William de Almeida Gilpin

wgilpin@fas.harvard.edu | wgilpin.com | gilpin_lab | @wgilpin0

Education

Stanford University, PhD in Applied Physics, 2019
Stanford University, MS in Applied Physics, 2016
Princeton University, AB in Physics with High Honors, 2014

Fellowships & Grants

NSF-Simons Independent Fellow at Harvard, 2019–2021.
Miller Fellowship at UC Berkeley, 2019–2021 *(declined)*.
National Geographic Young Explorers Grant, 2017.
NDSEG Graduate Research Fellowship, 2016-2019.
National Science Foundation Graduate Research Fellowship, 2014-2017.
Stanford EDGE-STEM and H&S Fellowships, 2014-2019
Princeton ODOC, Class of 1984, and Fred Fox Research Grants. 2013
NSF REU Fellowships: Harvard SEAS/NNIN, 2012, 2013; Mote Marine Laboratory, 2011
Princeton Class of 1930, and SRQ Ivy League Scholarships. 2010 - 2014.

Awards

Forbes Magazine 30 under 30 in Science, 2022
APS Prize for Outstanding Doctoral Thesis Research in Biological Physics, 2020.
Scientific Visualization Prizes:
Grand prize, Nikon Small World (2016) [vid],
Grand prize, NSF "Vizzies," (2017),
Physics Today "Backscatter," (2017) [url].
Milton van Dyke Award, APS Gallery of Fluid Motion, 2016. [vid]
Travel Awards: American Physical Society Travel Award (2016), APS US-India Travel Grant (2018),
Bio-X Travel Award (2018).
Princeton Physics Department: Shenstone Prize (2013), Sigma Xi (2014),
Kusaka Memorial Prize (2014).
National AP Scholar, 2010.

Selected Publications

W. Gilpin. "Chaos as an interpretable benchmark for forecasting and data-driven modelling" ***Neural Information Processing Systems (NeurIPS)***, 2021. [pdf]

W. Gilpin. "Deep reconstruction of strange attractors from time series" ***Neural Information Processing Systems (NeurIPS)***, 2020. [pdf]

W. Gilpin. "Cryptographic hashing using chaotic hydrodynamics" ***The Proceedings of the National Academy of Sciences***, 2018. [pdf]
kcbs radio interview | stanford homepage | phys.org | futurity | scishow

W. Gilpin, M. S. Bull, M. Prakash. "The multiscale physics of cilia and flagella" ***Nature Reviews Physics***, 2020. [pdf] [cover]

W. Gilpin, V. N. Prakash, M. Prakash "Vortex arrays and ciliary tangles underlie the feeding-swimming tradeoff in starfish larvae" ***Nature Physics***, 2017. [pdf]
nature physics news & views | new york times | nature | stanford homepage | popular science | cbs | smithsonian | reuters | yahoo | vox | phys.org | business insider | scientific american

W. Gilpin, M. W. Feldman, K. Aoki "An ecocultural model predicts Neanderthal extinction through competition with modern humans." ***The Proceedings of the National Academy of Sciences***, 2016. [pdf]
newsweek | science | daily mail | stanford homepage | ars technica | huffington post | national geographic | phys.org | yahoo | international business times | ifl

Additional Publications

W. Gilpin. "Desynchronization of jammed oscillators by avalanches" ***Physical Review Research***, 2021. [pdf]

W. Gilpin, Y. Huang, D. Forger. "Learning dynamics from large biological datasets: Machine learning meets systems biology" ***Current Opinion in Systems Biology***, 2020. [pdf]

W. Gilpin. "Cellular automata as convolutional neural networks" ***Physical Review E***, 2019. [pdf]

W. Gilpin, M. W. Feldman. "Cryptic selection forces and dynamic heritability in generalized phenotypic evolution" ***Theoretical Population Biology***, 2018. [pdf]

W. Gilpin, M. W. Feldman. "A phase transition induces chaos in a predator-prey ecosystem with a dynamic fitness landscape" ***PLOS Computational Biology***, 2017. [pdf]

W. Gilpin, V. N. Prakash, M. Prakash. "Flowtrace: simple visualization of coherent structures in biological fluid flows" ***Journal of Experimental Biology***, 2017. [pdf] [code] [cover art]

J. Y. Wakano*, **W. Gilpin*** *(*co-first)*, S. Kadowaki, M. W. Feldman, K. Aoki. "Ecocultural range-expansion scenarios for the replacement or assimilation of Neanderthals by modern humans" ***Theoretical Population Biology***, 2017. [pdf]

W. Gilpin, V. N. Prakash, M. Prakash. "Rapid behavioral transitions produce chaotic mixing by a planktonic microswimmer" [arXiv]

W. Gilpin, V. N. Prakash, M. Prakash. "Dynamic vortex arrays created by starfish larvae" ***Physical Review Fluids***, 2017. [pdf] [aps feature article]

W. Gilpin, V. N. Prakash, M. Prakash "Boundary effects on currents around ciliated larvae" ***Nature Physics***, 2017. [pdf]

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

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

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

Career

UT Austin, Assistant Professor of Physics, associated with the Oden Institute for Computational Science and Engineering. 2022—
Harvard University, Independent Fellow at NSF-Simons Center for Mathematical Biology. 2019–
Osmosis Education, Content Developer Write and develop educational videos about undergraduate physics and chemistry for an audience of ∼1.7 million YouTube subscribers. 2018–2020
Stanford University, Prakash Lab, Dissertation research on soft matter physics and mathematical biology. 2014–2019
Stanford University, Feldman Group, Modelling of catastrophes in eco-evolutionary processes, applied to prehistoric human migration. 2015–2019
Meiji University (Tokyo), Visiting Scholar. October 2016. Reaction-diffusion models of human migration. Guest of Profs. Joe Yuichiro Wakano and Kenichi Aoki.
Stanford University, Spakowitz Group, 2015. Modeling epigenetic regulation as anomalous diffusion of polymers. [code]
Stanford University, Pande Lab, 2015. Renormalization for protein folding pathways. [code]
Khan Academy, Content Developer 2014-2016. Write and review physics content for Khan Academy's free online physics and chemistry videos; ∼10 million viewers to date. [example]
Princeton University, Brangwynne Lab. Research Assistant 2011-2014. Microfluidic experiments and stochastic modelling of mechanical properties of *C. elegans*.
Harvard University, Lončar Group, NSF REU intern, 2012 & 2013. Manipulate spectroscopic properties of diamond qubits using a nanofabricated MOSFET/Hall probe.
Princeton University, Callan Group, Research Assistant, 2013. Using nonequilibrium thermodynamics to derive the computational bounds of biological sensing networks.

Mote Marine Laboratory, Kirkpatrick Group, NSF REU 2011. Statistical inference for spectroscopic discrimination of phytoplankton taxa.
Venice Theatre, Apprentice technician 2008-2011. Certification for high-wattage lighting systems.

Invited Talks

Johns Hopkins Physics, research seminar, 2021
Flatiron Institute, research seminar, 2021
APS March Meeting, Biological physics Dissertation Prize Talk, 2021
UC Santa Cruz Applied Mathematics, research seminar, 2021
UT Austin Physics, Center for Nonlinear Dynamics and Biophysics Seminar, 2021
Emory Biology, research seminar, 2021
University of British Columbia Mechanical Engineering, research seminar, 2021
Brandeis Mathematics, research seminar, 2021
Caltech Computing & Mathematical Sciences, CMS Frontiers Colloquium, 2021
UC Berkeley Physics, research seminar, 2021
University of Waterloo Applied Mathematics, research seminar, 2021
UC Berkeley Chemical and Biomolecular Engineering, research seminar, 2021
University of Chicago Physics, research seminar, 2021
UC Irvine Mathematics, research seminar, 2021
UCLA Mathematics, Applied Math Colloquium, 2021
Princeton University Bioengineering, "Rising Stars" Colloquium, 2020
Microsoft Research New England, 2020
Stephens group, Vrije Universiteit & Okinawa Institute of Science & Technology, 2020
MIT Physics, Pappalardo Interview seminar, 2018
Princeton University Physics, PCTS & CPBF Symposium, 2018
Harvard University Quantitative Biology, symposium, 2018
Meiji University, Mathematical biology seminar, 2016
Tokyo University of Agriculture and Technology, 2016
National Nanotechnology Infrastructure Network Symposium, 2012

Contributed Talks

2019 PhD thesis defense: "Swimming and hashing using chaotic fluids" [video]
2018 American Physical Society March Meeting: "Low-dimensional behavior and chaotic mixing by swimming starfish larvae" [video]
2016 American Physical Society, Division of Fluid Dynamics Meeting: "Vortex arrays and ciliary tangles underlie the feeding-swimming tradeoff in starfish larvae" [video]
2013 Harvard REU Convocation: "Manipulating the charge state of nitrogen vacancy centers in diamond."
2012 Harvard REU Convocation: "Controlling the charge occupancy of nitrogen vacancy centers in diamond."
2011 Mote Laboratory Research Meeting: "Improving taxal resolution in the Optical Phytoplankton Discriminator"

Community

Research supervisor for one undergraduate student (Duke University, Harvard QBio REU)
Grant Referee for National Geographic Society (2019-present), European Research Council (2020).
Peer review for *Nature Physics*, *The Proceedings of the National Academy of Sciences*, *Nature Communications*, *eLife*, *PLOS Computational Biology*, *Bioinformatics*, *IEEE Transactions on Artificial Intelligence*, *Journal of Experimental Biology*, *Journal of Theoretical Biology*, *Theoretical Population Biology*, *Chaos*, *International Journal of Bifurcation and Chaos*, and *Journal of Archaeological Science*
Invited contributor of scientific visualizations to the 2021 Neal Gallery art exhibition in Shenzhen.
Educational content developer. Write and develop widely-distributed educational videos for the non-profit education startups Khan Academy (2014–2016), and Osmosis (2018–2020).
Invited judge for the 2018 American Physical Society "Gallery of Fluid Motion" competition
EDGE-STEM mentor. Mentor and advise early-career doctoral students at Stanford (2016–2019).