Philip Taranto

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LinkedIn
ORCiD

Profile

I am enthusiastic, diligent, and passionate about constantly learning and growing through experience and application. I thrive on solving complex problems, distilling key ideas and disseminating expertise broadly to stir interdisciplinary debate and advancement. My research focuses on quantum physics and mathematics, through which I aspire to positively impact society. I also consider myself a de-facto student of the arts — especially literature, music and visual art — and am deeply interested in the intersection of modern culture, politics and society, and philosophy.

Commitment

I am committed to empowering historically excluded and marginalised groups, in particular those that face systemic oppression due to class, race, ethnicity, gender, sexuality, or disability (amongst others). I am an advocate for open science and climate justice, and am constantly working to improve structural and material conditions both within and beyond the academic landscape.

Academic Employment

Present—2023/03: **Japan Society for the Promotion of Science (JSPS) Post-Doctoral Fellow**
Hosted by Prof. Mio Murao, University of Tokyo (Japan)

2023/02—2022/12: **Post-Doctoral Researcher**
Group of Prof. Mio Murao, University of Tokyo (Japan)

2022/11—07: **Post-Doctoral Researcher**
Group of Prof. Marcus Huber, TU Wien (Austria)

Grants & Funding

2024/02—2023/03: **JSPS Post-Doctoral Fellowship (~6m ¥)**
Characterizing and Controlling Complex Quantum Processes with Classical Memory

Research

My main research interests lie at the interface of quantum physics, mathematics, and information science, focusing on fields including (but not limited to):

- Quantum Information Theory
- Quantum Thermodynamics
- Quantum Foundations
- Quantum Computation & Simulation
- Open Quantum Dynamics
- Correlations & Entanglement
- Stochastic & Complex Processes
- Philosophy of Physics & Science

According to Google Scholar, my research has generated 317 citations, with an h-index of 8 (as of 24/12/2023). I pride myself on successful collaboration, having worked with around 36 coauthors whose affiliations span at least 19 external institutions.

Present—2022/07: Post-doc (Murao)

Universal algorithm for transforming Hamiltonian eigenvalues
Authors: Tatsuki Odake, Hlér Kristjánsson, Philip Taranto, Mio Murao
Pre-print: arXiv:2312.08848

Characterising the Hierarchy of Multi-time Quantum Processes with Classical Memory
Authors: Philip Taranto, Marco Túlio Quintino, Mio Murao, Simon Milz

Pre-print: arXiv:2307.11905

2022/06—2019/07:
PhD (Physics)

Quantum Information Processing: Thermodynamics, Complexity, and Multi-Time Phenomena (PhD Dissertation)
Authors: Philip Taranto
Available: University of Vienna Library

Connecting Commutativity and Classicality for Multi-Time Quantum Processes
Authors: Fattah Sakuldee, Philip Taranto, Simon Milz
Published: Phys. Rev. A 106, 022416 (2022)
Pre-print: arXiv:2204.11698

★ **Hidden Quantum Memory: Is Memory There When Somebody Looks?**
Authors: Philip Taranto, Thomas J. Elliott, Simon Milz
Published: Quantum 7, 991 (2023)
Pre-print: arXiv:2204.08298

★ **Landauer vs. Nernst: What is the True Cost of Cooling a Quantum System?**
Authors: Philip Taranto[1], Faraj Bakhshinezhad[1], Andreas Bluhm[2], Ralph Silva[2], Nicolai Friis, Maximilian P. E. Lock, Giuseppe Vitagliano, Felix C. Binder, Tiago Debarba, Emanuel Schwarzhans, Fabien Clivaz, Marcus Huber
Published: Phys. Rev. X Quantum 4, 010332 (2023)
Pre-print: arXiv:2106.05151

Experimental Demonstration of Instrument-Specific Quantum Memory Effects and Non-Markovian Process Recovery for Common-Cause Processes
Authors: Yu Guo[1], Philip Taranto[1], Bi-Heng Liu, Xiao-Min Hu, Yun-Feng Huang, Chuan-Feng Li, Guang-Can Guo
Published: Phys. Rev. Lett. 126, 230401 (2021)
Pre-print: arXiv:2003.14045

Exponential Improvement for Quantum Cooling through Finite-Memory Effects
Authors: Philip Taranto, Faraj Bakhshinezhad, Philipp Schüttelkopf, Fabien Clivaz, Marcus Huber
Published: Phys. Rev. Appl. 14, 054005 (2020)
Pre-print: arXiv:2004.00323

★ **When is a Non-Markovian Quantum Process Classical?**
Authors: Simon Milz, Dario Egloff, Philip Taranto, Thomas Theurer, Martin B. Plenio, Andrea Smirne, Susana F. Huelga
Published: Phys. Rev. X 10, 041049 (2020)
Pre-print: arXiv:1907.05807

2019/03—2017/03:
Masters (Physics)

Memory Effects in Quantum Processes (Master Thesis)
Author: Philip Taranto
Published: Int. J. Quantum Inf. 18, 1941002 (2020)
Pre-print: arXiv:1909.05245

[1,2] Equal contributions.
★ Denotes 5 most important works.

Non-Markovian Memory Strength Bounds Quantum Process Recoverability
Authors: Philip Taranto, Felix A. Pollock, Kavan Modi
Published: npj Quantum Inf. 7, 149 (2021)
Pre-print: arXiv:1907.12583

★ **Quantum Markov Order**
Authors: Philip Taranto, Felix A. Pollock, Simon Milz, Marco Tomamichel, Kavan Modi
Published: Phys. Rev. Lett. 122, 140401 (2019)
Pre-print: arXiv:1805.11341

★ **The Structure of Quantum Stochastic Processes with Finite Markov Order**
Authors: Philip Taranto, Simon Milz, Felix A. Pollock, Kavan Modi
Published: Phys. Rev. A 99, 042108 (2019)
Pre-print: arXiv:1810.10809

2015/11–03: Honours (Physics)

Emergence of a Fluctuation Relation for Heat in Nonequilibrium Open Quantum Processes
Authors: Philip Taranto, Felix A. Pollock, Kavan Modi
Published: Phys. Rev. E 97, 052111 (2018)
Pre-print: arXiv:1510.08219

Education

2022/06—2019/07 **University of Vienna — Doktor der Naturwissenschaften [PhD Equivalent] (Physics)**
Thesis: Quantum Information Processing: Thermodynamics, Complexity, and Multi-Time Phenomena
Supervisor: Assoc. Prof. Marcus Huber
Assessors: Prof. Nicolas Brunner & Prof. John Goold
Date of Defence: 28/06/2022
Grade: 1.0 Distinction (Highest Possible)

2022/11—02 **Atominstitut, Technische Universität Wien (Vienna)**

2021/01—2019/07 **Institute for Quantum Optics and Quantum Information (IQOQI Vienna)**

2019/03—2017/03 **Monash University, Melbourne — Master of Science (Physics)**
Thesis: Memory Effects in Quantum Processes
Supervisors: Dr. Kavan Modi & Dr. Felix A. Pollock
Assessors: Prof. G. Massimo Palma & Dr. Fabio Costa
Grade: H1 (97%)

2015/11—03 **Monash University, Melbourne — Bachelor of Science (Honours)**
Thesis: Landauer's Principle in Nonequilibrium Quantum Thermodynamics
Supervisors: Dr. Kavan Modi & Dr. Felix A. Pollock
Assessors: Assoc. Prof. Peter Skands & Dr. Meera Parish
Grade: H1 / **GPA:** 4.000 (Highest Possible)

2014/11—2012/03 **Monash University, Melbourne — Bachelor of Science (Science Scholar Program)**
Majors: Double Major in Applied Mathematics, Major in Physics
GPA: 3.917

2011/12—2006/02 **De La Salle College, Melbourne**
ATAR Grade: 99.35 (College Dux)

Supervision

Present—2020

Co-Supervisor
Master's Thesis: Felix Hubmann, "Open quantum evolution from thermodynamic collision models", University of Vienna (Co-supervisors: Simon Milz, Felix Binder; Official Supervisor: Marcus Huber).

2020—2019

Co-Supervisor
Master's Thesis: Philipp Schüttelkopf, "Non-Markovian dynamics in quantum cooling", University of Vienna (Official Supervisor: Marcus Huber).
Grade: 1.0 (Highest Possible)

Teaching

2018/11—2015/03

Teaching Assistant — Monash University
Tutoring undergraduate courses twice weekly to groups of ~20+ students, holding office hours, grading assignments and exams, and responding to student queries.

2018

Semester 2: Second Year Core Physics: Optics, electromagnetism & quantum theory.
Semester 1: Second Year Core Physics: Electromagnetism, thermodynamics & entropy.

2017

Semester 2: First Year Core Physics: The Area for Physics & Astronomy Study Tutor.
Semester 1: Foundation Physics Laboratories: Mechanics & kinematics, electromagnetism, quantum physics.

2015

Semester 2: Advanced Engineering Maths: Complex analysis, integral transforms, statistics.
Semester 1: Foundation Engineering Maths: Functions, coordinate geometry, complex numbers, calculus, vector analysis.

2018—2012

Private Tutoring
Tutoring undergraduate and high school students with a range of abilities in topics of mathematics, physics and chemistry, both in a one-on-one and small class (~6 students) format.

Conferences

2024/01

Quantum Information Processing (Taipei, Taiwan)
Poster: Hidden Quantum Memory: Is Memory There When Somebody Looks?

2023/12

Japanese-French Quantum Information Workshop (Tokyo, Japan)
Invited Talk: Characterising the Hierarchy of Multi-time Quantum Processes with Classical Memory

2023/11

International Conference on Quantum Energy (Melbourne, Australia)
Contributed Talk: Characterising the Hierarchy of Multi-time Quantum Processes with Classical Memory

2023/11

Quantum Innovation (RIKEN Tokyo, Japan)
Poster: Characterising the Hierarchy of Multi-time Quantum Processes with Classical Memory

2023/06

Quantum Information (Benasque, Spain)

2023/02 **JSPS Japan—NUS Singapore Joint Seminar (NII Tokyo, Japan)**
Poster: Operational Characterisation of Quantum Memory Effects via Multi-Time Probing Schemes

2022/09 **Quantum Characterization and Control of Quantum Complex Systems (Lake Como, Italy)**
Poster: Operational Characterisation of Quantum Memory Effects via Multi-Time Probing Schemes

2022/09 **Quantum Intelligence (LOFAR Birr, Ireland)**
Invited Talk: Hidden Quantum Memory: Is Memory There When Somebody Looks?

2022/08 **Quantum Confessions (Mehedeby, Sweden)**
Contributed Talk: Hidden Quantum Memory: Is Memory There When Somebody Looks?

2022/07 **741. WE-Heraeus-Seminar. Quantum Measurement Theory: Foundations and Applications (Bad Honnef, Germany)**
Poster: Operational Characterisation of Quantum Memory Effects via Multi-Time Probing Schemes

2022/05 **Workshop on Stochastic Thermodynamics [WOST III] (Online)**
Poster: Landauer vs. Nernst: What is the True Cost of Cooling a Quantum System?

2022/04 **European Spring School for Quantum Science & Technology (Strasbourg, France)**
Poster: Landauer vs. Nernst: What is the True Cost of Cooling a Quantum System?

2021/10 **Quantum Thermodynamics [QTD] (Online)**
Contributed Talk: Landauer vs. Nernst: What is the True Cost of Cooling a Quantum System?

2021/04 **International Conference for Young Quantum Information Scientists VI [YQIS] (Online)**
Contributed Talk: Exponential Improvement for Quantum Cooling through Finite-Memory Effects

2020/11 **Q-Turn (Online)**
Contributed Talk: Exponential Improvement for Quantum Cooling through Finite-Memory Effects

2020/06 **Conference on the Theory of Quantum Computation, Communication and Cryptography [TQC] (Online)**
Poster: Memory Effects in Quantum Processes

2019/12 **Vienna-Bratislava Thermodynamics Seminar (Bratislava, Slovakia)**
Organiser: 1 afternoon, ~20 participants, 2 invited talks

2019/09 **International Conference for Young Quantum Information Scientists V [YQIS] (Gdańsk, Poland)**
Poster: Memory Effects in Quantum Processes

2019/06 **Quantum Information (Benasque, Spain)**

Academic Seminars

2023/05 **Centre for Quantum Technologies (Singapore)**
Talk: Multi-Time Quantum Processes and Non-Markovian Dynamics
Host: Ng Hui Khoon

2022/11 **University of Tokyo (Tokyo, Japan)**
Talk: Hidden Quantum Memory: Is Memory There When Somebody Looks?
Host: Mio Murao

Review & Community

Present—2020 **25 verified reviews in 6 different journals, including:** Phys. Rev. Lett., Phys. Rev. X Quantum, Phys. Rev. Research, Phys. Rev. A, Quantum, and Int. J. Quantum Inf. (see Web of Science profile)

Present—2023/02 **Qulink Seminar (International)**
Organiser: Monthly seminar hosted between University of Tokyo and OIST, Japan. Role includes inviting a diverse array of internationally renowned experts in fields related to quantum information science and computing, facilitating presentations, and chairing discussion sessions.

2022—2020 **Academic Mentoring Program:** Vienna Doctoral School (Physics)

2020/07 **Huber Group Retreat (Hohentauern, Austria)**
Organiser: 4 days, ~20 members, 8 invited talks, 4 workshops (Entanglement & Non-locality, Quantum Thermodynamics, Causality, Assessing & Reshaping Issues in the Academic Landscape)

Outreach

2020/07 **Nice to Know Podcast**
Episode 9: Philosophy? Technology? Quantum Physics

Selected Awards & Grants

2023—2022 — Japan Society for the Promotion of Science (JSPS) Fellowship: Characterizing and Controlling Complex Quantum Processes with Classical Memory
2018—2017 — Australian Government RTP Postgraduate Scholarship
— Monash University (Physics) J. L. Williams Postgraduate Top-up Scholarship
2015 — Highly Commended Honours Student
2014—2012 — Dean's Honours List Fellow
— Monash University Scholarship for Academic Excellence
2011 — Dux of De La Salle College

Languages

German
Advanced (CEFR C1)

Italian
Intermediate (CEFR B1)

Japanese
Beginner (JLPT N5)

References

Dr. Mio Murao
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Atominstitut, TU Wien
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