

Jeffrey Daniel Kaplan

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Education

California Institute of Technology, Pasadena CA

September 2007 to Present

Ph.D. Candidate in Physics

Areas of interest and research:

- ✧ General Relativity – both analytical and numerical
- ✧ Theoretical Astrophysics
- ✧ Differential Geometry and Physics from a Geometrical Viewpoint
- ✧ Visualization of Physics as a tool for teaching, learning and research

Northwestern University, Evanston IL

September, 2003 to June, 2007

B.A. in Physics, Mathematics, and Integrated Science

- ✧ Graduated Magna Cum Laude, GPA: 3.86/4.00
- ✧ Honors in Physics with Senior Thesis: “Low-frequency Non-radial Oscillations of Stars”
 - Thesis was selected as an Outstanding Senior Thesis in the Physics Department

Research & Employment History

- ✧ 2008 – present: Researcher in Theoretical Astrophysics and Numerical Relativity, Caltech
 - Advisor: Professor Christian Ott
 - Currently investigating simulations of neutron-star binary coalescence using the Caltech/Cornell spectral numerical relativity code, SpEC
- ✧ 2009 – 2010: Head teaching assistant for Physics 2, Caltech
 - Responsibilities include: Preparing and teaching a recitation section twice a week, holding office hours to assist students with course work, and devising practice, quiz and final problems.
 - Head TA responsibilities: Creating and maintaining course website, manage

- TA grading schedule, review schedule and office hours. In charge of managing student grades and recitation sections.
 - Course Matter: Normal mode oscillations; Fourier analysis; wave propagation, interference, reflection and refraction; quantum mechanics up to the hydrogen atom; thermodynamics and statistical mechanics
- ✧ 2008 – 2011: Researcher in General Relativity, Caltech
 - Advisors & collaborating Professors: Professors Yanbei Chen, & Kip Thorne
 - Studied breakthrough methods of visualizing gravitational fields, using 'tendex' and 'vortex' field lines, as well as field pseudo-momentum. Studied these quantities on the event horizons of binary black holes from numerical relativity simulations.
- ✧ 2008 – 2009, 2012: Teaching assistant for Physics 1, Caltech
 - Responsibilities included: Preparing and teaching a recitation section twice a week, holding office hours to assist students with course work, and devising practice, quiz and final problems
 - Course Matter: Core introductory physics material, including mechanics, special relativity & electromagnetism
- ✧ 2004 – 2007: Researcher in Theoretical Astrophysics, Northwestern U
 - Advisor: Professor Vicky Kalogera
 - Completed multiple analyses of data from the population synthesis code 'StarTrack' for applications in understanding populations of compact object binaries
 - Also worked closely with Postdoctoral associate Dr. Bart Willems on asymptotic approximations of low frequency non-radial oscillations of stars
- ✧ 2004 – 2007: Teaching assistant for Integrated Science Computing Applications Course, Northwestern U
 - Responsibilities included: Head TA, organizing TA schedule, devising and proof-checking homework assignments, and helping students in the computer lab
 - Course Matter: Unix operating system, HTML, C++ for scientific applications, and other computing topics for scientific applications

- ✧ 2004 – 2005: Researcher in Experimental Particle Physics, Northwestern U
 - Advisor: Professor Michael Schmitt
 - Wrote code to analyze muon pair mass data from Fermilab, as well as worked to develop an improved statistical analysis to apply to the data

Fellowships & Research Grants

- ✧ 2007-2008: Richard P. Feynman Fellowship – Caltech
- ✧ 2007-2009: National Science Foundation Graduate Fellowship Research Program, Honorable mention for both years 2007 & 2008
- ✧ 2005-2007: Barry M. Goldwater Scholar
- ✧ 2006-2007: Katherine L. Kriegbaum Scholar, Northwestern University
- ✧ 2006-2007: NASA Summer Research Program for both years 2006 & 2007, Northwestern University
- ✧ 2005: Weinberg College of Arts and Sciences 2005 Summer Research Grant

Honor Societies and Awards

- ✧ June, 2007: Outstanding Senior Thesis, Physics Department, Northwestern University
- ✧ April, 2006: Elected to Phi Beta Kappa Honorary Society
- ✧ May, 2006: Elected to Sigma Pi Sigma Physics Honor Society
- ✧ May, 2006: Elected to Pi Mu Epsilon, Mathematics Honor Society

Computer skills & languages

- ✧ Proficient in: C/C++, Python, Bash/Shell Scripting
- ✧ Competent in: Perl, HTML, SQL, Linux system administration
- ✧ Experienced in both Windows and Linux/Unix operating systems
- ✧ Word processing skills: Microsoft Word, Google Docs, LaTeX
- ✧ Spreadsheet skills: Microsoft Excel, Google Docs Spreadsheet
- ✧ Rapid learner in any computer languages, tool-sets and skills

Talks & Presentations

- ✧ “Resolving Topological Features of Event Horizons,” April Meeting of the American Physical Society. Atlanta, Georgia. April 3, 2012.
 - Also gave this talk at 28th Pacific Coast Gravity Meeting. Kavli Institute for Theoretical Physics, UCSB. March 24, 2012.
- ✧ “Dynamical Coordinates for Numerical Relativity with Hydrodynamics,” Theoretical Astrophysics in Southern California. Kavli Institute for Theoretical Physics, UCSB. November 4, 2011.
- ✧ “Simulations of Astrophysical Black-Hole Formation using the Spectral Einstein Code (SpEC),” April Meeting of the American Physical Society. Anaheim, California May 3, 2011
- ✧ “Simulations of Neutron-Star Binaries using SpEC” 26th Pacific Coast Gravity Meeting. University of California San Diego, San Diego, California. March 27, 2010
Received Best Talk Award
- ✧ “Simulations of Neutron-Star Binaries using the Spectral Einstein Code (SpEC),” April Meeting of the American Physical Society. Washington, DC. February 13-17, 2010.
- ✧ “Post-Newtonian Approximation in a Maxwell-Like Form for Use in Interpreting Binary-Black-Hole Simulations,” 2009 April Meeting of the American Physical Society [L11.00002](#) Denver, Colorado. May 2-5, 2009
- ✧ “Post-Newtonian Approximation in a Maxwell-Like Form for Use in Interpreting Binary-Black-Hole Simulations,” 25th Pacific Coast Gravity Meeting. University of Oregon. Eugene, Oregon. March 27-28, 2009
- ✧ “Asymptotic Approximations For Low-frequency G-modes Of Stars” 210 AAS Meeting, #45.06 Honolulu, Hawaii 05/2007.
- ✧ “Upper Limits on Black Hole Spins” at the 14th Midwest Relativity Meeting at the University of Wisconsin – Milwaukee, October 14-16, 2004

Papers

- ✧ “Toroidal Horizons in Binary Black Hole Inspirals,” Cohen, Michael I.; Kaplan, Jeffrey D.; Scheel, Mark A. *Physical Review D* 85, 024031 (2012)
- ✧ “Visualizing Spacetime Curvature via Frame-Drag Vortexes and Tidal Tendexes I. General Theory and Weak-Gravity Applications,” Nichols, David A.; Owen, Robert;

Zhang, Fan; Zimmerman, Aaron; Brink, Jeandrew; Chen, Yanbei. . Kaplan, Jeffrey D. Lovelace, Geoffrey; Matthews, Keith D.; Scheel, Mark A.; ; Thorne, Kip S. *Physical Review D* 84, 124014 (2011)

- ✧ “Frame-Dragging Vortexes and Tidal Tendexes Attached to Colliding Black Holes: Visualizing the Curvature of Spacetime,” Owen, Robert; Brink, Jeandrew; Chen, Yanbei. Kaplan, Jeffrey D. Lovelace, Geoffrey; Matthews, Keith D.; Nichols, David A.; Scheel, Mark A.; Zhang, Fan; Zimmerman, Aaron; Thorne, Kip S. *Physical Review Letters* 106, 151101 (2011)
- ✧ “Momentum flow in black-hole binaries: II. Numerical simulations of equal-mass, head-on mergers with antiparallel spins,” Lovelace, Geoffrey.; Chen, Yanbei. Cohen, Michael.; Kaplan, Jeffrey D. ; Keppel, Drew.; Matthews, Keith D.; Nichols, David A.; Scheel, Mark A.; Sperhake, Ulrich. *Physical Review D* 82, 064031 (2010)
- ✧ “Post-Newtonian Approximation in Maxwell-Like Form”, Kaplan, Jeffrey D. ; Nichols, David A.; Thorne, Kip S. *Physical Review D* 80, 124014 (2009)
- ✧ “On the Formation and Progenitors of PSR J0737-3039: New Constraints on the Supernova Explosion Forming Pulsar B”, Willems, B, Kaplan, J. Fragos, T., Kalogera, V., Belczynski, K. 2006. *Physical Review D*, 74, 043003.
- ✧ “Bounds on Expected Black Hole Spins in Inspiring Binaries”, O’Shaughnessy, R., Kaplan, J., Kalogera, V., Belczynski, K. 2005, *The Astrophysical Journal*, 632:1035-1041.