Susanne Still

Professor, Department of Physics and Astronomy
University of Hawai'i at Mānoa,
2505 Correa Rd, Honolulu, HI 96822.
Cooperating Graduate Faculty, Department of Information and Computer Sciences.

email: sstill@hawaii.edu
URL: www2.hawaii.edu/∼sstill

Employment

since 2021 *Professor* Department of Physics and Astronomy, University of Hawai'i at Mānoa (UHM).

2017-2021 *Professor* Department of Information and Computer Sciences (ICS), UHM.
2011-2017 *Associate Professor* ICS, UHM.
2005-2011 *Assistant Professor* ICS, UHM.

2000-2005 *Postdoc* Theoretical Biophysics Group, Prof. Dr. W. Bialek
2001–2005 Princeton University, Physics Department
2000–2001 NEC Research Institute, Princeton, NJ.

1995-2000 *Research Assistant* ETH Zürich, Switzerland
1999–2000 Physics Department
1995–1999 Institute of Neuroinformatics

Education

2000 Dr. nat. sci. (equiv. Ph.D.) Physics Department, ETH Zürich, Switzerland.
Advisors: Dr. M. Mahowald, Prof. Dr. K. Hepp, Prof. Dr. R. J. Douglas.

1995 Physik Diplom (equiv. Master's degree in physics) Universität Hannover, Germany.
1994-95 Diplomarbeit (Master's Thesis) research, Paul Scherrer Institute, Switzerland.
1993-94 ETH Zürich, Switzerland (with scholarship).

Summer Schools

2001 *Physics of bio-molecules and cells*, Ecole de Physique Theorique, Les Houches, France.
1999 *Methods in Computational Neuroscience*, Marine Biological Laboratory, Woods Hole, MA.
1997 *Crete Course in Computational Neuroscience*, Institute of Applied Mathematics, Heraklion.
1996 *Neuromorphic Engineering*, NSF Workshop, Telluride, CO.

Funding, awards and honors

since 2020 **Fellow**, European Center for Living Technology, Universita Ca' Foscari Venezia, Italy.

2019-2021 **PI**, "Intelligence in Context", $193,186, Foundational Questions Institute. With Chris Watkins, Royal Holloway, London (PI) and Lee Altenberg, ICS, UHM (PI).

2019-2021 **co-PI**, "Maxwell's demon in the real world", $633,293, Foundational Questions Institute. With John Bechhoefer (PI), and David Sivak (co-PI), Simon Fraser University, Canada.

2019 **Visitor**, Pauli Center for Theoretical Studies, Institute for Theoretical Physics (ITP), ETH, Zürich, Switzerland.

2018-2020 **PI**, "Thermodynamics of Agency", $116,853, Foundational Questions Institute.

2018-2021 **co-PI** "30 Year, Multi-Sensor Analysis of Global Volcanic Thermal Unrest", $661,000, NASA. PI: Robert Wright, HIGP, UHM.

2013-2015 **PI**, "Foundations of Information processing in living systems", $129,524, Foundational Questions Institute. With G. E. Crooks (PI).

since 2013 **Member**, Foundational Questions Institute.

2013, 2014 **Visiting Scientist**, International Center for Theoretical Physics (ICTP), Trieste, Italy.

2009 **Junior Fellow**, Institute for Advanced Study, Collegium Budapest, Hungary.

2009 **Visiting Scientist**, Max Planck Institute for Mathematics in the Natural Sciences, Leipzig, Germany.

2008 **Visitor**, Institute for Advanced Study, Collegium Budapest, Hungary.

2006-2010 **Senior personnel** UBM: Research Experiences in Mathematical Biology, $ 298,922, NSF; Leslie Wilson (PI), Mathematics, University of Hawai'i at Mānoa.

2002-2003 **Forschungsstipendium**, Deutsche Forschungsgesellschaft (Research Grant, German Research Association).

1993-1994 Physics student international scholarship, "EMSφS".

Selected publications

(Names of students whose work on the project I supervised are printed in *italic*).

(preprint) **S. Still** and *D. Daimer*, Partially Observable Szilard Engines. **Physical Review X** (under review); arXiv:2103.15803

(preprint) L. Altenberg, **S. Still** and C. J. Watkins, The Evolution of Imitation Without Cultural Transmission. [pdf]

2021 J. Song, **S. Still**, R. Diaz Hernandez Rojas, I. Perez Castillo, M. Marsili, Optimal work extraction and mutual information in a generalized Szilard engine **Physical Review E** 103, 052121

2020 **S. Still**, Thermodynamic cost and benefit of memory. **Physical Review Letters** 124 (5) 050601.

2019 G. E. Crooks and **S. Still**, Marginal and Conditional Second Laws of Thermodynamics. **EPL** *(Europhysics Letters)* 125 (4) 40005.

2019 *E. Stopnitzky*, **S. Still**, T. E. Ouldridge and L. Altenberg, Physical Limitations of Work Extraction from Temporal Correlations. **Physical Review E** 99, 042115.

2019 *E. Stopnitzky* and **S. Still**, Non-equilibrium odds for the emergence of life. **Physical Review E** 99, 052101.

2016 *A. L. Grimsmo* and **S. Still**, Quantum Predictive Filtering. **Physical Review A** 94: 012338.

2016 *F. Caccioli*, I. Kondor, M. Marsili and **S. Still**. Liquidity Risk And Instabilities In Portfolio Optimization. **International Journal of Theoretical and Applied Finance** 19 (5) 1650035.

2016 G. P. Berman, A. I. Nesterov, R. T. Sayre and **S. Still**, On improving the performance of nonphotochemical quenching in CP29 light-harvesting antenna complex. **Physics Letters A**, 380 (13), pp. 1279-1283.

2014 **S. Still**, Lossy is lazy. In: *Proc. Seventh Workshop on Information Theoretic Methods in*

Science and Engineering, Eds. J. Rissanen, P. Mylymäki, T. Roos, N. P. Santhanam.

2014 **S. Still**, Information Bottleneck Approach to Predictive Inference. **Entropy** 16(2), 968-989.

2014 *L. J. Miller*, R. Gazan and **S. Still**. Unsupervised classification and visualization of unstructured text for the support of interdisciplinary collaboration. *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing*, pp. 1033-1042.

2013 *C.W. Hamilton*, C. Beggan, **S. Still**, M. Beuthe, R. Lopes, D. Williams, J. Radebaugh, and *W. Wright*. Spatial distribution of volcanoes on Io: implications for tidal heating and magma ascent. **Earth and Planetary Science Letters**, 361, 272-286. On the news, e.g. NBC.

2012 **S. Still**, D. A. Sivak, A. J. Bell and G. E. Crooks. Thermodynamics of prediction. **Physical Review Letters** 109 (12) 120604 (Editors' Suggestion). Covered in Nature News, by Philip Ball.

2012 **S. Still** and D. Precup. An information-theoretic approach to curiosity-driven reinforcement learning. **Theory in Biosciences** 131 (3) pp. 139-148.

2011 *F. Caccioli*, **S. Still**, M. Marsili, and I. Kondor. Optimal liquidation strategies regularize portfolio selection. **The European Journal of Finance**, 19 (6), 554-571.

2010 **S. Still** and I. Kondor. Regularizing Portfolio Optimization. **New Journal of Physics** 12, 075034.

2010 **S. Still**, J. P. Crutchfield, and C. Ellison. Optimal causal inference: estimating stored information and approximating causal architecture. **Chaos** 20, 037111.

2009 **S. Still**. Information-theoretic approach to interactive learning. **EPL** *(Europhysics Letters)* 85, 28005

2009 D. Mandic, **S. Still** and S. C. Douglas. Duality between widely linear and dual channel adaptive filtering. *Proc. IEEE Int. Conf. on Acoustics, Speech and Signal Processing*, pp: 1729-1732.

2006 **S. Still**, K. Hepp and R. J. Douglas. Neuromorphic Walking Gait Control. **IEEE Transactions on Neural Networks**, 17 (2) pp. 496-508.

2004 **S. Still** and W. Bialek. How many clusters? An information theoretic perspective. **Neural Computation** 16, pp. 2483-2506.

2004 **S. Still**, W. Bialek and L. Bottou. Geometric Clustering using the Information Bottleneck method. **Advances In Neural Information Processing Systems 16 (NIPS 2003)**, S. Thrun, L. K. Saul and B. Schölkopf (Eds.), MIT Press, Cambridge, MA. [pdf]

2003 E. Schneidman, **S. Still**, M. J. Berry II and W. Bialek. Network information and connected correlations. **Physical Review Letters** 91, 238701.

2001 **S. Still**, B. Schölkopf, K. Hepp and R. J. Douglas. Four-legged Walking Gait Control Using a Neuromorphic Chip Interfaced to a Support Vector Learning Algorithm. **Advances in Neural Information Processing Systems 13 (NIPS 2000)**, T. K. Leen, T. Dietterich, and V. Tresp (Eds.), MIT Press, Cambridge, MA, pp. 741-747.

1999 **S. Still** and G. LeMasson. Traveling waves in a ring of three inhibitory coupled model neurons. **Neurocomputing** 26-27, pp. 533-539

1998 **S. Still** and M.W. Tilden. Controller for a four legged walking machine. In: *Neuromorphic Systems: Engineering Silicon from Neurobiology*, L.S. Smith, A. Hamilton (Eds.), World Scientific. [pdf]

Selected Invited Conference Talks

Expenses covered (for in-person meetings).

10/2021 (planned) *Information Processing in Noisy Biological Systems*, Stochastic Physics in Biology, Gordon Research Conference, Ventura, CA.

09/2021 (planned) *Models of Consciousness conference (MoC2-2021)*, Stanford, CA.

07/2021 (planned) *Physics of Emergent Behaviour III: from origin of life to multicellularity*, virtual conference, hosted by the Physics of Life Network of Excellence at Imperial College, with support from the Institute of Physics (IOP) in the UK.

05/2021 *Workshop on Stochastic Thermodynamics II*, Santa Fe Institute.

10/2020 *Informational Lens Workshop*, IBM Research.

07/2020 *Joint Structures and Common Foundation of Statistical Physics, Information Geometry and Inference for Learning*, Ecole de Physique Theorique, Les Houches, France (remote talk).

01/2020 *Combining information-theoretic perspectives on agency*, University of Tokyo, Japan (remote).

12/2019 *Information Transitions in Life*, Santa Fe Institute, NM (remote talk).

11/2019 *Montreal Artificial Intelligence and Neuroscience (MAIN)*, Montreal, Canada.

07/2019 *The Foundational Questions Institute 6th International Conference*, Tuscany, Italy.

07/2019 *The Physics of Evolution*, Francis Crick Institute, London.

08/2018 *Runde Workshop*, Runde Island, Norway.

02/2018 *Non-equilibrium dynamics and information processing in biology*, Okinawa Institute of Science and Technology, Japan (remote talk).

11/2016 *Statistical Physics, Information Processing and Biology*, Santa Fe Institute, Santa Fe, NM.

09/2016 *Information, Control, and Learning–The Ingredients of Intelligent Behavior*, Center for Brain Sciences, Hebrew University, Jerusalem, Israel (remote talk).

08/2016 *The Foundational Questions Institute 5th International Conference*, Banff, Canada.

07/2015 *Conference on Sensing, Information and Decision at the Cellular Level*, International Center for Theoretical Physics (ICTP), Trieste, Italy.

05/2015 *Nature as Computation*, Beyond Center for Fundamental Concepts in Science, Arizona State University, Tempe, AZ.

04/2015 *Workshop on Entropy and Information in Biological Systems*, National Institute for Mathematical and Biological Synthesis, University of Tennessee, Knoxville, TN.

10/2014 *Biological and Bio-Inspired Information Theory.* Banff International Research Station for Mathematical Innovation and Discovery (BIRS), Canada.

07/2014 *The Seventh Workshop on Information Theoretic Methods in Science and Engineering (WITMSE 2014)*, Honolulu, HI.

05/2014 *Statistical Mechanics Foundations of Complexity: Where do we stand?* Santa Fe Institute, NM.

01/2014 *The Foundational Questions Institute Fourth International Conference*, Vieques Island, PR.

05/2013 *Modeling Neural Activity: Statistics, Dynamical Systems, and Networks (MONA)*, Kauai, HI.

01/2011 *Berkeley Mini Stat. Mech. Meeting*, UC Berkeley, CA.

01/2011 *Workshop on measures of complexity*, Santa Fe Institute, NM.

09/2009 *European Conference on Complex Systems*, Warwick (ECCS '09), Workshop on Information, Computation, and Complex Systems.

08/2009 Keynote Lecture. *2nd International Conference on Guided Self-Organization (GSO)*, Leipzig, Germany.

07/2009 *Chaos/Xaoc*, Conference Center of the National Academy of Sciences in Woods Hole, MA.

04/2006 *Bellairs Reinforcement Learning Workshop*, Barbados.

Invited faculty at Summer Schools

04/2016 *Spring College in the Physics of Complex Systems*, International Center for Theoretical Physics (ICTP), Trieste, Italy.

09/2010 *Eigth Fall Course on Computational Neuroscience*, Bernstein Center for Computational Neuroscience, and Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany.

08/2008 *Sante Fe Institute Complex Systems Summer School* at the Institute of Theoretical Physics, Chinese Academy of Sciences (CAS), Beijing, China.

09/2008 *Ecole Recherche Multimodale d'Information Techniques & Sciences (ERMITES)*; Université du Sud Toulon-Var, Laboratoire des Sciences de l'Information et des Systèmes, Association Francaise de la Communication Parlée; Giens, France.

Invited Department Colloquia and Seminars

04/2021 *Princeton Biophysics Seminar*, Princeton University, NJ (remote talk).

04/2021 *Center for bits and atoms*, MIT, Cambridge, MA (remote talk).

01/2020 *University of Hawai'i at Mānoa*, Physics Colloquium.

09/2019 *ETH Zürich*, Institute for Theoretical Physics (ITP), Switzerland.

08/2018 *ETH/UNI Zürich*, Institute for Neuroinformatics, Switzerland.

07/2018 *IST*, Austria.

06/2018 *Google Deepmind*, Montreal, Canada.

06/2018 *Facebook AI*, Montreal, Canada.

11/2016 *Condensed Matter Seminar*, UC Santa Cruz.

08/2016 *Biophysics Seminar*, Simon Fraser University, Vancouver, Canada.

06/2013 *Max Planck Institute for Dynamics and Self-organization*, Göttingen, Germany.

04/2013 *Scuola Internazionale Superiore di Studi Avanzati (SISSA)*, Trieste, Italy.

03/2013 *The University of Auckland*, Physics Department, Auckland, NZ.

03/2013 *The University of the South Pacific*, Physics Department, Suva, Fiji.

11/2012 *Stanford University*, Center for Mind, Brain and Computation.

08/2012 *University of Hawai'i at Mānoa*, Physics Colloquium.

10/2011 *University of California at Berkeley*, Redwood Center for Theoretical Neuroscience.

08/2011 *ETH/UNI Zürich*, Institute for Neuroinformatics, Switzerland.

04/2011 *Santa Fe Institute*, Santa Fe, NM.

09/2010 *University of Edinburgh*, Institute of Perception, Action and Behaviour, Edinburgh, UK.

04/2010 *University of British Columbia, Canada*, Physics Colloquium.

03/2010 *University of Victoria, Canada*, Physics Colloquium.

01/2010 *University of California at Berkeley*, Redwood Center for Theoretical Neuroscience.

12/2009 *Universität Köln*, Germany, Physics Department.

11/2009 *International Center of Theoretical Physics (ICTP)*, Trieste, Italy.

04/2009 *University of California at Davis*, Computational Science & Engineering Center, Davis, CA.

10/2008 *Max Planck Institute for Biological Cybernetics*, Machine Learning Seminar, Tübingen.

09/2007 *University of Montreal*, Montreal, Canada. Department of Computer Science.

09/2007 *McGill University*, Montreal, Canada. *McGill-UdeM-MITACS* Machine Learning Seminar.

03/2007 *University of California at Davis*, Computational Science & Engineering Center, Davis, CA.

01/2007 *University of Hawai'i at Mānoa*, Physics Colloquium.
01/2007 *TU Munich*, Institute of Computer Science, Munich, Germany.
01/2007 *ETH Zürich*, Institute for Neuroinformatics, Zürich, Switzerland.
01/2007 *IDSIA*, Institute for Artificial Intelligence (Istituto Dalle Molle di Studi sull'Intelligenza Artificiale), Lugano, Switzerland.
01/2007 *ETH Zürich*, Institute of Computer Sciences, Zürich, Switzerland.
07/2006 *Max Planck Institute for Biological Cybernetics*, Tübingen, Germany.
06/2006 *McGill University*, Montreal, Canada. Department of Computer Science.
09/2005 *University College Dublin*, Dublin, Ireland.
04/2005 *University of Hawai'i at Mānoa*, Honolulu, HI, Mathematics Colloquium.
04/2005 *University of Hawai'i, Hilo*, Hilo, HI, Department of Computer Science.
04/2005 *University of Hawai'i, Mānoa*, Honolulu, HI, Department of Electrical Engineering.
04/2003 *Columbia University*, New York, NY, Applied Mathematics Seminar.
03/2003 *University of British Columbia*, Vancouver, Canada, Department of Physics.
08/2003 *Humboldt University*, Berlin, Germany, Theoretical Biology Seminar.
08/2003 *Hamilton Institute, National University of Ireland*, Maynooth, Ireland. Machine Learning and Cognitive Neuroscience Seminar.
08/2003 *University of Hawai'i*, Honolulu, HI. Department of Electrical Engineering.
07/2003 *Max Planck Institute for Biological Cybernetics*, Tübingen; Machine Learning Seminar.
07/2003 *ETH Zürich*, Switzerland, Institute for Neuroinformatics.

Invititation-only Workshop Participant

11/2019 Thermodynamic Computing. Proposal development workshop, Portland State University, OR. (remote participation)
08/2017 Thermodynamics of Computation in Chemical and Biological Systems, Santa Fe Institute, NM.
08/2017 Thermodynamics and Computation: Towards a New Synthesis, Santa Fe Institute, NM.
10/2009 Financial risk, market complexity and regulation. Collegium Budapest, Hungary.
04/2009 NSF: Opportunities and Challenges in Uncertainty Quantification for Complex Interacting systems. University of Southern California.

Students and Postdocs

Current:

Dorian Daimer (PhD student Physics) Advisor.

Lisa Miller (PhD student ICS) Advisor.

Samuel Birns (M.S. student ICS, starting August 2021, currently PhD student Mathematics) Advisor.

Hyeonjo Kim (PhD student Finance) PhD committee member and co-advisor on parts of the thesis work.

Jannik Ehrich (Postdoc) Co-supervisor, with J. Bechhoefer and D. Sivak.
Supported by FQXi grant "Maxwell's demon in the real world".

Jenny Poulton (Postdoc) Co-supervisor, with C. J. Watkins and L. Altenberg.
Supported by FQXi grant "Intelligence in Context".

Former:

(Advisor, unless otherwise stated).

Elan Stopnitzky (2019) PhD Physics. "Physics of information in nonequilibrium systems".

Ka'imi Kahihikolo (2019) BS Physics. Advisor on undergraduate research, funded by UROP Undergraduate Research Opportunities Grant, UHM.
Now data scientist and senior consultant at Booz Allen Hamilton, Honolulu. Continues collaborations with my lab.

Emiliano Miranda (2013) M.S. Computer Science. "Statistical learning in video games".
Now at Imber Studios LLC (Co-founder, Technical Director).

Lisa Miller (2012) M.S. Computer Science. "Information theoretic clustering of astrobiology documents". Now Ph.D. student in my group, and faculty at Kapiolani Community College.

Lane McIntosh (2012) M.A. Mathematics "Information Processing and Energy Dissipation in Neurons" [pdf] . Now in Ph.D. program at Stanford University.

Christopher Hamilton (2010) Ph.D. Geophysics (member of PhD committee and advisor on research project). Now Faculty at the University of Arizona.

Dr. Taku Ishikawa (Postdoc 2015-2017) *Markerless motion capture for human movement analysis.* Supported by the National Printing Bureau of Japan, Research Institute.

Other:

UHM students who did lab rotation, or collaborated on a project:

- Hunter Hatfield (PhD, Linguistics, 2010), now faculty at the University of Otago, NZ.
- Pardis Niknejadi (PhD, Physics, 2016), now postdoctoral scientist at DESY.
- Jonathan Page (Economics, 2016), now Director of Analytics at UHERO.
- Spencer Long (BS, Physics, 2019).
- Carlos Andrade Silva (PhD, ICS, 2017-2019).
- William Wright (PhD, ICS, 2018-2019).
- Bocar Wane (M.S. student, Mathematics, 2018-2019).
- Victor Miagkikh (PhD student, ICS, 2010)

Students from other Universities whom I supervised on research projects:

- Fabio Caccioli, SISSA, Italy; now faculty at University College London (UCL).
- Sarah Marzen, UC Berkeley; now faculty at W. M. Keck Science Department at the Claremont colleges.
- Chris Ellison, UC Davis.

Service

Editorial Board

- Entropy

Reviewer

- Advances in Complex Systems
- CHAOS
- Computer Vision and Pattern Recognition
- European Biophysical Journal (EBJ)
- IEEE Transactions on Neural Networks and Learning Systems
- Journal of Banking and Finance
- Journal of Machine Learning Research
- Nature
- Neural Computation
- Neural Information Processing Systems (NIPS)
- Physical Review Letters (PRL)
- Physical Review X
- Physical Review E
- Proceedings of the National Academy of Sciences (PNAS)
- Transactions on Pattern Analysis and Machine Intelligence
- Transactions on Knowledge and Data Engineering

Conference Organization

01/2019 Mānoa Mini-Symposium on Physics of Adaptive Computation, Honolulu, HI. *Organizer*.

01/2019 Thermodynamic Computation. Honolulu, HI. *Co-organizer*.

06/2013 Modeling Neural Activity (MONA): Statistics, Dynamical Systems and Networks. Lihue, HI; *Local Chair*.

University Service

2005-present **Organizer** Mānoa Seminar Series on Physics of Information Processing (formerly: Mānoa Seminar Series on Machine Learning and Computational Neuroscience).

Mānoa campus wide service:

AY 20-21 CNS workgroup for CNS faculty senate

AY 17-18 Tenure and Promotion Review Committee

AY 17-18 Excellence in Teaching Awards (CNS).

AY 16-17 Search Advisory Committee for the Dean of the College of Engineering.

AY 16-17 Convener for Excellence in Teaching Awards (CNS).

AY 15-16 Search Advisory Committee for the Dean of the College of Natural Sciences (CNS).

AY 15-16 HHMI 2017 Undergraduate Science Ed Grant: Working Group no.2 ("killer" courses).

AY 15-16 CNS Interim Associate Dean Search Committee.

AY 09-10 Foundations FS (focus on symbolic reasoning) Working Group.

ICS Department service (2005-2020):

- Department Personnel Committee
- Hiring Committee
- Curriculum committee (Chair, Fall 2017)
- Space and infrastructure committee (Chair, Spring 2017)
- Graduate committee
- Undergraduate math education working group

Department of Physics and Astronomy service:

- External member, DPC hiring committee, 2011.

Selected Press

05/15/2017 Begat out of hell, P. Ball in Chemistry World.

01/26/2017 How Life (and Death) Spring From Disorder, P. Ball in Quanta Magazine.

06/18/2015 Life's quantum crystal ball, C. Piekema in Plus.

02/19/2015 Nostalgia Just Became a Law of Nature, by S. DeDeo in Nautilus.

11/29/2014 Predicting the Future. Podcast - Foundational Questions Institute.

04/05/2013 Volcanoes on Jupiter's moon Io out of place, M. Wall for NBC News.

10/04/2012 Proteins remember the past to predict the future, P. Ball in Nature News.

Member of Professional Associations

- American Physical Society
- Deutsche Physikalische Gesellschaft (German Physical Society)

Languages

Fluent in German and English.
Some formal language education in:
- Chinese (Freie Universität Berlin, Germany, 1989)
- Spanish and Russian. (Princeton University, 2002-3)
- Latin and French. (High School, Germany)