

Trevor Vincent

PHYSICIST · PHD

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Experience

PhD Student

UNIVERSITY OF TORONTO

09/13 - Now

For my PhD, I have developed next generation numerical methods for solving the Einstein field equations (General Relativity) on supercomputers and implemented them in a self-maintained 200,000-line code available on GitHub. I've also worked on a team (10+ developers) to develop a task-based parallelism framework for numerical relativity called SpECTRE. On top of this, I was a member of the Nobel-prize winning LIGO collaboration, working on the neutrino and matter emission properties of binary neutron star mergers. This work has provided me with proficiency in C/C++, CMake, git, MPI and Python as well as working knowledge of next-generation frameworks such as Charm++.

Research Scientist

UNIVERSITY OF WINNIPEG

05/09 - 09/13

With funding from multiple NSERC and CIHR grants, I developed a pipeline for measuring axon properties via oscillating gradient diffusion MRI imaging. This work was done under the guidance of Prof. Melanie Martin, who runs a small-animal MRI lab. This work involved not only programming the MRI imaging equipment to handle oscillating magnetic fields, but writing a state-of-art GPU-accelerated (CUDA) C++ code for the diffusion and collision of water molecules around randomly oriented axons in 3d brain matter and writing a MCMC code for estimating axon distribution properties.

Education

PhD - Physics

UNIVERSITY OF TORONTO

2013 - 2019

PhD work was funded by an NSERC CGSD scholarship and a NSERC CGSM scholarship.

BSc - Mathematical Physics Honours

UNIVERSITY OF WINNIPEG

2009 - 2013

Undergraduate work was funded by 15 scholarships. Winner of the Governor General's Silver Medal for highest graduating GPA in the university.

Skills

• **HIGHLY PROFICIENT** : C/C++, PYTHON, BASH, GIT, CMAKE, EMACS, ~~TEX~~ L^AT_EX, GNU/LINUX

• **SUBSTANTIAL EXPERIENCE** : CUDA, OPENCL, MPI, MATLAB, MATHEMATICA, HDF5, PARAVIEW, VISIT

• **WORKING KNOWLEDGE** : FORTRAN, JAVA, OPENMP, CHARM++

Selected Awards

2015 NSERC CGSD Scholarship
2014 NSERC CGSM Scholarship
2013 Governor General's Silver Medal
2013 CIHR Undergraduate Research Award
2012 NSERC Undergraduate Research Award
2011 NSERC Undergraduate Research Award
2010 NSERC Undergraduate Research Award

Publications

- 2019 Vincent, Trevor, Pfeiffer, Harald. Fischer, Nils. A hp-adaptive discontinuous Galerkin solver for elliptic equations in numerical relativity. Submitted to Physical Review D. arXiv:1907.01572 [physics.comp-ph]
- 2019 Vincent, Trevor, Foucart Francois, Duez, Matthew, Kidder, Lawrence, Pfeiffer, Harald, Scheel, Mark. Unequal Mass Binary Neutron Star Simulations with M1 Neutrino Transport: Ejecta and Neutrino Emission. Being prepared for Physical Review D.
- 2018 Hinderer, T., Nissanke, S., Foucart, F., Hotokezaka, K., Vincent, T., et al. Discerning the binary neutron star or neutron star-black hole nature of GW170817 with Gravitational Wave and Electromagnetic Measurements. Physical Review D. Preprint: <https://arxiv.org/abs/1808.03836>.
- 2017 Kidder, L. E., Field, S. E., Foucart, F., Schnetter, E., Teukolsky, S. A., Bohn, A., ... Vincent, T. Spectre: a task-based discontinuous galerkin code for relativistic astrophysics. Journal of Computational Physics.
- 2016 Mercredi, M., Vincent, T. J., Bidinosti, C. P., Martin, M. (2016). 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, 1-14.
- 2014 Hayes, K., Buist, R., Vincent, T.J., Thiessen, J.D., Zhangf, Y., Zhangg, H., Wang, J., Kongh, J. , Li, X., Martin, M. Development of an In-Vivo Magnetic Resonance Imaging Method to Evaluate Hippocampus Volume in APP and PS1 Transgenic Mice. Neuroscience Methods. 221:103-111.
- 2012 *Thiessen, J.D., *Vincent, T.J., Herrera, S.L., Martin, M. Diffusion Tensor Metric Measurements as a Function of Diffusion-Time in Rat Central Nervous System. Magnetic Resonance Insights. 5:37-47. *These authors contributed equally to this paper.
- 2011 Vincent, T.J., Thiessen, J.D., Kurjewicz, L.M., Gerscheid, S.L., Turner, A.J., Zhilkin, P., Alexander, M.E., Martin, M. Longitudinal Brain size Measurements in APP/PS1 Transgenic Mice. Magnetic Resonance Insights. 4:19-26.