

# Peter Barnett

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## Education

### Master of Science with Distinction in Physics

UNIVERSITY OF OTAGO, NEW ZEALAND

2018 – 2019

- **Thesis:** “Theory of Microwave to Optical Photon Upconversion Using Erbium Doped Crystals”
- **Supervisor:** Prof. Jevon Longdell
- **Grade:** A+ (95%)
- Theoretical research into simulating a complex quantum system, with enough accuracy to be able inform experiments
- Focus on analytic and computational linear algebra, novel numerical integration methods, and solving complex optimisation problems
- Developed fast and accurate computational simulations from the ground up
- Performed data analysis on experimental data
- Application to building practical quantum computers
- Received a poster prize at an international conference for this work

### Bachelor of Science with Honours (First Class) in Physics

UNIVERSITY OF OTAGO, NEW ZEALAND

2017

- **GPA:** 8.9/9
- **Dissertation:** “Two-Time Correlations of an Energy-Damped Bose-Einstein Condensate”
- **Supervisor:** Dr. Ashton Bradley
- **Dissertation Grade:** A+
- Focus on stochastic calculus, and computational simulations
- Second author on published paper, based on this research
- For coursework I generally achieved in at least the top 3 students, passing 2 out of 8 courses with a mark of 100% and an average grade of 96%

### Bachelor of Science

UNIVERSITY OF OTAGO, NEW ZEALAND

2014 – 2016

- **Major:** Physics
- **Minors:** Mathematics, Chemistry
- **GPA:** 8.9/9

Transcripts available on request

## Skills

<b>Programming</b>	Python, MATLAB, $\LaTeX$ , numpy, scipy, cython, matplotlib
<b>Maths</b>	Linear algebra, multivariate calculus, stochastic calculus, Bayesian statistics
<b>Numerical methods</b>	Numerical integration, differential equations, stochastic ensemble simulations
<b>Machine Learning</b>	PyTorch, Keras, reinforcement learning, Ray RLlib (RL library)
<b>Communication</b>	Explaining technical topics to non-experts, scientific writing, science outreach
<b>Research</b>	Problem solving, able to work alone and with a team
<b>Other</b>	Inkscape (SVG editor)

## Experience

### Research Analyst

NONLINEAR

May 2021 – Ongoing

- Researching interventions for improving AI safety research, AI safety benchmarks, and the research ecosystem

### Summer Research Fellow

CAMBRIDGE EXISTENTIAL RISK INSTITUTE

Jul – Aug 2021

- Researching multi-agent reinforcement learning and game theory
- Submitted a paper to a workshop (awaiting response)

## Deep Reinforcement Learning Research

AI SAFETY CAMP 5

Feb – May 2021

- Implementing and investigating a novel reinforcement learning algorithm using uncertainty for OOD detection
- Working with one of the authors of the algorithm
- Investigating the use of [Gated Linear Networks](#) for reinforcement learning

## Volunteer Coordinator

EAGxASIA-PACIFIC 2020 CONFERENCE

Oct – Nov 2020

- Organised a team of volunteers for moderating the Slack of an international virtual conference
- Managed team of 19 people in many different timezones
- Regularly liaised with the other volunteer coordinators

## Research Intern

OKINAWA INSTITUTE OF SCIENCE AND TECHNOLOGY

[Okinawa, Japan](#)

Jan – May 2018

- Research into quantum fluid dynamics using high performance computing and GPU based simulations
- Second author for a published paper, which was marked as an "Editors' Suggestion"

## Summer Research Intern

UNIVERSITY OF OTAGO

[Dunedin, New Zealand](#)

Nov 2016 – Jan 2017

- Research into quantum fluid dynamics simulations using MATLAB

## Summer Research Intern

UNIVERSITY OF SYDNEY

[Sydney, Australia](#)

Jan – Feb 2016

- Investigating the use of metal organic frameworks for carbon capture
- Synthesising compounds in a chemistry research lab, and testing their carbon capture abilities

## Summer Research Intern

UNIVERSITY OF OTAGO

[Dunedin, New Zealand](#)

Nov – Dec 2015

- Designing microwave resonators for use in an atomic clock
- Using CAD and physics simulation software

## Science Outreach

OTAGO OPTICS CHAPTER

2015 – 2019

- Organising and taking part in science outreach in schools and local community
- Working with team of other people doing science outreach
- Explaining and hopefully enthusing students and parents about physics
- Organised a several day long outreach trip around rural schools to demonstrate physics
- Visited Malaysia to work with school students, and student teachers

## Teaching/Tutoring

UNIVERSITY OF OTAGO

### Demonstrator for 2nd year Electromagnetism and Optics

2018

- Large focus on multivariable calculus (vector calculus and volume integration)
- Running tutorials and helprooms
- Helping students understand complicated concepts

### Demonstrator for 1st year biological physics

2016

- Helping health science students with both written problems and experiments

### Tutor for physics and chemistry

2015

- One-on-one or small group tutoring for pre-university students

## Publications

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P. S. Barnett, J. J. Longdell (2020) *Theory of microwave-optical conversion using rare-earth-ion dopants*. Physical Review A, 102(6), 063718. 10.1103/PhysRevA.102.063718

J. Schloss, P. S. Barnett, R. Sachdeva, T. Busch (2020) *Controlled creation of three-dimensional vortex structures in Bose-Einstein condensates using artificial magnetic fields*. Physical Review A, 102(4), 043325. 10.1103/PhysRevA.102.043325

R. G. McDonald, P. S. Barnett, F. Atayee, A. S. Bradley (2020) *Dynamics of hot Bose-Einstein condensates: stochastic Ehrenfest relations for number and energy damping*. SciPost Physics, 8(2). 10.21468/SciPostPhys.8.2.029.

G. G. King, P. S. Barnett, J. G. Bartholomew, A. Faraon, J. J. Longdell (2021) *Probing strong coupling between a microwave cavity and a spin ensemble with Raman heterodyne spectroscopy*. *Physical Review B*, 103(21), 214305. 10.1103/PhysRevB.103.214305

P. S. Barnett, John Burden (2021) *Oases of Cooperation: An Empirical Evaluation of Reinforcement Learning in the Iterated Prisoner's Dilemma*, submitted to the SafeAI 2022 workshop.

## Scholarships and Awards

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<b>Poster Prize – International Conference on Dynamical Processes in Excited States of Solids</b>	2019
<b>University of Otago Master's Research Scholarship</b>	2018
<b>Beverly Bursary in Physics</b>	2017
<b>University of Otago Prestige Scholarship in Science</b>	2016
<b>NZ Energy Education Trust Undergraduate Scholarship</b>	2016
<b>Beverly Bursary in Physics</b>	2016
<b>Beverly Bursary in Physics</b>	2015