

Sreekanth K. Manikandan

✉ sreekanth.km@fysik.su.se ☎ +46760720560 📍 Stockholm, Sweden

Research interests

Non-equilibrium statistical physics, Stochastic & Quantum thermodynamics,
Biophysics and *Stochastic inference* using Machine Learning

Academic positions

Sep 2020 – Aug 2022	Post-doctoral Research Fellow NORDITA, KTH Royal Institute of Technology and Stockholm University, Stockholm, Sweden <ul style="list-style-type: none">Developed an inference scheme for estimating the time-dependent entropy production rate in non-equilibrium systemsTested the <i>short-time</i> TUR based inference scheme in colloidal experimentsApplied stochastic thermodynamics to experimental data from fluctuating cell membranesObtained generic properties of <i>equidistant quenches</i> in few-level quantum systems
Sep 2015 – June 2020	Doctoral Degree (PhD) from department of physics, Stockholm University <i>Thesis title</i> : <i>Non-equilibrium thermodynamics at the microscopic scales</i> <i>Supervisor</i> : Prof. Supriya Krishnamurthy <ul style="list-style-type: none">Proposed an inference scheme to estimate entropy production rate in non-equilibrium systems from <i>short</i> experimentsObtained universal features of <i>efficiency fluctuations</i> in microscopic machinesDeveloped a path-integral technique to compute <i>finite-time</i> statistics of current fluctuations in non-equilibrium steady states

Education

Aug 2010 – Aug 2015	Integrated BS-MS Degree from IISER Thiruvananthapuram, India. CGPA: 8.64 (Major in Physics, Minor in Mathematics) Master's thesis: Symmetries and conservation Laws in Stochastic dynamical systems (with Dr. Sreedhar B. Dutta).
Aug 2012 – Aug 2015	Visiting student, Institute of Mathematical Sciences Chennai, India. Project: Random walk, diffusion and first passage problems in Physics — Exact calculation of spatiotemporal correlations in mass diffusion and aggregation models — Force percolation in brick lattices (with Prof. Purusattam Roy and prof. Rajesh Ravindran)

Experimental collaborations

May 2019 - Ongoing	Light – Matter Lab, IISER Kolkata, India (Prof. Ayan Banerjee) <ul style="list-style-type: none">Brownian data from optically trapped colloidal particles in non-equilibrium environments
August 2020 - Ongoing	Cell Biophysics Lab, IISER Kolkata, India (Prof. Bidisha Banerjee Sinha) <ul style="list-style-type: none">High resolution images of cell membrane fluctuations
June 2021 - Ongoing	Soft Matter Lab, University of Gothenburg, Sweden (Prof. Giovanni Volpe) <ul style="list-style-type: none">Brownian data from optically trapped colloidal particles in non-equilibrium and active environments (with bacteria).
September 2021 -	Photonics Lab, KTH, Sweden (Dr. Apurba Dev) <ul style="list-style-type: none">AFM experiments with nano-vesicles

Publications and preprints

1. Otsubo, S., **Manikandan, S. K.**, Sagawa, T. & Krishnamurthy, S. *Estimating time-dependent entropy production from non-equilibrium trajectories*. Communications Physics (Nature) volume 5, Article number: 11 (2022)
2. **Manikandan, S. K.** et al. *Quantitative analysis of non-equilibrium systems from short-time experimental data*. Communications Physics (Nature) volume 4, Article number: 258 (2021)
3. **Manikandan, S. K.**. *Equidistant quenches in few-level quantum systems*. Phys. Rev. Research 3, 043108 (2021)
4. **Manikandan, S. K.**, Gupta, D. & Krishnamurthy, S. *Inferring entropy production from short experiments*. Physical review letters, 124(12), p.120603 (2020)
5. **Manikandan, S. K.**, Dabelow, L., Eichhorn, R. & Krishnamurthy, S. *Efficiency fluctuations in microscopic machines*. Physical review letters, 122(14), p.140601 (2019)
6. **Manikandan, S. K.** & Krishnamurthy, S. *Exact results for the finite time thermodynamic uncertainty relation*. Journal of Physics A: Mathematical and Theoretical, (51) 11LT01 (2018)
7. **Manikandan, S. K.** & Krishnamurthy, S. *Asymptotics of work distributions in a stochastically driven system*. The European Physical Journal B, (90) 12, p1 - 19(2017)
8. **Manikandan, S. K.** et. al.,. *Non-monotonic skewness of currents in non-equilibrium steady states*. arXiv:2201.06563 (2022)

Analytical skills

- **Path integral formalism:** Martin-Siggia-Rose Path integrals, Method of *functional determinants* for evaluating path integrals exactly
- **Stochastic differential equations:** Lie symmetry analysis of ordinary and stochastic ODEs / PDEs
- **Large deviation theory**

Programming skills

- **Languages & Softwares:** Python, Matlab, C, Octave, Mathematica
- **Libraries & Tools:** NumPy, PySwarms, PyTorch, Matplotlib, Jupyter notebook

Professional services

- Referee for *Physical Review Letters*, *Physical Review Research*, *Physical Review E*, *Physical Review A*
- Referee for *Communications Physics - Nature*, *Scientific Reports*
- Referee for *Journal of Physics A: Mathematical and theoretical*

Teaching Experience

- Teaching Assistant in the Department of Physics, Stockholm University:
Statistical Physics II, Condensed Matter and Statistical Physics, Quantum Phenomena for Medical Radiation Physics

Honors

- NORDITA Fellowship for independent post doctoral research (Sep 2020 - Aug 2022)
- IOP Trusted Reviewer Award (2020)
- Donation Scholarship Rhodinns Minnes, Stockholm University (2019)
- Donation Scholarship G & E Kobbes, Stockholm University (2018 - 2019)
- Donation Scholarship Fonden för främjande av fysisk forskning (FF) Stockholm University (2018)
- Visiting Students Fellowship, Institute of Mathematical Sciences, Chennai (2012 – 2015)
- Inspire-SHE Fellowship, Department of Science and Technology, Govt. of India (2010-2015)

Featured Research

- Work on **Efficiency fluctuations in microscopic machines** featured in Fysikum blog:
<https://www.fysik.su.se/english/research/research-news/efficiency-fluctuations-in-microscopic-machines-1.434969>
- Work on **Inferring entropy production from short experiments** featured in Fysikum blog:
<https://www.fysik.su.se/english/research/research-news/inferring-entropy-production-from-short-time-series-1.497056>

Outreach

- Host for *Fysikshow*, the department outreach program for school children in Sweden, during the period 2016-2020.
Link: <https://www.fysik.su.se/samverkan/kommun-skola/fysikshow>
- Participated in the podcast *Nyfiken*, and talked about microscopic non-equilibrium systems.
Link: <https://www.buzzsprout.com/1191659/8190254>

Conferences/ Workshops/ Schools/ Seminars

Jun 2021	Seminar: NORDITA, Stockholm. Title: <i>Equidistant quenches in few-level quantum systems</i>
May 2021	Virtual Workshop: Workshop on Stochastic Thermodynamics (WOST II), Santa Fe Institute.
Feb 2021	Seminar: IIT Gandhinagar, India. Title: <i>Inferring entropy production from short experiments</i>
Oct 2019	Seminar: Sagawa group, University of Tokyo, Japan. Title: <i>Inferring entropy production from short experiments</i>
Oct 2019	Seminar: NORDITA, Stockholm. Title: <i>Inferring entropy production from short experiments</i>
Jun 2019	Conference: Quantum thermodynamics'19, Espoo, Finland
May 2019	Conference: Statistical Physics of Complex systems, NORDITA, Stockholm Contribution: Poster on <i>Efficiency fluctuations in microscopic machines</i>
Apr 2019	Seminar: Sagawa group, University of Tokyo, Japan. Title: <i>Efficiency fluctuations in microscopic machines</i>
Mar-2019	Conference: Nordic Statistical Physics Meeting, NORDITA, Stockholm Contribution: Poster on <i>Efficiency fluctuations in microscopic machines</i>
Mar 2019	Seminar: Mathematical Physics Seminar, Stockholm University Title: <i>Efficiency fluctuations in microscopic machines</i>
Mar 2019	Seminar: NORDITA, Stockholm Title: <i>Efficiency fluctuations in microscopic machines</i>
Nov 2019	Conference: APEF 2018, University of Tokyo, Japan Contribution: Poster on <i>Efficiency fluctuations in microscopic machines</i>
Jul 2018	Seminar: Institute of Mathematical Sciences (IMSc) Chennai, India Title: <i>Non-equilibrium thermodynamics of a colloidal particle</i>
Sep - Oct 2017	Conference: Current and future trends in stochastic thermodynamics, NORDITA, Stockholm Contribution: Talks in the JAM session <ol style="list-style-type: none">1. Asymptotics of work distributions in a stochastically driven system2. Exact calculation of a finite-time moment generating function using path-integral techniques

Aug 2017	Seminar: Indian Institute of Science Education and Research (IISER) Thiruvananthapuram, India Title: <i>Asymptotics of work distributions in a stochastically driven system</i>
Jul 2018	School: Bangalore School of Statistical Physics IX, ICTS, Bangalore, India
Jul 2017	School: Bangalore School of Statistical Physics VIII, ICTS, Bangalore, India
Feb 2018 Feb 2017	School: SFT-18, SFT-17 - Lectures on Statistical Field Theory, The Galileo Galilei Institute for Theoretical Physics (GGI), Florence, Italy
Sep - Oct 2015	Conference: Stochastic Thermodynamics in Biology, NORDITA, Stockholm
Dec 2013	Conference: Fracture meet'13, Institute of Mathematical Sciences (IMSc) Chennai, India Contribution: Talk on Force Percolation in Brick lattices

Referees

PhD Advisor: Prof. Supriya Krishnamurthy,
Associate Professor, Departement of Physics, Stockholm University.
supriya@fysik.su.se

Dhrubaditya Mitra,
Assistant Professor, NORDITA, Stockholm.
dhruba.mitra@gmail.com

Personal Details

Name: Sreekanth K. Manikandan
Date of Birth: 27th October 1992
Nationality: Indian
Residence status: Permanent Resident in Sweden
Current Address: Hjortrongatan 22, Uppsala, Sweden. SE - 75452