Thomas C. Fraser

November 20th, 2016
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Objective

Studying theoretical physics in the areas of quantum foundations, quantum gravity and/or condensed matter. An emphasis on computational physics and teaching is also desired.

Education

2012 – 2017 **B.Sc., Mathematical Physics, Astrophysics Specialization**
Cumulative Average: **97.79%**
University of Waterloo, Waterloo, ON

2008 – 2012 **High School Diploma**
Renfrew Collegiate Institute, Renfrew, ON

Awards & Scholarships

[Awarded by University of Waterloo]

2016 **Mike Lazaridis Scholarship**
Theoretical Physics Fellowship at Perimeter Institute

2015 **Xerox Research Centre of Canada Limited Award**
Best Work-term Report "Acoustic Modelling Using Mel-Frequency Cepstral Coefficients"

2015 **C. C. Lim Physics Prize**
Top Marks in Undergraduate Thermodynamics

2013 **Don E. Brodie Scholarship**
Highest Experimental Physics Lab Performance

2012 **A. Donald Maynes Scholarship**
Outstanding Academic Record

2012 **BMO Undergraduate Entrance Scholarship**
Outstanding Academic Average

2012 – Present **Dean's Honour List**
Academic Performance

2012 **President's Distinction Scholarship**
Entrance Average

[Awarded by Renfrew Collegiate Institute]

2012 **Governor General's Medallion**
Top Student

Research & Work Experiences

Mike Lazaridis Fellow

Perimeter Institute For Theoretical Physics. Waterloo, ON — May 2016 – September 2016

Research in quantum foundations studying quantum non-locality from the perspective of causal inference. Discovered new causal compatibility inequalities leading to a better understanding of quantum information

resources. Computationally simulated six-entangled qubits and associated measurements to find new entanglement resources. Invented new computational techniques capable of out-performing existing methods when large computational networks are required.

Research & Develop Data Scientist
SYSOMOS. TORONTO, ON — SEPTEMBER 2015 – JANUARY 2016

Industry application of varied machine learning methods. Designed algorithms to perform automatic speech recognition on digital video extracted from Twitter. Implemented advanced signal processing techniques to perform acoustic modelling. Worked with a massive parallel computing architecture to process billions of data sources. Designed and built native Android & iOS apps from scratch. Culminated in award winning paper.

Game Developer
LUNARCH STUDIOS. WATERLOO, ON — SEPTEMBER 2014 – MAY 2015

Built an highly-compatible graphics engine that supports dynamic assets loaded asynchronously. Acted as project manager to complete large-scale, internal projects. Developed a highly scalable server platform with integration between multiple software languages. Researched and implemented numerous bin-packing algorithms in order to optimize application performance.

Mathematics Tutor
HUMBER COLLEGE. TORONTO, ON — JANUARY 2014 – MAY 2014

Tutored thousands of students one-on-one in fields such as statistics, technical math, engineering, biomechanics, and business. Lead an initiative to write and produce high quality educational videos to help students with their studies. Developed a multi-platform, browser-based student sign-in system in order to collect meaningful statistics to improve effectiveness of math centre. Designed and produced graphic art to promote and develop a mathematics community.

Solar Panel Technician
OVG SOLAR, INC. RENFREW, ON — JUNE 2011 – AUGUST 2011

Industry level experience engineering, assembling and maintaining numerous solar panel arrays. Worked in a team of carpenters, electricians and skilled engineers under flexible hours across all of eastern Ontario.

ACADEMIC WORKS

Invited Talks At Conferences

NOVEMBER 2016 — Quantum Networks Conference at International Institute for Physics, Natal, Brazil
Causal Compatibility Inequalities Admitting of Quantum Violations in the Triangle Scenario

Course Notes

WINTER 2016 — *General Relativity*
tensor formalism, Lorentz transformations, Poincare group, foil theories, differential geometry, Einstein field equations, solutions to field equations, black holes & singularities, cosmology, gravitational waves and perturbation theory, lie derivatives, killing vectors, curvature

WINTER 2016 — *Statistical Mechanics*
foundations, statistics, laws of thermodynamics, heat capacities, entropy, ensemble theory, micro canonical/canonical/grand canonical, Helmholtz free energy, equipartition and virial theorems, ideal quantum gases

FALL 2016 — *Applied Probability (In progress)*
FALL 2016 — *Quantum Physics 3 (In progress)*
FALL 2016 — *Electricity & Magnetism 3 (In progress)*
FALL 2016 — *Cosmology (In progress)*

Project Papers

APRIL 2016 *Variations in Stellar Metallicity*
Thomas Fraser
The metallicity and age of a star are closely related due to the composition of material left behind parent star(s). Older stars where formed when less metal was present and are expected to have lower metallicities. Does low metallicity provided an explanation as to why we have yet to observe any population III stars?

JANUARY 2016 *Acoustic Modelling Using Mel-Frequency Cepstral Coefficients*
Thomas Fraser
A technical report detailing the effectiveness of using Mel-frequency cepstral coefficients for audio classification tasks. Numerous audio features and signal processing techniques are considered for comparison. Personal implementation achieves classification accuracies commensurate winners of international competitions.

Manuscripts in Preparation (Drafts Available Upon Request)

JANUARY 2017 *Causal Compatibility Inequalities Admitting of Quantum Violations in the Triangle Scenario*
Thomas Fraser

JANUARY 2017 *The Definite Extension Procedure for Large-Scale Marginal Satisfiability*
Thomas Fraser

Acknowledgments

SEPTEMBER 2016 *The Inflation Technique for Causal Inference with Latent Variables*
Elie Wolfe, Robert W. Spekkens, Tobias Fritz

AUGUST 2016 *Qubit Dynamics in Presence of Thermal Noise*
John Rinehart
Available upon request.

COMPUTATIONAL SKILLS

LANGUAGES	C, C++, Python, Matlab, HTML, CSS, Actionscript, JavaScript, Java, Scheme, Basic, LaTeX
METHODS	Machine Learning, Linear Programming, Graph Theory, Group Theory, PDE Solvers, Linux/Unix Systems, Distributed Systems, Android & iOS App development
CREATIVE TOOLS	Adobe Suite, AutoCAD 3D, Vector Graphics, Video editing, 3D Animation/Modeling, Graphic Design

EXTRACURRICULARS

2015 – PRESENT	Personal Mathematics Blog (tcfraser.com)
2014 – PRESENT	Software Development (github.com/tcfraser)
2016 – PRESENT	Physics Interconnected Mentor
2013 – PRESENT	Undergraduate Year Rep
2016 – PRESENT	Intramural Basketball
2007 – PRESENT	Acoustic Guitar Player
2013 – PRESENT	Elected Treasurer/Media Officer/Secretary of The UW Physics Society
2013 – 2015	Member of The Canadian Association of Physicists
2013 – PRESENT	Independent Graphic Designer
2012	Reach-for-the-Top Trivia Team
2012 – 2013	Residence Council Member
2009 – 2011	Member of Ottawa Lions Track & Field Club
2009 – 2012	High School Basketball