Susanne Still

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Department of Physics and Astronomy URL: www2.hawaii.edu/∼sstill
Department of Information and Computer Sciences

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, University of Hawai'i at Mānoa.
2005-2011 *Assistant Professor* ICS, University of Hawai'i at Mānoa.
2000-2005 *Postdoc* Theoretical Biophysics Group, Prof. Dr. W. Bialek, Princeton, NJ.
2001–2005 Princeton University, Physics Department
2000–2001 NEC Research Institute, Princeton
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 Ques-

tions 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 UBM: RESEARCH EXPERIENCES IN MATHEMATICAL BIOLOGY; NSF (senior personnel); PI:

2002-2003 L. C. Wilson, Mathematics, University of Hawai'i at Mānoa.
FORSCHUNGSSTIPENDIUM, Deutsche Forschungsgesellschaft (Research Grant, German Research Association).

1993-1994 "EMSφS" student scholarship.

Publications

(preprint) S.Still and D. Daimer, Partially Observable Szilard Engines. *PRX* (submitted) arXiv:2103.15803

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 *Phys. Rev. E* (accepted); arXiv:1910.04191.

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, L. Altenberg, Physical Limitations of Work Extraction from Temporal Correlations. *Phys. Rev. E* 99, 042115.

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

2016 A. L. Grimsmo and S. Still, Quantum Predictive Filtering. *Phys. Rev. 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. 1279Ð1283.

2014 S. Still, Lossy is lazy. *Proceedings of the 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, 272Ð286.

2012 S. Still, D. A. Sivak, A. J. Bell and G. E. Crooks. The thermodynamics of prediction. *Physical Review Letters* 109 (12) 120604.

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 regular-

ize portfolio selection. *The European Journal of Finance*, 19 (6), 554-571 (preprint on arxiv:1004.4169)

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*, S. Thrun, L. K. Saul and B. Schölkopf (Eds.), MIT Press, Cambridge, MA

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*, 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. *Neuromorphic Systems: Engineering Silicon from Neurobiology*, L.S. Smith, A. Hamilton (Eds.), World Scientific.

Technical reports and miscellaneous conference contributions

2012 L.J. Miller and S. Still Information Theoretic Clustering of Astrobiology Documents, Astrobiology Science Conference, Atlanta, Georgia.

2007 S. Still and J. P. Crutchfield. Structure or Noise? Santa Fe Institute 07-08-020, arxiv:0708.0654.

2006 S. Still, M. Dinculescu and D. Precup. An information-theoretic approach for Building Approximate Predictive Models. *Neural Information Processing Systems (NIPS) 20* Workshop on Grounding Sensation, Knowledge, and Cognition in Sensori-Motor Experience.

2005 S. Still. Active learning and optimal behavior. *Neural Information Processing Systems (NIPS)19* Workshop on Value of Information in Inference, Learning and Decision-Making.

2001 S. Still, A. K. Schenk, B. D. Wright, A. J. Doupe and W. Bialek. Information theoretic approaches to the analysis of complex natural sounds. *Gordon Conference: Sensory Coding and the Natural Environment–Probabilistic models of perception*, Mount Holyoke College, MA, USA.

1998 S. Still and M.W. Tilden. Coupled Oscillators and Walking Control: A Hardware Implementation of a Distributed Motor System. *Proc. 26th Göttingen Neurobiology Conference* (2), N. Elsner and R. Wehner (Eds.), Georg Thieme, Stuttgart.

1998 C. Collin and S. Still. Towards a Neuronally-Controlled Walking Machine. *2nd Int. Conf. on Cognitive and Neural Systems*, Boston, MA, USA.

Theses

2000 S. Still. Walking gait control for four-legged robots. PhD Thesis, ETH Zürich, Department of Physics.

1995 S. Still. Characterization and Optimization of Lithium-Carbon-Intercalation Electrodes for the use in Litium-Ion-Exchange Batteries. Diplomarbeit (Master Thesis), Universität Hannover, Department of Physics.

Talks

Invited Conference Talks

11/2021 (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 (https://www.imperial.ac.uk/physics-of-life/about/) with support from the Institute of Physics (IOP) in the UK.

05/2021 (planned) Workshop on Stochastic Thermodynamics, Santa Fe Institute.

10/2020 IBM Research, Informational Lens Workshop.

08/2020 (postponed to 2021)*Are there universal laws in non-equilibrium statistical physics?*, Nordic Institute for Theoretical Physics (NORDITA), Stockholm, Sweden.

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

07/2020 (declined)*Mathematical Models in Biology: from Information Theory to Thermodynamics*, BIRS International Research Station, Banff, CA.

06/2020 (postponed due to COVID19)*Energy Efficient Computing*, Institute of Mathematics and its Applications, Bristol, UK.

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

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.

03/2019 (declined)*Origins of Meaning*, Beyond Center, Tempe AZ.

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).

09/2017 (declined) *Current and Future Trends in Stochastic Thermodynamics*, Nordic Institute for Theoretical Physics (NORDITA), Stockholm, Sweden.

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 *MONA (Modeling Neural Activity: Statistics, Dynamical Systems, and Networks)*, 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.

12/2005 *Neural Information Processing Systems (NIPS)*, Workshop on "Models of Behavioral Learning", Vancouver, BC, Canada.

07/2004 *Kavli Institute for Theoretical Physics (KITP)*, University of California, Santa Barbara. Program: Understanding the Brain.

12/1998 *Neural Information Processing Systems (NIPS)*, Workshop on "Learning Chips and Neurobots", Breckenridge, CO.

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.

Department Colloquia

03/2020 (postponed) *UC Santa Cruz*, Physics Colloquium.

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

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

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

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

01/2007 *University of Hawai'i at Mānoa*, Physics Colloquium.

04/2005 *University of Hawai'i at Mānoa*, Honolulu, HI, Mathematics Colloquium.

Seminars

04/2021 (planned) Princeton Biophysics Seminar, Princeton University, NJ.
04/2021 Center for bits and atoms, MIT, Cambridge, MA.
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.
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.
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, Ger-
09/2007 many. *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 *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, 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.
1998 *Max Planck Institute of Fluid Dynamics*, Göttingen, Germany.

1998 *Max Planck Institute of Biological Cybernetics*, Tübingen, Germany.

Invited Workshop Participant

11/2019 (remote participation) Thermodynamic Computing. Proposal development workshop, Portland State University, OR.
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.

Contributed Conference Talks

03/2010 *American Physics Society March Meeting*, Focus Session Physics of Behavior, Portland, OR.
12/2003 *Neural Information Processing Systems (NIPS)*. Spotlight Presentation. Vancouver, BC, Canada
12/2002 *Neural Information Processing Systems(NIPS)*, Workshop on "Bio-Informatics". Whistler, BC, Canada.

Students and Postdocs

Current

Dorian Daimer (PhD student Physics)
Lisa Miller (PhD student ICS)
Samuel Birns (M.S. student ICS, to start August 2021)
Dr. Jannik Ehrich (Postdoc, co-supervised with J. Bechhoefer and D. Sivak on our grant "Maxwell's demon in the real world")
Jenny Poulton (Postdoc, co-supervised with C. J. Watkins and L. Altenberg on our grant "Intelligence in Context")

Former

Elan Stopnitzky (2019) PhD Physics. "Physics of information in nonequilibrium systems".
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".
Lane McIntosh (2012) M.A. Mathematics "Information Processing and Energy Dissipation in Neurons". Ph.D. in Neuroscience, Stanford University
Christopher Hamilton (2010) Ph.D. Geophysics (member of PhD committee and advisor on research project) Faculty at University of Arizona.
Dr. Taku Ishikawa (Postdoc 2015-2017) *Markerless motion capture for human movement analysis.* Sponsored by the National Printing Bureau of Japan, Research Institute.

Journal 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*.

06/26-28/2013 Modeling Neural Activity (MONA): Statistics, Dynamical Systems and Networks. Lihue, HI; *Local Chair*.

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)