CV Jannik Ehrich

Postdoctoral Fellow · Department of Physics · Simon Fraser University, Burnaby, BC, Canada
Email: jehrich@sfu.ca · Website: https://jannikehrich.github.io

current as of February 24, 2023

Research experience

2020 - present **Postdoctoral fellow** at the Simon Fraser University in Burnaby, BC, Canada in the groups of Prof. John Bechhoefer and Prof. David A. Sivak. Topic: Maxwell's demon in the real world: Constrains governing information processing

10 - 12/2018 **Visiting researcher** with Prof. Juan M.R. Parrondo at the Universidad Complutense de Madrid, Spain. Topic: Thermalization of systems in collisional baths

2016 - 2020 **Graduate research (Ph.D.)** at the Universität Oldenburg with Prof. Andreas Engel. Topic: Stochastic thermodynamics of systems with multiple interacting degrees of freedom, systems with hidden degrees of freedom, and microswimmers

2015 - 2016 **Graduate Research (Master)** at the Universität Oldenburg. Topic: Model illustrating how predictive information bounds energy dissipation in small biomolecular systems

04 - 09/2014 **Undergraduate Research** at the Universität Oldenburg. Topic: Analyzing and extending the 'Mandal-Jarzynski model' of Maxwell's demon

02 - 04/2014 **Internship** at ForWind, Center for Wind Energy Research, Oldenburg, Germany. Topic: Wind tunnel experiments on the effect of wind velocity gradients on cup anemometers

Education

02/2020 **Ph.D. (Dr. rer. nat.) in physics** with Prof. Andreas Engel, Universität Oldenburg, Germany. Thesis title: *Coupled and Hidden Degrees of Freedom in Stochastic Thermodynamics* (grade: *summa cum laude*)

10/2016 **Master studies in physics**, Universität Oldenburg, Germany, Degree: Master of Science (grade*: 1.0). Thesis title: *Thermodynamics of Predictive Information*

10/2014 **Bachelor studies in engineering physics**, Universität Oldenburg, Germany, Degree: Bachelor of Engineering (grade*: 1.0). Thesis title (translated): *Analysis of a model of Maxwell's demon*

2011 - 2012 **Bachelor studies in physics**, Jacobs University Bremen, Germany

*German grades are awarded on a scale from 1 to 4, 1.0 being the best possible grade.

Publications

peer reviewed: 11, first author: 4, co-first author: 1, h-index: 7, total citations: 194 **[Google Scholar]**

Preprints:

* **J. Ehrich** and David A. Sivak, *Energy and information flows in autonomous systems*, in press at Frontiers in Physics, arXiv:2209.10644 (2022)

* T. K. Saha, **J. Ehrich**, Momčilo Gavrilov, Susanne Still, David A. Sivak, and John Bechhoefer, *Information engine in a nonequilibrium bath*, arXiv:2208.00288 (2022)

* **J. Ehrich**, Susanne Still, and D. A. Sivak, *Energetic cost of feedback control*, arXiv:2206.10793 (2022)

Published articles:

11 T. K. Saha, J. N. E. Lucero, **J. Ehrich**, D. A. Sivak, and J. Bechhoefer , *Bayesian information engine that optimally exploits noisy measurements*, Phys. Rev. Lett. **129**, 130601 (2022), **Editor's Suggestion, Synopsis on phys.org**

10 J. N. E. Lucero, **J. Ehrich**, J. Bechhoefer, and D. A. Sivak, *Maximal fluctuation exploitation in Gaussian information engines*, Phys. Rev. E **104**, 044122 (2021)

9. **J. Ehrich**, *Tightest bound on hidden entropy production from partially observed dynamics*, J. Stat. Mech., 083214 (2021)

8. T. K. Saha, J. N. E. Lucero, **J. Ehrich**, D. A. Sivak, and J. Bechhoefer, *Maximizing power and velocity of an information engine*, Proc. Natl. Acad. Sci. USA **118**, e2023356118 (2021), **PNAS Commentary, featured on SFU News**

7. S. J. Large, **J. Ehrich**, and D. A. Sivak, *Free energy transduction within autonomous systems*, Phys. Rev. E **103**, 022140 (2021)

6. K. Proesmans, **J. Ehrich**, and J. Bechhoefer *Optimal finite-time bit erasure under full control*, Phys. Rev. E **102**, 032105 (2020)

5. K. Proesmans, **J. Ehrich**, and J. Bechhoefer *Finite-time Landauer Principle*, Phys. Rev. Lett. **125**, 100602 (2020), **Editor's Suggestion, featured on phys.org**

4. **J. Ehrich**, M. Esposito, F. Barra, and J.M.R. Parrondo, *Micro-reversibility and thermalization with collisional baths*, Physica A **552**, 122108 (2020)

3. **J. Ehrich** and M. Kahlen, *Approximating microswimmer dynamics by active Brownian motion: Energetics and efficiency*, Phys. Rev. E **99**, 012118 (2019)

2. M. Kahlen and **J. Ehrich**, *Hidden slow degrees of freedom and fluctuation theorems: an analytically solvable model*, J. Stat. Mech, 063204 (2018)

1. **J. Ehrich** and A. Engel, *Stochastic thermodynamics of interacting degrees of freedom: Fluctuation theorems for detached path probabilities*, Phys. Rev. E **96**, 012118 (2017)

Talks and conference contributions

Invited talks (5):

07/2021 *Information thermodynamics with some biophysics spice*, Quantitative Biological Physics in Canada Seminar, online

01/2020 *Stochastic thermodynamics with hidden degrees of freedom*, Physics Seminar, Université du Luxembourg

09/2019 *Stochastic thermodynamics with hidden degrees of freedom*, Workshop on *Fundamental Aspects of Statistical Mechanics and the Emergence of Thermodynamics in Nonequilibrium Systems*, Hanse-Wissenschaftskolleg, Delmenhorst, Germany

11/2018 *Fluctuation Theorems for Interacting Systems and Systems with Hidden Degrees of Freedom*, Seminar of the Group of Statistical Mechanics, Dto. Física Atómica, Molecular y Nuclear, Universidad Complutense de Madrid, Spain

09/2018 *Overview: Stochastic Thermodynamics and Fluctuation Theorems*, Retreat of the Turbulence, Wind Energy and Stochastics group of the Carl von Ossietzky Universität Oldenburg, Neu Sammit, Germany

Contributed talks (9):

03/2023 *An information engine that rectifies nonequilibrium fluctuations*, GSNP Postdoctoral Speaker Award Session, APS March Meeting 2023, Las Vegas, USA

06/2022 *Ratchets, ratchets everywhere! How information can fuel molecular machines and why you should care*, Frontiers in Biophysics 2022, Vancouver, BC, Canada

07/2021 *Maximizing the performance of an information engine*, Information Engines at the Frontiers of Nanoscale Thermodynamics, Telluride, CO, online, USA

06/2021 *Maximizing the performance of an information engine*, Joint European Thermodynamics Conference (JETC21), Prague, online, Czech Republic

05/2021 *Tight bounds on hidden entropy production from partially observed dynamics*, Workshop on Stochastic Thermodynamics II, Santa Fe Institute, online, USA

03/2021 *Finite-Time Landauer Principle*, APS March Meeting 2021, online, USA

07/2019 *How to deal with hidden degrees of freedom in stochastic thermodynamics?*, StatPhys27, Buenos Aires, Argentina

04/2019 *Approximating microswimmer dynamics by active Brownian motion: Energetics and efficiency*, DPG-Spring Meeting (Annual Conference of the German Physical Society), Regensburg, Germany

03/2018 *Fluctuation Theorems for Detached Path Probabilities*, DPG-Spring Meeting and EPS-CMD27, Berlin, Germany

Posters (6):

01/2021 *Minimizing the energetic costs of fast computations*, SFU Physics *2021 Poster competition*, Burnaby, Canada

09/2018 *Hidden slow degrees of freedom and fluctuation theorems*, stet18, workshop on *Stochastic Thermodynamics: Experiment and Theory*, Dresden, Germany

03/2018 *Hidden slow degrees of freedom and fluctuation theorems: an analytically solvable model*, DPG-Spring Meeting and EPS-CMD27, Berlin, Germany

04/2017 *On the Role of Latent Variables in Stochastic Thermodynamics*, workshop on *Non-Markovianity and Strong Coupling Effects in Thermodynamics*, Bad Honnef, Germany

03/2017 *On the Role of Latent Variables in Stochastic Thermodynamics*, DPG-Spring Meeting, Dresden, Germany

07/2016 *On the Thermodynamics of Predictive Information*, conference on *Statistical physics methods in biology and computer science* (StatPhys satellite meeting), Paris, France

Peer Review

10 in total

3 each	Physical Review E
2 each	Physical Review Letters Physical Review Research
1 each	Physical Review X Nature Communications Journal of Statistical Physics

Professional Societies

since 2022 American Physical Society

since 2020 Biophysical Society of Canada

since 2011 German Physical Society

2020-2022 European Physical Society

Teaching and mentoring

2021 -2022 **Co-supervisor** of two summer students and one Master student

2018 **Substitute lecturer** (4 weeks) of theoretical quantum mechanics

2016 - 2019 **Thesis co-supervisor** of three Bachelor students and subsequent thesis review

2016 - 2019 Several **tutorials** in theoretical physics (classical mechanics, electrodynamics, quantum mechanics, and statistical physics)

2012 - 2016 Several **tutorials** in experimental physics (classical mechanics, optics, electrodynamics, atomic physics, and thermodynamics)

Service

2021 - 2022 **President** of the Simon Fraser University Postdoctoral Association

2020 - 2021 **Vice President** - **External Communications** of the Simon Fraser University Postdoctoral Association

Popular Science

Invited Speaker at the *Klaus-von-Klitzing-award* ceremony (2017), the state youth science competition *Jugend forscht* (2018), and the *pedagogic week* (2018), all hosted in Oldenburg, Germany

Finalists at the *groschen 2018*, a science-communication competition for a 10.000€ prize awarded by the *Landessparkasse zu Oldenburg*, Germany

Science Slams in Bremen, Oldenburg, Hannover, Lübeck, Osnabrück, and Ulm, Germany. Northern German Science Slam champion and contestant in the German finals of 2017

Awards and honors

03/2023	One of five selected finalists for GSNP Postdoctoral Speaker Award Session at APS March Meeting 2023 in Las Vegas, USA
06/2019	Young Scientist participant at the **Lindau Nobel Laureate Meeting** 2019
2017	**'Golden brains'** for winning the Science Slams in Oldenburg and Bremen
2016	Master's **degree with honors**
2014	Bachelor's **degree with honors**
2013, 2014, and 2015	Three consecutive *Landesstipendien* (**state scholarships**) covering the tuition fees (500€) at the public Universität Oldenburg
2011	**Partial Scholarship** (25%) towards the tuition fees at the private Jacobs University, Bremen

Miscellaneous

Languages: German (native), English (professional), French (intermediate), Dutch (basic)

Computer skills: Matlab, C, Java, Python, Maple, LaTeX, MSOffice, Linux

Jannik Ehrich
Burnaby, February 24, 2023