Angus Gruen

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I am currently pursuing a fully funded PhD in mathematics at the California Institute of Technology after having received an honours degree in pure mathematics from the Australian National University for which I was awarded the university medal. I have a keen interest in mathematics, theoretical physics and machine learning.

Education

California Institute of Technology — Pasadena, California

Doctorate of Philosophy – Mathematics — *2018 – Present*

Specialities: mathematics and theoretical physics
My work is in the field of Quantum Topology focusing on knot invariants and Chern Simons Theory.

Australian National University — Canberra, Australia

Bachelor of Philosophy (Honours) – Science — *2014 – 2017*

Received first class honours and awarded the University Medal.
My honours project was to prove and implement in GAP a formula which computed the modular data for twisted drinfeld doubles of finite groups.
Specialities: mathematics, theoretical physics and statistical machine learning.
High Distinctions achieved in every subject.

Prizes and Awards

University Medal — *2017*

Awarded to students who showed excellence in their Honours year and maintain a high level of achievement throughout their degree.

Deans Commendation List, ANU — *2015*

Awarded to students who achieved High Distinction at the level of 90% or higher in all subjects

Boyapati Computer Science & Mathematics Prize for Second Year, ANU — *2014*

Awarded to the students who achieved the highest marks in two second year mathematics and computer science courses.

Australian Physics Olympiad Team Member — *2013*

Selected as one of eight high school students to represent Australia at the 2013 Asian Physics Olympiad.

Australian Student Prize — *2013*

Awarded each year to the top 500 year 12 students in Australia.

Work Experience

Research

Applied Cryptography Engineer Intern, Polygon Zero — *2022*

In the summer of 2022 I Interned at Polygon Zero under supervision of Daniel Lubarov. My main focus was in researching methods to improve the fiiciency of zk-Starks. In particular I studied how to produce more efficient zero knowledge proofs for algorithms such as KECCAK and methods of extending the FRI protocol without compromising soundness.

Research Assistant - Data 61, Machine learning group — *2018*

Between the end of my undergraduate degree and the beginning of my PhD, I worked as a research assistant at Data 61 in the machine learning and probabilistic planning group. The end goal was to adapt the framework of Partially Observable Markov Decision Processes to a continuous input space. In my time there I implemented a Guumbel Softmax Variational Autoencoder to convert a continuous input space into a discrete latent space.

Tutoring

Teaching Assistant - Caltech *2018 – Present*

I taught Introduction to differential equations, probability and statistics, and calculus on manifolds in 2018-2019, the three semester high level undergraduate analysis stream in 2019-2020, the three semester high level undergraduate algebra stream in 2020 - 2021, Introduction to Group theory and probability and statistics in 2021 - 2022

Tutor - Physics Olympiad Program *2017 - 2018*

Tutor for 2017 and 2018 Australian Physics Olympiad training camps.

Teaching Assistant - ANU *2016 - 2018*

I taught the First year highest level mathematics course for three semesters and third year course on Galois Theory for one semester.

Papers:

Branches, quivers and ideals for knot Complements
with Tobias Ekholm, Sergei Gukov, Piotr Kucharski, Sunghyuk Park, Marko Stosic, Piotr Sulkowski
Submitted 2021, arXiv:2110.13768

$\widehat{Z}$ at large N: from curve counts to quantum modularity
with Tobias Ekholm, Sergei Gukov, Piotr Kucharski, Sunghyuk Park, Piotr Sulkowski
Submitted 2020, arXiv:2005.13349

Computing Modular Data for Pointed Fusion Categories,
with Scott Morrison
Indiana University Mathematics Journal, vol. 70, no. 2 (2021) arXiv:1808.050600

Programming:

Experienced:

Python, Mathematica, LaTex

Some Familiarity:

GAP, Julia, Haskell, Javascript, HTML

Non Academic Interests

Physical Hobbies

Edurance Running and Hiking

During my time at ANU, I competed four times in a collegiate endurance event called Inward Bound. My longest run was 80km in 2016 and I managed to win my division in 2017. More recently, I've been coaching a weekly intervals training group and am currently training to run my first triathlon and second marathon

Individual and Team Sports

Play a variety of sports including soccer, tennis and skiing.

Mental Hobbies

Games

I enjoy relaxing by playing a large variety of in person and online games such as Chess and Bridge.

Other

Enjoy reading science fiction and fantasy novels and following current affairs.