Shintaro Fushida-Hardy

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Research

Feb 2018 - Present, University of Auckland and Stanford University
Conformal geometry, with Professor Rod Gover. We aim to understand general relativistic notions through conformal geometry, with a current focus on the shear free condition. The research uses conformal tractor calculus, which is the natural invariant calculus on conformal manifolds. Some results are currently being prepared for publication (with Professor Gover).

Nov 2018 - March 2019, Auckland Bioengineering Institute
Battery modelling, supervised by Distinguished Professor Peter Hunter. I applied graph-theoretic concepts to create more accurate and meaningful models of Li-ion batteries.

Dec 2017 - Feb 2018, University of Auckland
Fluid dynamics, supervised by Dr. Geoff Willmott. I investigated the drop impact dynamics of ferrofluids. Using high speed cameras, I collected quantitative data describing the dynamics of drop impact ferrofluid instabilities, which had not been done before. The data was meticulously organised and is still in regular use by Dr. Frederick Wells and Mr. Stephen Chung.

Dec 2016 - Sep 2017, University of Auckland
Continuum theory, supervised by Dr. Sina Greenwood. I explored the necessary and sufficient conditions for a generalised inverse limit to be an arc, and determined conditions for each direction. Prior to this research, only arc-like inverse limits had been investigated, rather than arc inverse limits.

Dec 2015 - Feb 2016, University of Auckland
Mathematical biology, supervised by Professor James Sneyd and Associate Professor Vivien Kirk. I investigated the effectiveness of symbolic regression methods to reverse engineer biological models from real data. I concluded that symbolic regression is not yet a useful tool to study calcium dynamics in T-cells, primarily due to insufficient precision in measurements.

Education

2019 - Present, Stanford University
PhD student, mathematics.

2018, University of Auckland
Bachelor of Science (Honours) (First Class Honours). 9.00/9.00 GPA, mathematics.

2015 - 2017, University of Auckland
Bachelor of Science, 8.68/9.00 GPA, mathematics and physics.

Academic Awards

2018, *Collins Prize in Mathematics*, University of Auckland
Awarded annually to the student with the best overall result for a Bachelor with Honours in Mathematics.

2018, *Senior Scholar Award*, University of Auckland
Awarded to the students with the highest overall grades in their major.

2018, University of Auckland Faculty of Science Postgraduate Research Poster Competition
Awarded third place overall and a People's Choice Award.
Winner of the 2018 Department of Mathematics poster competition.

2015 - 2018, *First in Course Award*, University of Auckland
Awarded to the student who obtained the highest grade in a taught course. (Received in seven courses.)

2017, *University of Auckland Postgraduate Honours Scholarship*, University of Auckland
Monetary value: 13,000 NZD + course fees.

2014, *Premier Award*, New Zealand Qualifications Authority
Monetary value: 30,000 NZD.
Awarded to students who obtained the top 5-10 highest overall results in the New Zealand Scholarship examinations.

Teaching

2019 - Present, Stanford University
Course/Teaching Assistant.

Spring 2020	- Math 21, Calculus
Fall 2020	- Math 120, Groups and Rings
Summer 2020	- Stanford Summer Enginereeing Academy, linear algebra. *Instructor.* Designed syllabus and taught, together with Sophie Libkind and Megan Selbach-Allen. Focus on inquiry based learning, collaboration, and reading mathematics.
Spring 2020	- Math 171, Fundamental Concepts of Analysis
Fall 2019	- Math 20, Calculus

2016 - 2019, University of Auckland
Teaching Assistant.
Semester one 2019 - MATHS 120, Algebra, MATHS 130, Caclulus
Semester two 2018 - MATHS 332, Real Analysis, MATHS 340, Real and Complex Calculus
Semester one 2018 - MATHS 255, Principles of Mathematics
Semester two 2017 - MATHS 253, Advancing Maths III
Semester one 2017 - MATHS 250, Advancing Maths II

Talks

2019 - Present, Stanford University
July 15, 2020, Student Symplectic Seminar - *Cash in on the Casson Invariant*
April 29, 2020, Mathematical Physics - *Introduction to topological quantum field theory*
January 28, 2020, Mathematical Physics - *Conformal geometry with a view to understanding the cosmos*
December 2, 2019, Kiddie Colloquium - *How to cut shapes*
October 25, 2019, Student Analysis Seminar - *Using (a little bit of) entropy to classify surface geometries*
October 4, 2019, Student Symplectic Seminar - *The first Chern number*

2017 - 2019, University of Auckland
2018 - 2019, numerous talks in algebraic geometry, homological algebra, and arithmetic groups.
2017 - 2019, presentations at the department *Student Research Conference* each year.

Service and Outreach

2020 - Present, Peer mentor
Mentor incoming Stanford graduate students.

2020 - Present, Kiddie colloquium organiser

2020 - Present, Directed Reading Programme mentor
Mentor undergraduate students in reading projects.

2019, Graduate school application panel
Organised information session for undergraduates interested in pursuing further study overseas.

Referees

Professor Ciprian Manolescu
Department of Mathematics
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Professor Rod Gover
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