

Gavin S. Hartnett

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PROFESSIONAL SUMMARY

Experienced research leader working at the intersection of quantum computing, machine learning, and computational physics. As head of Q-CTRL's Applications and Algorithms team, I direct a group of physicists developing quantum algorithms and leveraging machine learning to enhance near-term quantum computer performance. Over eight years, I have successfully led cross-functional teams, architected shared scientific computing systems, and delivered high-impact results across academia, public policy, and industry. I excel at bridging theoretical research with practical software development to ensure real-world impact in quantum computing, AI/ML applications for defense, and computational modeling.

PROFESSIONAL EXPERIENCE

Lead Scientist | Q-CTRL | Santa Monica, CA | *June 2022 - Present*

- Lead the **Applications and Algorithms Team**, driving experimental demonstrations of quantum algorithms and managing diverse portfolio from theoretical development through experimental validation
- Co-led internal **"Tiger Team"** initiative to architect unified codebase for all core error suppression technology, collaborating with engineers and researchers to create single source of truth for R&D and production deployment
- Improved **large-scale entangled state generation** using quantum error correction primitives, demonstrating computational advantages over classical approaches
- Designed and implemented **machine learning approach for quantum circuit layout selection**, optimizing performance across different hardware architectures
- Developed state-of-the-art, **GPU-accelerated photonic circuit simulation and optimization engine** for linear optical quantum computing
- Established **quantum optimization pipeline** demonstrating gate-model quantum computer superiority over quantum annealers for complex optimization problems

Information Scientist | RAND Corporation | Santa Monica, CA | *Aug. 2017 - May 2022*

- Served as **AI/ML Lead** for Tech and Narrative Lab, establishing research priorities and technical standards for AI/ML applications across defense and policy domains
- Founded and organized **company-wide AI Study Circle**, fostering cross-disciplinary collaboration across RAND's research divisions
- **Co-Principal Investigator** for generative modeling for social networks project and COVID-19 modeling using city-scale contact networks
- Researched **adversarial vulnerabilities in autonomous systems** and developed game-theoretic ML approaches for cyber defense capability assessment
- Core faculty at **Pardee RAND Graduate School**, developing and teaching AI/ML curriculum
- Led multiple high-impact reports on AI applications in defense and national security

Independent Consulting | Large Language Model Red-Teaming | Sept. 2022 - Oct. 2023

- Contracted with **Meta** to conduct red-team evaluation of their language models, identifying potential risks and failure modes
- Contracted with **OpenAI** to red-team **GPT-4** prior to public release, contributing to responsible AI deployment practices

Postdoctoral Research Fellow | University of Southampton | Southampton, UK |

Sept. 2015 - Aug. 2017

- Conducted theoretical research on black holes and quantum field theories
 - Co-organized 3 seminar series and traveled extensively to present research
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EDUCATION

PhD in Physics | University of California, Santa Barbara | 2009-2015

- **Adviser:** Prof. Gary Horowitz
- **Dissertation:** “Aspects of Black Holes in Higher Dimensions”
- **Distinction:** Dean’s Fellowship (2014), James Hartle Award for Best Graduate Student Talk (2013)

MA in Physics | University of California, Santa Barbara | 2009-2011

BS in Physics and Mathematics | Syracuse University | 2005-2009

- **Summa Cum Laude**
 - **Honors Thesis:** “Spiral Patterns in Liquid Crystals”
 - **Distinctions:** Syracuse University Scholar (highest undergraduate academic honor), Barry Goldwater Scholarship
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PUBLICATIONS

Quantum Computing

- **Achieving computational gains with quantum error correction primitives: generation of long-range entanglement enhanced by error detection** H. Liao, G.S. Hartnett, A. Kakkar, A. Tan, M. Hush, P.S. Mundada, M.J. Biercuk, Y. Baum [PRX Quantum 6, 020331 \(2025\)](#) | [arXiv:2411.14638](#)
- **Resource-efficient context-aware dynamical decoupling embedding for arbitrary large-scale quantum algorithms** P. Coote, R. Dimov, S. Maity, G.S. Hartnett, M.J. Biercuk, Y. Baum [PRX Quantum 6, 010332 \(2025\)](#) | [arXiv:2409.05962](#)
- **Quantum optimization using a 127-qubit gate-model IBM quantum computer can outperform quantum annealers for nontrivial binary optimization problems** N. Sachdeva, G.S. Hartnett, S. Maity, S. Marsh, Y. Wang, A. Winick, R. Dougherty, D. Canuto, Y.Q. Chong, M. Hush, P.S. Mundada, C.D.B. Bentley, M.J. Biercuk, Y. Baum [arXiv:2406.01743](#) | *Preprint*
- **Learning to rank quantum circuits for hardware-optimized performance enhancement** G.S. Hartnett, A. Barbosa, P.S. Mundada, M. Hush, M.J. Biercuk, Y. Baum [Quantum 8, 1542 \(2024\)](#) | [arXiv:2404.06535](#)
- **Twisty-puzzle-inspired approach to Clifford synthesis** N. Bao, G.S. Hartnett [Phys. Rev. A 109, 032409 \(2024\)](#) | [arXiv:2307.08684](#)

Machine Learning and Computational Physics

- **The hierarchical parity model** G.S. Hartnett [Physica A 617, 128679 \(2023\)](#) | [arXiv:2208.13316](#)
- **Modeling the impact of social distancing and targeted vaccination on COVID-19 spread through a real city-scale contact network** G.S. Hartnett, E. Parker, T.R. Gulden, R. Vardavas, D. Kravitz [Journal of Complex Networks 9.6, cnab042 \(2021\)](#) | [arXiv:2107.06213](#)
- **Deep generative modeling in network science with applications to public policy research** G.S. Hartnett, R. Vardavas, L. Baker, M. Chaykowsky, C.B. Gibson, F. Girosi, D.P. Kenedy, O.A. Osoba [RAND Working Paper WRA843-1](#) | [arXiv:2010.07870](#)
- **Empirical evaluation of physical adversarial patch attacks against overhead object detection models** G.S. Hartnett, L. Zhang, C. O'Connell, A.J. Lohn, J. Aguirre [arXiv:2206.12725](#)
- **The Karzas-Latter-Seiler model of a high-altitude electromagnetic pulse: a new numerical code for an old model** G.S. Hartnett [RAND Working Paper WRA879-2](#) | [arXiv:2402.14864](#)
- **Replica symmetry breaking in bipartite spin glasses and neural networks** G.S. Hartnett, E. Parker, E. Geist [Phys. Rev. E 98, 022116 \(2018\)](#) | [arXiv:1803.06442](#)
- **Adversarial examples for cost-sensitive classifiers** G.S. Hartnett, A.J. Lohn, A.P. Sedlack [NeurIPS 2019 Workshop on Safety and Robustness](#) | [arXiv:1910.02095](#)
- **Self-supervised learning of generative spin-glasses with normalizing flows** G.S. Hartnett, M. Mohseni [arXiv:2001.00585](#) | *Preprint*
- **A probability density theory for spin-glass systems** G.S. Hartnett, M. Mohseni [arXiv:2001.00927](#) | *Preprint*

Public Policy

- **Understanding the limits of artificial intelligence for warfighters: volume 2: distributional shift in cybersecurity datasets** J.J. Steier, E. Van Hegewald, A. Jacques, G.S. Hartnett, L. Menthe [RAND Report RR-A1722-2 \(2024\)](#)
- **Cybersecurity and supply chain risk management are not simply additive** V.A. Greenfield, J.W. Welburn, K. Schwindt, D. Ish, A.J. Lohn, G.S. Hartnett [RAND Report RR-A532-1 \(2023\)](#)
- **Operational feasibility of adversarial attacks against artificial intelligence** L.A. Zhang, G.S. Hartnett, J. Aguirre, A.J. Lohn, I. Khan, M. Herron, C. O'Connell [RAND Report RR-A866-1 \(2022\)](#)
- **Maintaining the competitive advantage in artificial intelligence and machine learning** R. Waltzman, L. Ablon, C. Curriden, G. Hartnett, M. Holliday, L. Ma, B. Nichiporuk, A. Scobell, D. Tarraf [RAND Report RRA200-1](#)
- **Airline security through artificial intelligence** S. McKay, G.S. Hartnett, B. Held [RAND Perspective PEA731-1](#)
- **Protecting the most vulnerable by vaccinating the most active** T.R. Gulden, G.S. Hartnett, R. Vardavas, D. Kravitz [RAND Perspective PE-A1068-1](#)

High-Energy and Gravitational Physics

- **Covariant Noether charges for type IIB and 11-dimensional supergravities** O.J.C. Dias, G.S. Hartnett, J.E. Santos [Class. Quant. Grav. 31, 015003 \(2021\)](#) | [arXiv:1912.01030](#)
 - **Holographic dual of hot Polchinski-Strassler quark-gluon plasma** I. Bena, O.J.C. Dias, G.S. Hartnett, B.E. Niehoff, J.E. Santos [JHEP 9, 33 \(2019\)](#) | [arXiv:1805.06463](#)
 - **Constraining the mass of dark photons and axion-like particles through black-hole superradiance** V. Cardoso, O.J.C. Dias, G.S. Hartnett, M. Middleton, P. Pani, J.E. Santos [JCAP 1803, 043 \(2018\)](#) | [arXiv:1801.01420](#)
 - **Mass-deformed M2 branes in Stenzel space** O.J.C. Dias, G.S. Hartnett, B.E. Niehoff, J.E. Santos [JHEP 1711, 105 \(2017\)](#) | [arXiv:1704.02323](#)
 - **Localised anti-branes in flux backgrounds** G.S. Hartnett [JHEP 1506, 007 \(2015\)](#) | [arXiv:1501.06568](#)
 - **A no black hole theorem** G.S. Hartnett, G.T. Horowitz, K. Maeda [Class. Quant. Grav. 32, 055011 \(2015\)](#) | [arXiv:1410.1875](#)
 - **Quasinormal modes of asymptotically flat rotating black holes** O.J.C. Dias, G.S. Hartnett, J.E. Santos [Class. Quant. Grav. 31, 245011 \(2014\)](#) | [arXiv:1402.7047](#)
 - **Holographic thermalization, quasinormal modes and superradiance in Kerr-AdS** V. Cardoso, O.J.C. Dias, G.S. Hartnett, L. Lehner, J.E. Santos [JHEP 1404, 183 \(2014\)](#) | [arXiv:1312.5323](#)
 - **Non-axisymmetric instability of rotating black holes in higher dimensions** G.S. Hartnett, J.E. Santos [Phys. Rev. D 88, 041505 \(2013\)](#) | [arXiv:1306.4318](#)
 - **Geons and spin-2 condensates in the AdS soliton** G.S. Hartnett, G.T. Horowitz [JHEP 1301, 010 \(2013\)](#) | [arXiv:1210.1606](#)
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TEACHING & MENTORSHIP

Core Faculty Member/Professor | Pardee RAND Graduate School | 2018-2022

- **Introduction to Modern AI** - Designed and taught graduate-level course on contemporary AI methods and applications
- **Introduction to Blockchain Technology** - Developed curriculum covering technical foundations and policy implications

Lecturer | University of Southampton | 2015-2016

- MATH1052 Differential Equations
- MATH1008 Mathematical Methods
- MATH3071 Light and Waves

Head Teaching Assistant | UC Santa Barbara | 2010-2012

- Managed team of 40+ teaching assistants across entire Physics Department
 - Coordinated TA assignments and training programs
 - Liaised between faculty and graduate student instructors
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AWARDS & RECOGNITION

Industry & Research Awards

- **2021** - RAND Spotlight Award (AI applications for TSA baggage screening)
- **2020** - RAND Bronze Medal Award (company-wide recognition for vision, integrity, and leadership)
- **2019** - RAND Spotlight Award (game-theoretic ML approach for cyber defense)
- **2019** - RAND Project Air Force Team Innovation Award (adversarial ML research)

Academic Awards

- **2014** - Dean's Fellowship, UC Santa Barbara (competitive university-wide fellowship)
- **2013** - James Hartle Award (best graduate student talk)
- **2011** - Chair's Certificate of Appreciation (outstanding service as Head TA)
- **2009** - Syracuse University Scholar (highest undergraduate academic honor)
- **2008** - Barry Goldwater Scholarship (most prestigious undergraduate science award)