TREVOR VINCENT, PHD

trevorvincent.com ⋄ trevor.j.vincent@gmail.com ⋄ github: trevor-vincent

EXPERIENCE

MindKing Inc. Oct. 2022 - Now
High Performance Computing Consultant

· Providing HPC support for various software companies.

Xanadu Quantum Technologies Dec. 2019 - Nov 2022
High Performance Computing Specialist

· Lead HPC researcher/engineer for the Borealis Quantum advantage demonstration. Wrote all simulation code and ran all supercomputer simulations. Results published in Nature. Borealis is the world's first cloud accessible quantum computer with a peer-reviewed Quantum advantage claim.
· Creator, Lead Inventor (pending patent), author and developer of the task-based tensor network simulator Jet, which is available at github.com/XanaduAI/jet.
· Lead developer of the Pennylane-Lightning-Kokkos quantum simulator, which runs on multi-threaded CPUs, AMD GPUs and NVIDIA GPUs, as well as any other hardware support by the Kokkos library. Available at: github.com/PennylaneAI/pennylane-lightning-kokkos
· Creator and lead developer of the first benchmark regression analyzer software called 'Benchmark'. Benchmark pinpoints any speed/memory regressions in a software and presents its analysis through a web dashboard as well as notifying users on Slack that caused the regressions. It currently analyzes the software Pennylane live at: benchmarks.pennylane.ai
· Helped optimize C++ and python code in several Xanadu libraries: Pennylane, Pennylane-Lightning, Pennylane-Lightning-GPU and TheWalrus.

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 semi-analytical model for estimating axon distribution properties from magnetic resonance imaging signals signals.
· Used image-segmentation techniques to study brain changes in mice with different Alzheimer-based gene modifications.

EDUCATION

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 General Academic Medal for the highest graduating GPA in the university.

SELECTED AWARDS

NSERC CGSD Scholarship ($105000)	*2015*
NSERC CGSM Scholarship ($30000)	*2014*
Governor General's Academic Medal	*2013*
CIHR Undergraduate Research Award ($5000)	*2013*
NSERC Undergraduate Research Award ($5000)	*2012*
NSERC Undergraduate Research Award ($5000)	*2011*
NSERC Undergraduate Research Award ($5000)	*2010*

PUBLICATIONS

Ville Bergholm, ..., Trevor Vincent, et al. PennyLane: Automatic differentiation of hybrid quantum classical computations. Arxiv (2022). arXiv:1811.04968v4

Lars S. Madsen, Fabian Laudenbach, Mohsen Falamarzi Askarani, Fabien Rortais, Trevor Vincent, et al. Quantum computational advantage with a programmable photonic processor. Nature 606, 7581 (2022).

Trevor Vincent, Lee J. O'Riordan, Mikhail Andrenkov, Jack Brown, Nathan Killoran, Haoyu Qi, and Ish Dhand. "Jet: Fast quantum circuit simulations with parallel task-based tensor-network contraction." Published in Quantum (2022). arXiv:2107.09793v3

Abhinav Deshpande, Arthur Mehta, Trevor Vincent, Nicolas Quesada, Marcel Hinsche, Marios Ioannou, Lars Madsen et al. "Quantum Computational Supremacy via High-Dimensional Gaussian Boson Sampling." Published in Science Advances (2021). arXiv:2102.12474

Nicolas Quesada, Juan Miguel Arrazola, Trevor Vincent, Haoyu Qi, and Ral Garca-Patrn. "Quadratic speedup for simulating Gaussian boson sampling." Preprint. (2020). arXiv:2010.15595.

Trevor Vincent, 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." Physical Review D 101, no. 4 (2020): 044053. arXiv:1908.00655.

Trevor Vincent, 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:1907.01572.

Tanja Hinderer, 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:1808.03836.

Lawrence E. Kidder, 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.

Morgan Mercredi, 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.

Kerrie Hayes, 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.

Jonathan D. Thiessen, 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.

Trevor J. Vincent, Jonathan D. Thiessen, Laryssa M. Kurjewicz, Shelley L. Germscheid, 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.