

# TREVOR VINCENT, PHD

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## HIGHLIGHTS

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Independent problem solver and researcher with lots of experience presenting scientific work (20+ presentations) and communicating to audiences of different expertise. Currently working on multiple novel projects in the field of machine learning and artificial intelligence.

Experienced C++, C (over 100,000 lines+ in each) and python programmer with expert-level knowledge in numerical solution techniques for partial differential equations and a broad knowledge of machine learning algorithms.

Two years of experience working with a Nobel-prize winning scientific collaboration (LIGO; ligo.org), analyzing time series data and writing simulation software.

Four years of experience working with a team of 10+ programmers developing a next-generation code for upcoming exa-scale supercomputers.

Chess master (title earned in 2008). Former Manitoba chess champion (six consecutive times) and former Canadian scholastic chess champion.

## EXPERIENCE

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### **Xanadu**

Dec. 2019 - Now

*High Performance Computing Specialist*

- Xanadu is a hardware company developing a photonic quantum computer.
- I help develop high performance C++ codes to simulate Quantum circuits.

### **Canadian Institute for Theoretical Astrophysics**

Sept. 2013 - Aug. 2019

*PhD Researcher in Computational Astrophysics*

- Developed next generation numerical methods for solving the Einstein field equations (a non-linear set of partial differential equations) on supercomputers and implemented them in a  $\sim 100,000$ -line code available on GitHub.
- Worked on a team (10+developers) to develop a task-based parallelism framework for numerical relativity called SpECTRE, available on GitHub.
- Member of the LIGO collaboration, working on extracting neutrino and matter emission properties from gravitational wave and electromagnetic counterpart signals of binary neutron star mergers.

### **University of Winnipeg**

2009-2013

*Summer Research Scientist*

- Developed a state-of-art GPU-accelerated (via CUDA) C++ code for the diffusion and collision of water molecules around randomly oriented axons in 3d brain-matter. This was coupled with a numerical solve of the Bloch partial differential equations to obtain the magnetic resonance imaging signal in realistic environments.
- Developed a Markov chain Monte Carlo code for estimating axon distribution properties from magnetic resonance imaging signals.
- Used machine learning techniques to study brain changes in mice with different Alzheimer-based gene modifications.

## EDUCATION

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**University of Toronto, Toronto, ON***Sept. 2013 - August 2019*

PhD in Physics, specializing in computational astrophysics. PhD work was funded by an NSERC CGSD scholarship (\$105,000) and a NSERC CGSM scholarship (\$30,000).

Advisor: Prof. Harald Pfeiffer

**University of Winnipeg, Winnipeg, MB***Sept 2008 - Sept 2013*

Bachelors of Science in Physics. Undergraduate work was funded by 15 scholarships. Winner of the Governor Generals Silver Medal for highest graduating GPA in the university.

**SKILLS**

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**Highly Proficient**

C++, C, MPI, CUDA, Bash, Git, CMake, Emacs, GDB, LaTeX  
Python (Pandas, Matplotlib, scikit-learn, tensorflow, keras, etc)

**Substantial Experience**

OpenCL, Matlab, Mathematica, HDF5, Paraview, Visit,  
SQL, HTML, OpenMP, TravisCI, Jenkins

**Working Knowledge**

Java, Fortran, Hadoop, Spark

## PUBLICATIONS

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Vincent, Trevor, Harald P. Pfeiffer, and Nils L. Fischer. "hp-adaptive discontinuous Galerkin solver for elliptic equations in numerical relativity." *Physical Review D* 100, no. 8 (2019): 084052. arXiv preprint arXiv:1907.01572.

Vincent, Trevor, Francois Foucart, Matthew D. Duez, Roland Haas, Lawrence E. Kidder, Harald P. Pfeiffer, and Mark A. Scheel. "Unequal Mass Binary Neutron Star Simulations with Neutrino Transport: Ejecta and Neutrino Emission." arXiv preprint arXiv:1908.00655. Submitted to *Physical Review D*. (2019).

Hinderer, Tanja, Samaya Nissanke, Francois Foucart, Kenta Hotokezaka, Trevor Vincent, Mansi Kasliwal, Patricia Schmidt et al. "Distinguishing the nature of comparable-mass neutron star binary systems with multimessenger observations: GW170817 case study." *Physical Review D* 100, no. 6 (2019): 063021. arXiv preprint arXiv:1808.03836.

Kidder, Lawrence E., Scott E. Field, Francois Foucart, Erik Schnetter, Saul A. Teukolsky, Andy Bohn, Trevor Vincent et al. "SpECTRE: A task-based discontinuous Galerkin code for relativistic astrophysics." *Journal of Computational Physics* 335 (2017): 84-114.

Mercredi, Morgan, Trevor J. Vincent, Christopher P. Bidinosti, and Melanie Martin. "Assessing the accuracy of using oscillating gradient spin echo sequences with AxCaliber to infer micron-sized axon diameters." *Magnetic Resonance Materials in Physics, Biology and Medicine* 30, no. 1 (2017): 1-14.

Hayes, Kerrie, Richard Buist, Trevor J. Vincent, Jonathan D. Thiessen, Yanbo Zhang, Handi Zhang, Junhui Wang et al. "Comparison of manual and semi-automated segmentation methods to evaluate hippocampus volume in APP and PS1 transgenic mice obtained via in vivo magnetic resonance imaging." *Journal of neuroscience methods* 221 (2014): 103-111.

Thiessen, Jonathan D., Trevor J. Vincent, Sheryl L. Herrera, and Melanie Martin. "Diffusion Tensor Metric Measurements as a Function of Diffusion Time in the Rat central nervous system." *Magnetic Resonance Insights* 5 (2012): MRI-S10692. 5:3747.

Vincent, Trevor J., Jonathan D. Thiessen, Laryssa M. Kurjewicz, Shelley L. Gernscheid, Allan J. Turner, Peter Zhilkin, Murray E. Alexander, and Melanie Martin. "Longitudinal brain size measurements in APP/PS1 transgenic mice." *Magnetic Resonance Insights* 4 (2010): MRI-S5885.

## SELECTED AWARDS

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NSERC CGSD Scholarship (\$105000)	2015
NSERC CGSM Scholarship (\$30000)	2014
Governor Generals Silver Medal	2013
CIHR Undergraduate Research Award (\$5000)	2013
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