments *APS April meeting, Washington DC*
2009	Simulations of Binary Black Hole Mergers in Gaseous Environments *19th Midwest Relativity Meeting, University of Michigan*
2008	Relativistic Radiation Magnetohydrodynamics in Dynamical Spacetimes *18th Midwest Relativity Meeting, University of Notre Dame*
2008	Relativistic Radiation Magnetohydrodynamics in Dynamical Spacetimes *APS April meeting, St. Louis*

Educational Service and Outreach

2009	Research presentation at "2nd Annual Midwest Conference for Undergraduate Women in Physics" (UIUC)
2008	Research presentation for AP Physics class at New Trier Township High School (Chicago)
2007	Research presentation for high school students and community members through the "Saturday Physics Program" (UIUC)

Publications

B. D. Farris, P. Duffell, Andrew I. MacFadyen, Z. Haiman, "Characteristic Signatures in the Thermal Emission from Accreting Binary Black Holes".arXiv:1406.0007 (2014)

P. C. Duffell, Z. Haiman, A. I. MacFadyen, D. J. D'Orazio, **B. D. Farris**, "Type II Migration is not Locked to Viscous Disk Evolution". arXiv:1405.3711 (2014)

B. D. Farris, P. Duell, A. I. MacFadyen,& Z. Haiman, "Binary Black Hole Accretion From a Circumbinary Disk: Gas Dynamics Inside the Central Cavity". *ApJ*, **783**, 134 (2014)

B.D. Farris, R.G. Gold,V. Paschalidis & S.L. Shapiro, "Binary black hole mergers in magnetized disks: simulations in full general relativity". *Phys. Rev. Lett.*, **109**, 221102 (2012)

A.N. Staley, T.W. Baumgarte, J.D. Brown, **B.D. Farris**, & S.L. Shapiro, "Oppenheimer-Snyder Collapse in Moving-Puncture Coordinates". *Classical and Quantum Gravity*, **29**, 015003 (2012)

B.D. Farris, Y.T. Liu, & S.L. Shapiro, "Binary black hole mergers in gaseous disks: Simulations in general relativity". *Phys. Rev. D.*, **84**, 024024 (2011)

B.D. Farris, Y.T. Liu, & S.L. Shapiro, "Binary black hole mergers in gaseous environments: "Binary Bondi" and "binary Bondi-Hoyle-Lyttleton" accretion". *Phys. Rev. D.*, **81**, 084008 (2010)

M. Kowalski et al., "Improved Cosmological Constraints from New, Old and Combined Supernova Datasets". *Astrophys. J.*, **686**, 749 (2008)

B.D. Farris, T.K. Li, Y.T. Liu, & S.L. Shapiro, "Relativistic Radiation

Magnetohydrodynamics in Dynamical Spacetimes: Numerical Method and Tests". *Phys. Rev. D.*, **78**, 024023 (2008)

Computing Skills

Thorough expertise in the C, C++, Fortran, and Python programming languages. Broad knowledge of Linux, Unix, and MacOS development environments. Experience developing and deploying software on distributed memory (Beowulf-style) Linux clusters including NASAs petaflop SGI cluster, Pleiades. Experience coding and running parallel simulations using the Message Passing Interface (MPI) C and Fortran bindings. Experience with developing parallel algorithms for data mapping and communication. Familiar with the Lustre parallel file system and collective HDF5 operations for hardware-intensive data transfers. Working knowledge of Mathematica. Experience with additional science APIs including the GNU Science Library.

Primary References

Andrew MacFadyen, Ph.D., Professor. New York University.

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Zoltan Haiman, Ph.D., Professor. Columbia University

Email: zoltan@astro.columbia.edu