William C. Gilpin

Education

Stanford University, PhD candidate in Applied Physics, Fall 2014
NSF Graduate Research Fellowship, 2014-2017
Stanford H&S Fellowship, 2014-2019
Stanford EDGE-STEM Fellowship, 2014-2019
Coursework in accelerator physics, data mining and simulation, theoretical population genetics, continuum mechanics, nuclear physics, computational biology, marine embryology.

Princeton University, AB in Physics with High Honors (magna cum laude), 2014
Certificate in Biophysics, 2014
The Kusaka Memorial Prize in Physics, 2014
The Allen G. Shenstone Prize in Physics, 2013
Graduate courses in theoretical cosmology, statistical mechanics, theoretical astrophysics, and molecular biology. Departmental courses in electrodynamics, nonlinear dynamics, relativity, quantum mechanics, complex analysis, plasma physics, biophysics, and optics.

Pine View High (Sarasota, FL), 2008-2010, Cascia Hall High (Tulsa, OK), 2006-2008

Publications

W. Gilpin, M. W. Feldman, K. Aoki "An eco-cultural model predicts Neanderthal extinction through competition with modern humans." *To appear in The Proceedings of the National Academy of Sciences, 2016*

W. Gilpin, "PyPDB: A Python API for the Protein Data Bank." *Bioinformatics*, Oxford University Press, 2015. [pdf] [code]

W. Gilpin, S. Uppaluri, C. Brangwynne "Worms under pressure: bulk mechanical properties of *C. elegans* are independent of the cuticle" *Biophysical Journal*, Biophysical Society, 2015. [pdf] [video]

K. Bayat, W. K. C. Sun, **W. Gilpin**, M. Farrokh Baroughi, M & Lončar. "Formation of Nitrogen vacancy center ensembles in Diamond Nanowires." *CLEO: Science and Innovations*, Optical Society of America, 2014. [pdf]

W. Gilpin "Engineering the Charge Occupancy of Nitrogen Vacancies in Diamond." NNIN REU Convocation, 2012. [pdf] [cover image]

Research

Stanford University. Advisor: Prof. Manu Prakash, Bioengineering
- 2015, ongoing: Studying the fluid mechanics of marine organisms. Methods: PIV/PTV, analytic techniques for viscous flows.
- 2014: Mechanical characterization and modeling of collective cell behaviors in an epithelial sheet. Methods: Marine organism culturing, microscopy, image analysis (MATLAB/Python), analytic tools for nonlinear dynamical systems, numerical simulations of nonlinear systems (Python/numba).

Stanford University. Advisor: Prof. Marc Feldman, Biology
- 2015, ongoing: Using bifurcation theory to model the sudden exclusion of Neanderthals by early modern humans. Methods: standard analytic/numerical techniques for nonlinear differential equations (Python/numba/PyCont).

Stanford University. Advisor: Prof. Andrew Spakowitz, Applied Physics

- 2015 (spring quarter) rotation: Modeling epigenetic regulation as anomalous diffusion of polymers. Methods: standard numerical techniques (Python/Fortran), standard polymer physics and thermodynamics models. [code]

Stanford University. Advisor: Prof. Vijay Pande, Chemistry
- 2015 (winter quarter) rotation: A renormalization group approach to modeling protein folding kinetics. Methods: stochastic dynamical systems, nonequilibrium statistical physics, numerical simulation of stochastic systems (Python), random matrix analysis (Mathematica). [code]

Princeton University. Advisor: Prof. Clifford Brangwynne, Chemical and Biological Engineering
- 2013-2014 (Senior Thesis): "Characterizing the mechanical properties of *Caenorhabditis elegans* using a novel microfluidic approach." Development of a new method of probing the bulk mechanics of tissues, development of a viscoelastic model for the response of *C. elegans* to mechanical stress. Methods: microfluidics, cell culturing, confocal fluorescent microscopy, digital image processing (MATLAB/Python), solid and continuum mechanics models.
- 2011-2012 (Junior thesis): "Deriving a governing equation for the growth of *Caenorhabditis elegans*" Development of a Fokker-Planck model for growth in a population of *C. elegans,* microfluidic imaging experiments to corroborate the model. Methods: Cell culturing, microscopy, image analysis (MATLAB/Python), mathematics of stochastic systems.

Harvard University. Advisor: Prof. Marko Lončar, Applied Physics and Electrical Engineering
- 2013 NSF REU: "Characterizing the electrical properties of diamond NV centers using an on-chip Hall probe" Methods: standard clean room protocol, reactive ion etching, tabletop confocal scanning microscopy, electron beam lithography, rapid thermal annealing, plasma generation, simulation of charge occupation (Lumerical FDTD, Silvaco ATLAS)
- 2012 NNIN/NSF REU: "Engineering the charge occupancy of nitrogen vacancies in diamond nanowires" and "Design and characterization of a diamond MOSFET." Methods: standard clean room protocol, electron beam lithography, reactive ion etching, photolithography, atomic layer deposition, sputtering, simulation of surface states (Lumerical FDTD/COMSOL, ATLAS), design of lithographic masks (AutoCAD).

Princeton University. Advisor: Prof. Curt Callan, Physics
- 2013 (Junior Thesis): "Modeling computation in biological sensing networks." Used recent results in nonequilibrium statistical mechanics to search for Markov network topologies that effectively modeled and predicted the energetic limits of biological sensing processes, like chemotaxis. Methods: information theory, nonequilibrium statistical physics, discrete Markov models, MATLAB, Mathematica, high-performance computing. [thesis]

Mote Marine Laboratory. Advisor: Dr. Gary Kirkpatrick, Phytoplankton Ecology
- 2011 NSF REU: "Mathematical methods for optical discrimination of phytoplankton taxa." Developed several new analysis and reconstruction routines for absorption spectra collected by an automated probe in the Gulf of Mexico; the spectra are analyzed to infer the community structure of phytoplankton blooms. Methods: absorption spectroscopy, data analysis in Java/Mathematica, culturing of live *Karenia brevis*, participation in a research cruise to collect wild samples.

Professional Employment

Khan Academy Content Specialist. Contracted as a consultant to write and illustrate physics passages and questions for an AAMC/Khan Academy program to create free online MCAT preparation materials. Confer with professional educators and physicists in order to improve content and structure of passages and questions. July 2014, ongoing. [example passage]

Venice Theatre Technical Apprentice Program. A 3 Year (1,500 hour) Apprenticeship, nationally certified as a Stage Technician by the U. S. Department of Labor, Bureau of Apprenticeship and Training. Completed three professional technical courses certified by the Florida Department of Education. Travelled to Ontario, Canada for a one week work-study at the Stratford Shakespeare Festival. Worked as lighting director various theatre productions and student films at Princeton. Tools: DMX programming for robotic lights, ETC Console programming and patching, hardware support for standard ETC fixtures. March 2008 – April 2013.

Freelance digital illustration work. Produced illustrations for Khan Academy, Voices of Change, and various student groups. Tools: Adobe Illustrator, Photoshop, InDesign, AutoCAD, HTML/CSS. [gallery]

Awards

NSF Graduate Research Fellowship, topic area "The Physics of Living Systems," 2014.
Kusaka Memorial Prize, top graduating seniors in Princeton physics, 2014.
Allen G. Shenstone Prize, top juniors in Princeton physics, 2013.
Induction to Sigma Xi, the scientific research society, 2014.
ODOC Princeton Senior Thesis Funding, 2013.
Princeton Class of 1984 Memorial Fund Fellowship, 2013.
The Princeton Fred Fox Fellowship, 2013.
"Art of Science" acceptee at Princeton University, 2013 and Stanford University, 2015 [image]
A+ with faculty commendation Graduate Statistical Mechanics (Torquato and Car, Fall 2013), Honor and Normative Ethics (Appiah, Fall 2011).
Sarasota Area Ivy League Scholarship, 2010 - 2014.

Posters & Talks

2014 Stanford Bioengineering Retreat: "Ultrafast epithelium contractions in the world's simplest organism." S. Armon, W. Gilpin, A. Aranda-Diaz, A. Bhargava, M. Prakash *(Poster)*
2013 Harvard REU Convocation: "Manipulating the charge state of nitrogen vacancy centers in diamond." W. Gilpin, K. Bayat, and M. Loncar *(Poster and talk)* [poster]
2012 NNIN Convocation: "Controlling the charge occupancy of nitrogen vacancy centers in diamond" W. Gilpin, K. Bayat, and M. Loncar *(Poster and talk)* Talk: [video]
2012 Harvard REU Convocation: "Controlling the charge occupancy of nitrogen vacancy centers in diamond." W. Gilpin, K. Bayat, and M. Loncar *(Poster and talk)*
2011 Mote Laboratory REU Convocation: "Improving taxal resolution in the Optical Phytoplankton Discriminator" W. Gilpin and G. Kirkpatrick *(Poster and talk)*

Outreach

Maintain a personal science blog with tutorials on home-built science projects like Tesla coils, 50,000 unique visitors to date. Summer 2010, ongoing. [url]
NanoDays science demonstrator and educator for Brangwynne Group (March 2012, 2013) and Harvard SEAS (June 2012, 2013). [url]
Princeton peer tutor. Meet weekly with students in introductory math, science, and Latin courses. 2010-2014

Interests

Fossil and mineral collecting since elementary school; currently catalogue of ∼8000 fossil shark teeth, 400 other fossils, and 200 unique rocks and fluorescent minerals. Former member of Tulsa Rock Mineral Society, Sarasota Area Rockhound club. [gallery]
Hobby photography. Several photographs have been used as backgrounds in the Yahoo! Weather mobile app. Photographs and artwork accepted into *plain china* and the Nassau Literary Review. [gallery]
Five years of Latin, two in college, three in high school.
Certified HAM radio operator, call sign KJ4NLQ.

Contact

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wgilpin@[university in palo alto].edu

Addresses obfuscated to limit web scraping; substitute appropriate names where indicated by brackets.

References

Professor Manu Prakash, Stanford University

Professor Cliff Brangwynne, Princeton University

Professor Marko Lončar, Harvard University