Jonathan C. McKinney

US Citizen

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Education

2004	**Ph.D.** in Theoretical Astrophysics, UIUC
	Thesis: Black Hole Accretion Systems (Prof. Gammie, advisor)
1999	**M.S.** in Physics, UIUC
1997	**B.Sc.** in Physics (Summa Cum Laude), Texas A&M Univ., College Station
	Sr. Thesis: *2-D Wavefunction Time Evolution using Wavelets/Fourier transforms investigating Periodic Potentials* (Prof. Siu Ah Chin, advisor)
	Jr. Thesis: *Atmospheric Polarization due to Incoherent Light from Sun: A Layer Model of the Atmosphere* (Prof. George W. Kattawar, advisor)

Research Interests

High-energy astrophysics, non-relativistic and relativistic jets, black hole and neutron star accretion, pulsar emission, general relativity, plasma physics, plasma and MHD instabilities, stellar and planetary internal magnetic fields and magnetospheres, non-thermal emission, gamma-ray bursts, galaxy/galaxy cluster evolution, AGN feedback

Research Experience

2007-	**Chandra Fellow**, Stanford Physics/KIPAC
2004-2007	**Institute for Theory & Computation Fellow**, CfA, Harvard College Obs.
2001-2004	**NASA Fellow**, UIUC
1999-2000	**Research Assistant**, UIUC
	Computational and theoretical study of black hole accretion disks.
	Advisor: Prof. Charles Gammie
	Molecular Clouds, Galactic Dynamics, Accretion Disks
1998	**Research Assistant**, UIUC
	General relativistic hydrodynamic processes involving shocks as applied to cosmological sheets.
	Advisor: Prof. Mike Norman, Sr. res. scientist, NCSA (now UCSD)
	Numerical methods to model astrophysical fluid dynamical systems
1996Sum	**Research Assistant** (REU), UIUC
	Symmetry breaking and chaos in electron transport in semiconductor superlattices.
	Advisor: Prof. David K. Campbell (now Dean Boston University)
	Nonlinear Dynamics of Electrons in Mesoscopic Nanostructures
1996-1997	**Research Assistant**, Texas A&M University

1-D and 2-D wavefunction time evolution using wavelet/Fourier transform. Periodic reflectionless quantum waveguides.
Advisor: Prof. Siu Ah Chin
Theoretical nuclear physics; high-density matter; lattice calculations; Monte Carlo methods

1995 **Research Assistant**, Texas A&M University
Atmospheric polarization due to incoherent light from Sun interacting with the layers of the sky. Light from Moon and Sun that create the green and blue shock on sunsets and sunrises.
Advisor: Prof. George W. Kattawar
Atmospheric/oceanic optics; radiative transfer w/ elastic and inelastic scattering in the atmosphere-ocean system

Fellowships, Awards, Honors

2007-2010 **Fellowship:** 3yr Chandra Fellowship
2007-2012 **Fellowship:** Stanford Physics 5yr KIPAC Fellow/Senior Research Scientist
2007 **Honor:** IAS 5yr Long Term Member (declined)
2007 **Honor:** CITA 5yr Senior Research Associate (declined)
2007 **Fellowship:** Harvard CfA 4yr Clay Fellowship (declined)
2007 **Fellowship:** Princeton Univ. 3yr Council on Sci. & Tech. Teaching Fellowship (declined)
2007 **Fellowship:** Princeton Astro. 3yr Lyman Spitzer, Jr. Fellowship (declined)
2007 **Fellowship:** Princeton Society of Fellows (declined)
2006 **Fellowship:** NYU 5yr James Arthur Fellow – Senior Res. Sci. (declined)
2004 **Fellowship:** Institute for Theory and Computation (ITC) Fellow, CfA, Amount: $52,000/yr stipend, $14,000/yr research expenses. (2004-2007)
2001-2004 **Fellowship:** NASA GSRP Fellow (S01-GSRP-044), *General Relativistic MHD*, sole author proposal. Amount: $45,000 stipend + $18,000 expenses.
1997, 2000 **Fellowship:** General Electric Fellow (for scholastic excellence as graduate at UIUC), Amount: twice received $7,000 stipend + $500 expenses
1996-1997 **Award:** Faculty Achievement Award (for leadership in the College of Science at Texas A&M as recognized by physics faculty)
1996 **Fellowship:** Summer Research Fellowship, UIUC http://www.physics.uiuc.edu/education/undergrad/reu/
1994 **Award:** Golden Key National Honor Award: National Honor Society ($1,000 scholarship award) http://goldenkey.org

Research Grants

2003 **Research Award:** Co-Investigator/Co-Author for NCSA NRAC, 300,000 hours on Tungsten (2900 CPU Xeon cluster), with a significant portion for my research. PI: Charles F. Gammie (2003-2006)
2002 **Research Award:** Co-Investigator for NSF ITR Program, #0205155, *MHD Simulations in Full General Relativity*. PI: Charles F. Gammie. Amount: $2,250,000 (2002-2007)
2001 **Research Award:** Co-Investigator for NSF, #0093091, *Theory of Black Hole Accretion Flows*. PI: Charles F. Gammie. Amount: $570,429. (2001-2007)

Teaching Experience

2000 **Teaching Assistant**, 1 semester, UIUC, Graduate level: *The Physics of Compact Objects*, Prof. Stuart L. Shapiro
1999 **Teaching Assistant**, 1/2 year, UIUC, ENGR. level Stat. Mech.
1999 **Teaching Assistant**, 1/2 year, UIUC, ENGR. level Mechanics

1998 **Teaching Assistant**, 1 year, UIUC, ENGR. level E&M
1997 **Teaching Assistant**, 1 year, UIUC, ENGR. level Quantum Mechanics
1996-1997 **Teaching Assistant**, 1 year, Texas A&M, Graduate level: Stat. Mech.

Student Mentoring

(Under supervision by Ramesh Narayan)
2005-2006 **Undergraduate students:**
Manuel Antonio Aguilar: Senior thesis research advisor (CfA, 1st year 2002)
2004-2007 **Ph.D. student:**
Alexander Tchekhovskoi: Research advisor (CfA, 1st year 2004)

Other Work Experience

1997Sum **Electrical Engineer Apprentice** for Turnkey in Plano, TX for Mr. Steve Williams
1995Sum **Wafer Lab Technician** for Dallas Semiconductor in Dallas, TX for Mr. David Massey
1994 **Autocad Designer Apprentice** for B.L. & P. Engineers in Dallas, TX for Scott Brady

Publications

19) Komissarov, S.S. & **McKinney, J.C.**, *"Meissner effect" and Blandford-Znajek mechanism in conductive black hole magnetospheres*, MNRAS LETTERS, accepted (astro-ph/0702269)
18) Mignone, A. & **McKinney, J.C.,** *On the Equation of State in Relativistic Magnetohydrodynamics*, MNRAS, submitted
17) Tchekhovskoi, A.D., **McKinney, J.C.**, & Narayan, R., *WHAM: WENO-based general relativistic scheme I: hydrodynamics*, MNRAS, accepted
16) Narayan, R. **McKinney, J.C.**, & Farmer, A.J., *Self-Similar Force-Free Wind from an Accretion Disk*, MNRAS, accepted (astro-ph/0610817)
15) **McKinney, J.C.** & Narayan, R., *Disk-Jet Coupling in Black Hole Accretion Systems I: General Relativistic Magnetohydrodynamical Models*, MNRAS, accepted (astro-ph/0607575)
14) **McKinney, J.C.** & Narayan, R., *Disk-Jet Coupling in Black Hole Accretion Systems II: General Relativistic Force-Free Models*, MNRAS, accepted (astro-ph/0607576)
13) Noble, S. C., Gammie, C. F., **McKinney, J.C.**, & Del Zanna, L., *Primitive Variable Solvers for Conservative General Relativistic Magnetohydrodynamics*, 2006, ApJ, **641**, 626
12) **McKinney, J.C.** , *Relativistic Force-Free Electrodynamic Simulations of Neutron Star Magnetospheres*, 2006, MNRAS LETTERS, **368**, L30
11) **McKinney, J.C.** , *General Relativistic Magnetohydrodynamic Simulations of Jet Formation and Large Scale Propagation from Black Hole Accretion Systems*, 2006, MNRAS Main Journal, **368**, 1561
10) **McKinney, J.C.** , *General Relativistic Force-Free Electrodynamics: A New Code and Applications to Black Hole Magnetospheres*, 2006, MNRAS Main Journal, **367**, 1797
9) **McKinney, J.C.** , *Total and Jet Blandford-Znajek Power in the Presence of an Accretion Disk*, 2005, ApJ Letters, **630**, L5-L8
8) **McKinney, J.C.** & Gammie, C.F., *A measurement of the hydromagnetic luminosity of a Kerr black hole*, 2004, ApJ, **611**, 977M
7) Watson, W. D., Wiebe, D. S., **McKinney, J. C.**, & Gammie, C. F., *Anisotropy of magnetohydrodynamic turbulence and the polarized spectra of OH masers*, 2004, ApJ, **604,** 707W
6) Gammie, C.F., Shapiro, S.L., & **McKinney, J.C.**, *Black hole spin evolution*, 2004, ApJ, **602**, 312G

5) Gammie, C.F., **McKinney, J.C.**, & Tóth, G., *HARM: A numerical scheme for general relativistic magnetohydrodynamics*, 2003, ApJ, **589**, 444G
4) **McKinney, J. C.** & Gammie, C. F., *Numerical models of viscous accretion flows near black holes*, 2002, ApJ, **573**, 728M
3) Anninos, P. & **McKinney, J.** *Relativistic hydrodynamics of cosmological sheets*, 1999, Phys. Rev. D **60**, 064011
2) K. N. Alekseev, E. H. Cannon, **J. C. McKinney**, F. V. Kusmartsev, & D. K. Campbell. *Symmetry-breaking and chaos in electron transport in semiconductor superlattices*, 1998, Physica D. **113**, 129-133
1) K. N. Alekseev, E. H. Cannon, **J. C. McKinney**, F. V. Kuzmartsev, & D. K. Campbell. *Spontaneous dc current generation in a resistively shunted semiconductor superlattice driven by a terahertz field*, 1998, Phys. Rev. Lett. **80**, 2669-2672

Proceedings

2) Gammie, C.F. and McKinney, J.C. *Numerical Models of Black Hole Accretion Flows , C*ontribution to The APCTP Winter Workshop 2004, Pohang, Korea http://www.astro.uiuc.edu/~gammie/pohang2004.pdf
1) Watson, W.D., Wiebe, D.S., McKinney, J.C., Gammie, C.F. (2004), *Anisotropy of MHD Turbulence and the Polarized Spectra of OH Masers*, AAS.

Publications in Preparation

1) **McKinney, J.C.,** *Pulsar Power: The Oblique Rotator*
2) **McKinney, J.C.** , Tchekhovskoi, A.D., & Narayan, R., *WHAM: WENO-based general relativistic scheme II: magnetohydrodynamics*
3) **McKinney, J.C.** , *Magnetized Bondi-Hoyle accretion*
4) Broderick, A., **McKinney, J.C.**, & Loeb, A., *Disk vs. jet emission from GRMHD models of SgrA**

Professional Memberships/Services and Other Services

1999-	Member: AAS, APS
2002-	Refereed: ApJ, ApJ Letters, MNRAS, MNRAS Letters, PRL, A&A
2006	CfA organizer and leader: Weekly 2 hour group meeting of postdocs and graduate students where an individual discusses a paper on astro-ph in detail or discusses their own research in detail.

Invited Talks

Dec06	*Review Talk on AGN Jets* , 5th Stromlo Symposium, Texas in Australia http://www.mso.anu.edu.au/5SS
Oct06	*Disk-Jet Coupling in Accreting X-ray Binary Systems*, MIT Workshop on Magnetized Accretion Disks. http://xte.mit.edu/~rr/magdisk_workshop.ls
Sep06	*Black Hole Accretion*, IAS http://www.sns.ias.edu/~seminar/wed_seminars_fall06.html
Sep06	*Adventures in Relativistic MHD as Applied to Compact Objects*, CITA http://www.cita.utoronto.ca/index.php/events_calendar/archive
Jul06	*Relativistic MHD Models of Accretion Disks*, Marcell Grossmann 11, CM2 http://www.icra.it/MG/mg11/
Jun06	*GRMHD Simulations of Jet Formation and Large-Scale Propagation from Black Hole Accretion Systems*, IAM, Sicily http://www.mporzio.astro.it/cefalu2006/
May06	*Jet Formation and Propagation in Black Hole Accretion Systems*, BU
May06	For*mation of Jets in MHD Simulations*, Sackler, CfA http://www.cfa.harvard.edu/bh2006/

Mar06	*Pulsar Spin-down*, NYU http://www.physics.nyu.edu/cgi-bin/astro
Oct05	*Black Hole Jet Formation*: Teaching forum for audience of graduate students, CfA , http://cfa160.cfa.harvard.edu/~r˙forum/
Apr05	*Jet Formation in Black Hole Accretion Systems*, CfA/TA
Jan05	*GRMHD Models of Black Hole Accretion*, Black Hole Astrophysics, Kyoto http://www2.yukawa.kyoto-u.ac.jp/~ykato/BHworkshop2004/program.html
Feb05	*The Blandford-Znajek effect and Spin Equilibrium*, Tapir, Caltech http://www.tapir.caltech.edu/tapir˙seminars.html
	CTA Seminar on Theoretical Astrophysics & General Relativity http://www.physics.uiuc.edu/Research/CTA/seminars/
2003Spr	*Intermediate-Mass Black Holes: Formation Theories & Observational Constraints*
2002Spr	*Efficient Acceleration and Radiation in Poynting Flux Powered GRB Outflows*
2002Fal	*High-Energy Gamma Rays from AGN, GRBs, and Plerions*
2001Fal	*Black Hole accretion in Active Galactic Nuclei* (also prelim. exam)
2001Spr	*Bar-Driven Dark Matter Halo Evolution: A Resolution of the Cusp-Core Controversy*
2000Fal	*Gamma-Ray bursts: Magnetized Collapsars and duration of GRBs*
2000Spr	*Planet Formation: The Effects of Thermal Energetics on 3-D Hydrodynamic Instabilities in Massive Protostellar Disks*
1999Fal	*Discussion of Numerical Methods on the study of AGN: GRMHD*
1999Spr	*Global Magnetohydrodynamical Simulations of Accretion Tori*

Contributed and other Talks

2005Fal	*Jet Formation and Propagation in Black Hole Accretion Systems*, UMICH http://www.astro.lsa.umich.edu/users/mctpwww.contrib.html
1996Sum	*Semiconductor Superlattices* **REU (Research Experience for Undergraduates)** http://www.physics.uiuc.edu/education/undergrad/reu/

Computational Experience

Software Written:	Sole author of nonlinear dynamics code used by Alekseev et al. (1998) Sole author of ZEUS-like parallel and efficient 3D MHD code with resistivity and viscosity. Contributed significantly to writing HARM Parallelized all our group's codes using MPI Developed original formalism/code for GR Force-free Co-developed higher-order accurate new WENO scheme Developed 3D GRMHD scheme with advanced divB=0
Beowulf Cluster:	Was principle designer, builder, and manager of a 32 CPU Linux gigabit & Myrinet cluster for testing, development, and up to medium scale simulations. Design and associated publications: http://rainman.astro.uiuc.edu/cluster/
Digital Demo Room:	Helped create a web portal for astrophysical simulations: http://ddr.astro.uiuc.edu
Workshops:	NCSA Microprocessor Performance Tuning, Jan 2002 NCSA Linux Clusters Institute Workshop, Oct 2001 NCSA MPI Workshop, Mar 2001
Science Applications:	Expert: Mathematica, Supermongo, Matlab, Vis5D+ Basic: Maple

Operating Systems:	Expert: All forms of Linux, DOS, and Windows Basic: VMS, Solaris, SUN
Programming:	Expert: C, FORTRAN77 & 90, C++, Visual C++, Bash

References

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