Thomas GUFF

PERSONAL INFORMATION

NATIONALITY:	Australian
LANGUAGES:	Native English Speaker

ABOUT ME: Analytical problem-solver with a PhD in theoretical physics and a strong foundation in data science, statistical modelling, and Python programming. Passionate about leveraging data-driven insights to optimise decision-making and solve complex problems in industry. Experienced in working with large datasets, predictive modelling, and communicating technical results to diverse stakeholders. Beyond work, I enjoy teaching, exploring new mathematical techniques, and reading about history. In my free time, you will often find me bouldering, hiking, or immersed in a great book.

EMPLOYMENT

2022-2024 **Research Fellow**
University of Surrey, United Kingdom
Supervisor: A/Prof. Andrea ROCCO
Conducted pioneering research in quantum thermodynamics and open quantum systems. Used Brownian motion and diffusion to study long-time behaviour of models of open quantum systems. Examined the time-symmetries of several common quantum differential equations. Findings were published in high-impact journals.

2020-2022 **Postdoctoral Researcher**
Stockholm University, Sweden
Supervisor: A/Prof. Igor PIKOVSKI
Performed foundational research on the intersection of gravity and quantum information. Used numerical optimisation to determine optimal conditions for a future quantum-gravitational experiment. Used numerical integration to model gravitational quantum entanglement. This resulted in several high-quality publications in leading journals.

SKILLS

DATA SCIENCE & ANALYTICS:	Python (Pandas, NumPy, Scikit-Learn, Statsmodels), SQL, Bayesian Inference, Statistical Modeling, Time-Series Analysis, Diffusion Models.
MACHINE LEARNING & AI:	Regression, Classification, Predictive Modelling.
DATA VISUALIZATION:	Matplotlib, Seaborn.
WEB DEVELOPMENT:	HMTL, CSS, JavaScript.
MATHEMATICS:	Probability, Statistics, Matrix Analysis, Calculus, Linear Algebra, Abstract Algebra, Functional Analysis.

Publications & Technical Writing

I have published multiple peer-reviewed papers in leading quantum physics journals. These utilise statistical modelling; Bayesian inference; numerical integration and optimisation; and apply advanced mathematical techniques to analyse complex datasets. Full list available here.

Education

2015-2019	**Doctor of Philosophy in Physics and Astronomy, Macquarie University** Thesis: ``Quantum Measurements and Quantum Resources'' | Advisor: A/Prof. Alexei Gilchrist Summary: This thesis focuses on quantum measurements and quantum information. We use statistics, Bayesian inference, Bayesian experimental design and matrix analysis to build a framework for evaluating the quality of quantum measurements. We also built mathematical models of quantum heat engines and applying numerical integration techniques to leverage quantum coherence in optimising the engine performance. Skills: Probability & Statistics, Bayesian Inference, Numerical Modelling, Numerical Integration, Numerical Optimisation, Linear Algebra, Matrix Analysis, Calculus, Technical Writing.
2013-2014	**Master of Research in the Faculty of Science, Macquarie University** Thesis: ``Probing Gravity with Optical Experiments'' | Advisor: A/Prof. Daniel R. Terno Summary: This this examines the behaviour of light rays in an interferometer in a near-earth gravitational field. Using general relativity and geometric techniques the precise behaviour of the light-rays was determined. Skills: Geometry, Calculus, Differential Equations, Technical Writing.
2010-2012	**Bachelor of Science, Macquarie University** Major: Astronomy and Astrophysics | Minor: Mathematics Gpa: 3.73/4.0

Student Supervision

2021	Bachelor Project Nicolas Boulle - Stockholm University Thesis: `Gravitationally Induced Entanglement and Witnessing''

News Articles

The following news articles have highlighted my scentific research or outreach:

2025-02-21	NewScientist.com
2025-02-18	ScienceAlert.com
2025-02-18	TheDebrief.org
2025-02-16	CosmosMagazine.com
2025-02-13	Phys.org
2018-12-01	CentralWesternDaily.com.au

Teaching

2017-2018	Physics IA (Tutor) Led interactive tutorials for first year undergraduate students in Newtonian mechanics and electromagnetism, enhancing student comprehension through problem-solving sessions and real-world applications.
2015	Physics IB (Tutor) Led interactive tutorials for first year undergraduate students in special relativity and thermodynamics. Increased student engagement with interesting problems and relatable examples.

Conference Presentations

Talk   **Australia-New Zealand Conference on Optics and Photonics 2017 (Queenstown, New Zealand)**
Delivered a talk highlighting new research on coherent quantum mechanical heat engines, followed by an interactive Q&A period.

Poster   **Frontiers of Quantum and Mesoscopic Thermodynamics 2017 (Prague, Czech Republic)**
Presented a poster on quantum mechanical heat engine, discussing with fellow physicists on possible experimental implementation.

Poster   **QTD 2023 (Vienna, Austria)**
Presented original research on time-reversal symmetry, beginning discussions with leading quantum physicists on implications and directions for future research.

Research Visits

2017   **Prof. Stephen Barnett - Quantum Theory Group**
University of Glasgow, United Kingdom

Scholarships and Awards

2018   Macquarie University Physics and Astronomy Department Service Excellence Award

2015-2017   Australian Postgraduate Award Scholarship