

Joel Franklin

Physics Department, Reed College
3203 SE Woodstock Blvd.
Portland, OR
97202

Education

B.A. Physics, Reed College, 1997.

M.A. Physics, Brandeis University, 1999.

Ph.D. Computational Mathematics, Stanford University, 2003.

(“Topics in macro-molecular dynamics integration” with Sebastian Doniach.)

Visiting Researcher, Structural Biology & Chemistry, Pasteur Institute, 2003.

Work Experience

Postdoctoral Associate, M.I.T., 2003-2005. Member, $\Sigma\Xi$, M.I.T. Chapter.

Visiting Assistant Professor, Reed College, 2005–2007.

Assistant Professor, Reed College, 2007 – 2010.

Associate Professor, Reed College, 2010 – 2016

Professor, Reed College, 2016 –

Visiting Associate Professor, Stanford University, 2012.

KITP Scholar, UCSB, 2012–2014.

Publications

Papers

1. S. Deser, J.S. Franklin, D. Seminara, “Graviton-Graviton Scattering, Bel-Robinson and Energy (Pseudo)-Tensors”. *Class. Quant. Grav.* 16(9):2815-2821, 1999.
2. S. Deser, J. Franklin, B. Tekin, “Shortcuts to Spherically Symmetric Solutions: A Cautionary Note.” *Class. Quant. Grav.* 21(22): 5295-5296, 2004.

3. S. Deser, J. Franklin, “Schwarzschild and Birkhoff a la Weyl.” *Am. J. Phys.* **73**(3):261-264, 2005.
4. S. Deser, J. Franklin, “Birkhoff for Lovelock Redux.” *Class. Quant. Grav.* **22**:L103-106, 2005.
5. S.A. Hughes, S. Drasco, E.E. Flanagan, J. Franklin, “Gravitational Radiation Reaction and Inspiral Waveforms in the Adiabatic Limit.” *Phys. Rev. Lett.* **94**, 221101, 2005.
6. J. Lipfert, J. Franklin, Fang Wu & Sebastian Doniach, “Protein Misfolding and Amyloid Formation for the Peptide GNNQQNY from Yeast Prion Protein Sup35: Simulation by Reaction Path Annealing.” *J. Mol. Biol.* **349**(3):648-58, 2005.
7. J. Franklin, S. Doniach, “Adaptive Time Stepping in Molecular Dynamics.” *J. Chem. Phys.* **123**, 124909, 2005. (selected for the Virtual Journal of Biological Physics Research).
8. J. Franklin, S. Doniach, “Dynamic Bond Constraints in Protein Langevin Dynamics.” *J. Chem. Phys.* **124**, 154901, 2006. (selected for the Virtual Journal of Biological Physics Research).
9. J. Franklin, P. T. Baker, “Linearized Kerr and Spinning Massive Bodies: An E&M Analogy” *Am. J. Phys.* **75**(4):336–342, 2007.
10. J. Franklin, P. Koehl, S. Doniach & M. Delarue. “MinActionPath: Maximum Likelihood Trajectory for Large-Scale Structural Transitions in a Course-Grained Locally Harmonic Energy Landscape”. *Nucleic Acids Research*, **35**, W477-482, 2007.
11. S. Deser, J. Franklin, “Time-(In)Dependence in General Relativity” *Am. J. Phys.* **75**(3):281–283, 2007.
12. S. Deser, J. Franklin, “Circular Symmetry in Topologically Massive Gravity” *Class. Quant. Grav.* **27**:1007002, 2010.
13. S. Deser, J. Franklin, “De/Re-Constructing the Kerr Metric” *General Relativity and Gravitation*, **42**, 11, 2657–2662, 2010.
14. J. Franklin, F. Morton-Park. “Charged Radial Infall for Spherical Central Bodies”, *Am. J. Phys.* **78**(12):1336, 2010.
15. S. Deser, J. Franklin. “Is BTZ a Separate Superselection Sector of CTMG?”, *Phys. Lett. B*, **693**, 609–611, 2010.
16. S. Deser, J. Franklin, “Bel-Robinson for TMG”, *Class. Quant. Grav.* **28**:032002, 2011.
17. J. Franklin, T. Garon, “Approximate Born-Infeld Effects on the Relativistic Hydrogen Spectrum”, *Phys. Lett. A*, **375**, 1391–1395, 2011.

18. S. Deser, J. Franklin, “No Bel-Robinson Tensor for Quadratic Curvature Theories”, *Class. Quant. Grav.*, **28** 235016, 2011.
19. S. Deser, J. Franklin, “Canonical Analysis of Lanczos-Lovelock Gravity”, *Class. Quant. Grav.*, **29** 072001, 2012.
20. D. Clark, J. Franklin, N. Mann, “Relativistic Linear Restoring Force”, *Eur. J. Phys.* **33**, 1041–1051, 2012.
21. S. Deser, J. Franklin, “Symmetrically Reduced Galileon Equations and Solutions”, *Phys. Rev. D.* **86** 047701, 2012.
22. J. Franklin, C. LaMont, “The Motion of a Pair of Charged Particles”, *Braz. J. Phys.* **43** 4, 2013.
23. J. Franklin, D. Griffiths, “The Fields of a Charged Particle in Hyperbolic Motion”, *Am. J. Phys.* **82** 8, 2014.
24. J. Franklin, “Self-Consistent, Self-Coupled Scalar Gravity”, *Am. J. Phys.* **83** 4, 2015.
25. J. Franklin, Y. Guo, A. McNutt & A. Morgan, “The Schrödinger-Newton System with Self-Field Coupling”, *Class. Quant. Grav.*, **35** 065010, 2015.
26. S. Deser, J. Franklin, “Bel-Robinson as Stress-tensor Gradients and their Extensions to Massive Matter”, *Gen. Rel. Grav.*, **47**, 68, 2015. (editor’s choice).
27. J. Franklin, K. Cole Newton, “Classical and Quantum Mechanical Motion in Magnetic Fields”, *Am. J. Phys.*, **84**, 263, 2016 (editor’s pick).
28. J. Franklin, Y. Guo, K. Cole Newton & M. Schlosshauer, “The Dynamics of the Schrödinger-Newton System with Self-Field Coupling”, *Class. Quant. Grav.*, **33** (7), 2016.
29. E. Banyas, J. Franklin, “The (Weak) Gravitational Field of a Dirac Monopole”, *Class. Quant. Grav.*, **34** 195004, 2017.

Books

30. J. Franklin. *Advanced Mechanics and General Relativity*, Cambridge University Press, 2010.
31. J. Franklin. *Computational Methods for Physics*, Cambridge University Press, 2013.
32. J. Franklin. *Classical Field Theory*, Cambridge University Press, 2017.

Talks and Presentations

1. “Constellations: post-show Talkback”, Portland Center Stage, June, 2017.

2. "Electromagnetic and Gravitational Radiation", Oregon Episcopal School, June, 2017.
3. "Magnetic Motion and Ehrenfest's Theorem", Willamette University, March, 2017.
4. "Seeing Light, Hearing Gravity" (a more technical version of below), University of Puget Sound, February, 2017.
5. "Seeing Light, Hearing Gravity", OMSI Science Pub, July, 2016.
6. "Rolling cylinders", talk given to kindergartners at Duniway Elementary School, May, 2016.
7. "Seeing Light", Digital Scholarship panel, Reed College, April, 2016.
8. "Motion in a Magnetic Field", University of Portland, November, 2015.
9. "Newtonian Gravity and Special Relativity", University of Portland, January, 2014.
10. "The Motion of Two Charged Particles", Reed College, January, 2014.
11. "Newtonian Gravity and Special Relativity", ORAAPT, October, 2013.
12. "A Pair of Charged Particles", University of Puget Sound, April 2013.
13. "Motion of Charged Particles", University of Portland, November, 2012.
14. "Lanczos-Lovelock Gravity and Other Modifications", Stanford University SPS faculty seminar, February 2012.
15. "Birkhoff's Theorem for Lovelock Forms" – presentation of research to the Kavli Institute for Theoretical Physics, undergraduate theory section, July 2007.
16. "Birkhoff's Theorem in Electricity & Magnetism, and General Relativity", Linfield College, May, 2007.
17. "Spinning Charged Bodies and the Linearized Kerr Metric" – paper for AAPT topical conference, "Teaching General Relativity to Undergraduates", 2006.
18. "Particles and Fields in General Relativity", Reed College Physics Seminar, December, 2004.
19. "Dynamic Bond Constraints for Stochastic Molecular Dynamics", SIAM Conference on the Life Sciences, July, 2004. (Session Chair)
20. "Adaptive Time Stepping for Langevin Dynamics of Macromolecules", Uppsala University, May, 2003, and Pasteur Institute, July, 2003.

21. “Molecular Dynamics and the Gravitational N-Body Problem” – 2nd annual SIGRAV meeting, Pisa Italy, June, 2003.

Summer Students

1. Kreicbergs, Toms. “Multipole moments in Curved Space: E&M and General Relativity”, Sherman Fairchild summer research student, 2006.
2. Schlender, Amory. “Time Scales and Potentials for N -body Physics”, 2007.
3. Rhines, Andrew. “Hookean Vibrating Strings”, 2007.
4. Case, Steven. “Reed College Physics Computing Cluster Setup and Configuration”, 2008.
5. Garon, Todd. “Relativistic Born-Infeld Corrections to the Hydrogen Spectrum”, 2010.
6. Gopaldaswamy, Varchas & Allison Morgan, Andrew McNutt, Carl Proeper. “The Schrödinger-Newton system with self-coupled gravitational sourcing”, 2013.
7. Newton, Katherine. “Wave function localization in gravitational and continuous spontaneous collapse models”, 2014.
8. Banyas, Ella. “Conical Singularities in Physics”, 2017.
9. Ryder, Andrew. “Electromagnetic Field Visualization in Virtual Reality”, 2017.

Thesis Students (present position, when known, appears in brackets)

1. Baker, Paul. “Electrodynamics and an Investigation of Weak Field Kerr Geometry”, 2006. [faculty, SUNY Geneseo.]
2. Katz, David. “Surface Phenomena in Ferrohydrodynamics”, 2006.
3. Kreicbergs, Toms. “Dynamics of Doubly Special Relativity”, 2007. [broker, UBS Securities.]
4. Rhines, Andrew. “A Realistic Model of Elastic Vibrations”, 2007. [post-doctoral fellow, University of Washington.]
5. Schlender, Amory. “On the Dynamics of Coupled Particle Systems with a Periodic Pair Potential”, 2007.
6. Znameroski, David. “Normalizing the Most Likely Trajectory Connecting Local Minima”, 2007. [actuary.]

7. Flashman, Michael. “Modified Electrodynamics: Fixing Relativistic Field Theories”, 2008. [software engineer, Zymergen, Inc.]
8. Houglund, Juliet. “Separability of the Kerr Geodesic Hamilton-Jacobi Equation”, 2008. [technical Staff, WibiData.]
9. Vergara, Verónica. “Laplacian Growth: How Mistaken are we by Calling it DLA?”, 2008. [graduate student, applied math, Florida State University.]
10. Chartrand, Tom. “Numerical Solutions to Bohmian Quantum Mechanics”, 2009. [graduate student, applied math, UC Davis.]
11. Vaccaro, Kristen. “Teaching Computers Prejudice”, 2009. [graduate student, computer science, UIUC.]
12. Lazarus, Reuven. “Measuring Boltzmann’s Constant Through Automated Video Tracking of Brownian Motion”, 2010. [Google.]
13. Morton-Park, Frank. “On the Neutralization of Charged Black Holes”, 2010.
14. Rodriguez, Carl. “Accretion Disk Geodesics in Extreme Kerr Geometries”, 2010. [Pappalardo Postdoctoral Fellow, MIT.]
15. LaMont, Colin. “Relativistic Direct Interaction Electrodynamics: Theory and Computation”, 2011. [graduate student, University of Washington.]
16. Silver, Jeremy. “Parkour: A Study of Efficient Human Movement”, 2011.
17. Warren, MacKenzie. “An Introduction to Stellar Gravitohydrodynamics”, 2011. [graduate student, physics, University of Notre Dame.]
18. Maxwell Gurewitz. “Multilayer Perceptrons”, 2013.
19. Lucas Howard. “A Numerical Investigation of Water Waves”, 2013. [graduate student, University of Vermont.]
20. Carolynn Polancheck. “Composing Cavities and Stringing 19 Tones into One Octave”, 2013.
21. Eliot Vrijmoet. “Numerically Levitating Objects with Rockets”, 2013. [graduate student, astronomy, San Diego State University.]
22. Prakher Bajpai, “Attraction Between Two Charged Conducting Circles”, 2014.
23. Gregory Kohler, “Bound States in Singular Potentials”, 2014.
24. Allison Morgan, “Relativistic Strings and Ehrenfest’s Paradox”, 2014. [data scientist, Lytics.]

25. Jay Collins, “Using the Photon Wave Function to Compute the Behavior of Single Photon Wave Packets Travelling Through Linear Material Interfaces”, 2015. [graduate student, University of Oregon.]
26. Dan Guo, “Scalar Gravity with Self-Field Coupling”, 2015. [graduate student, Stanford University.]
27. Alex Emerman, “A Geometric Approach to k_T Clustering”, 2015. [graduate student, Columbia University.]
28. Katherine Newton, “Bohmian Mechanics and the Aharonov-Bohm Effect: A Computational Approach”, 2015.
29. Julia Selker, “Electrospray Plume Evolution”, 2015.
30. Aaron Cholden-Brown, “Issues with First Quantization Quantum Mechanics on Curved Space-Times”, 2016.
31. Timoteo Delgado-Esbenshade, “Bound Orbits in Classical Electrodynamics”, 2016.
32. William Holdhusen, “First Quantization of the Radiation Reaction Force”, 2016.
33. Ella Banyas, “The Gravitational Signature of a Dirac Monopole”, 2017.
34. Muldrow Etheredge, “Electrodynamics on Manifolds”, 2017.
35. Kevin Freymiller, “Numerical Modeling of Waves and Wave Breaking”, 2017.

Service

I have performed the usual academic duties at a small liberal arts college, serving on the following committees at various times: accreditation, radiation safety, drug and alcohol policy, community affairs, honor council, Reed Union, and the Committee on Academic Policy and Planning. I have served on various search committees in math/cs, and physics. I have been the faculty clerk, and chair of my department.

Academic service beyond Reed: I am a reviewer for the American Journal of Physics, European Journal of Physics, Classical and Quantum Gravity, General Relativity and Gravitation, and Foundations of Physics. I also perform referee functions for the Oxford University Press. I am currently a member of the Apker Selection Committee of the APS. I have served as an external honors examiner at Swarthmore College (2016).

Summary of Previous Research

- Numerical solutions of 1.5 dimensional magnetohydrodynamics equations for cylindrical geometry, including work on shock-capturing and total variation diminishing methods
- $\alpha - \Omega$ dynamo models of solar magnetic fields. Spherical solutions of Maxwell's (dynamo) equations to model the 11-year cycle of poloidal/toroidal magnetic fields inside the sun (poster presentations at SOHO-9 and SOHO-10 meetings).
- Numerical approximations for solving stochastic differential equations (Ph.D. research).