

Alexey Galda

Scientific Director, Quantum Algorithms and Applications, Moderna

alexey@alexeygalda.com · alexeygalda.com · linkedin.com/in/alexeygalda

EMPLOYMENT HISTORY

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| 07/2026 – present | Scientific Director, Quantum Algorithms and Applications, Moderna <ul style="list-style-type: none">◦ Quantum algorithms and applications for mRNA drug discovery |
| 09/2023 – 07/2026 | Associate Scientific Director, Quantum Algorithms and Applications, Moderna <ul style="list-style-type: none">◦ Developed quantum algorithms for mRNA drug discovery |
| 01/2023 – 09/2023 | Senior Staff Research Scientist, Extropic <ul style="list-style-type: none">◦ Pioneered new algorithms for thermodynamic computing |
| 09/2021 – 01/2023 | Principal Scientist, Quantum Computing, Menten AI <ul style="list-style-type: none">◦ Led a team of research scientists working on a broad range of quantum computing approaches for drug discovery and small protein design, including quantum machine learning, QAOA, and quantum annealing◦ Established collaborations with industry and academia, including IBM Quantum, NVIDIA, QuEra, Alpine Quantum Technologies, and Argonne National Laboratory |
| 03/2017 – 08/2021 | Research Assistant Professor, University of Chicago <ul style="list-style-type: none">◦ Developed and studied quantum and hybrid quantum-classical algorithms and their efficient implementation on NISQ devices (IBM Quantum, IonQ, Quantinuum)◦ Developed and patented a tensor-network simulator of quantum circuits◦ Developed techniques for speed-up and symmetry-based error mitigation of QAOA |
| 03/2020 – 04/2021 | Consultant, Aliro Quantum <ul style="list-style-type: none">◦ Established and led a collaboration with IBM Quantum to pioneer qutrit algorithms◦ Performed research on quantum optimization and quantum machine learning |
| 09/2016 – 03/2017 | Research Scientist, University of Chicago <ul style="list-style-type: none">◦ Research in quantum information science and theoretical physics |
| 10/2012 – 09/2016 | Postdoctoral Research Associate, Argonne National Laboratory <ul style="list-style-type: none">◦ Research in theoretical quantum and condensed matter physics |

PROFESSIONAL EDUCATION

- Ph.D., Theoretical Physics, University of Birmingham (UK), 2008 – 2012
- B.Sc., Applied Mathematics and Physics, Moscow Institute of Physics and Technology, 2004 – 2008, *Summa cum Laude* (GPA 5.0/5.0)

HONORS AND AWARDS

- IBM Open Science Prize Winner, 2021
- IBM Pulse Access Award, 2020
- Argonne Director's Competitive Grant, 2015
- Moreton Prize, University of Birmingham 2012, 2011
- Postgraduate Teaching Assistantship, University of Birmingham, 2009
- Midlands Physics Alliance Graduate School Scholarship, UK, 2008
- Overseas Research Student Scholarship, UK, 2008
- HSP Huygens Scholarship, Netherlands, 2008 (declined)

FUNDING

Approximately \$1.4M in competitive research funding as PI or co-PI (2015–2022).

- NSF EAGER "Large Scale QAOA Quantum Simulator", co-PI, \$200k, 2020 – 2022
- NSF I-Corps (UChicago Polsky Center), PI, \$2.5k, 2020 – 2021
- NSF DMR Award "Transport, Fluctuation, and Nonequilibrium Phase Transition in Atomically Thin Crystalline Van der Waals Superconductors", with P. Kim (Harvard) and V. Vinokur (Argonne), co-PI, \$440k, 2018 – 2021
- NSF BSF Award "Non-equilibrium phase transitions in thin superconductors", with A. Frydman (Bar-Ilan University, Israel), PI, \$240k, 2019 – 2021
- Argonne Laboratory Directed R&D Grant "Theory of Out-of-Equilibrium Phase Transitions", PI, \$480k, 2015 – 2018

SERVICE

- Scientific advisor to two venture capital funds
- Reviewer for international physics and quantum computing journals (Nature group, APS, IOP, IEEE)
- Co-organizer of three international scientific conferences hosted by Argonne National Laboratory and the University of Chicago
- Co-organizer of the Workshop on Quantum Algorithms for Bio and Life Sciences, IEEE Quantum Week 2024 and 2025

PATENTS

Y. Alexeev, A. Galda, D. Lykov, Quantum simulation, US Patent 12,585,841 B2 (2026)

PROFESSIONAL MEMBERSHIPS

American Physical Society, Materials Research Society

PUBLICATIONS

41. T. Friedhoff, M. Metkar, W. Davis, V. Kumar, **A. Galda**, Pauli Correlation Encoding for mRNA Secondary Structure Prediction: Problem-Aware Decoding for Dense-Constraint QUBOs, *Accepted in 2026 IEEE QCE*, arXiv:2605.20163 (2026).
40. S.P. Sundar, P.F. Kwao, **A. Galda**, and A. Asthana, Molecular Excited States using Quantum Subspace Methods: Accuracy, Resource Reduction, and Error-Mitigated Hardware Implementation of q-sc-EOM, arXiv:2604.05380 (2026).
39. S. Shivpuje, T.P. Gujarati, R. Van, F.C. Pickard IV, T. Friedhoff, I. Liepuoniute, W. Davis, G.O. Jones, **A. Galda**, Sample-based Quantum Diagonalization Methods for Modeling the Photochemistry of Diazirine and Diazo Compounds, arXiv:2510.00484 (2026).
38. D. Alevras, M. Metkar, T. Friedhoff, J.-E. Park, M. LaDue, V. Kumar, W. Davis, **A. Galda**, Co-Optimization of Codon Usage and mRNA Secondary Structure Using Quantum Computing, 2025 IEEE QCE, 2346 (2025).
37. V. Kumar, D. Alevras, M. Metkar, E. Welling, C. Cade, I. Niesen, T. Friedhoff, J.-E. Park, S. Shivpuje, M. LaDue, W. Davis, **A. Galda**, Towards Secondary Structure Prediction of Longer mRNA Sequences Using a Quantum-Centric Optimization Scheme, 2025 IEEE QCE, 2334 (2025).
36. M. Demidik, F. Utro, **A. Galda**, K. Jansen, D. Blankenberg, L. Parida, Quantum Machine Learning Framework for Longitudinal Biomedical Studies, arXiv:2504.18392 (2025).
35. A.M. Smaldone, Y. Shee, G.W. Kyro, C. Xu, N.P. Vu, R. Dutta, M.H. Farag, **A. Galda**, S. Kumar, E. Kyoseva, V.S. Batista, Quantum Machine Learning in Drug Discovery: Applications in Academia and Pharmaceutical Industries, *Chem. Rev.* 125 (12): 5436–5460 (2025).
34. D. Alevras, M. Metkar, T. Yamamoto, V. Kumar, T. Friedhoff, J.-E. Park, M. Takeori, M. LaDue, W. Davis, and **A. Galda**, mRNA Secondary Structure Prediction Using Utility-Scale Quantum Computers, 2024 IEEE QCE, 488 (2024).
33. A. Kazmina *et al.*, Demonstration of a parity-time symmetry breaking phase transition using superconducting and trapped-ion qutrits, *Physical Review A* 109, 032619 (2024).
32. D. Herman, C. Googin, X. Liu, **A. Galda**, I. Safro, Y. Sun, M. Pistoia, Y. Alexeev, Quantum Computing for Finance, *Nature Reviews Physics* (2023).
31. **A. Galda**, E. Gupta, J. Falla, X. Liu, D. Lykov, Y. Alexeev, and I. Safro, Similarity-Based Parameter Transferability in the Quantum Approximate Optimization Algorithm, *Frontiers in Quantum Science and Technology*, 2 (2023).
30. S. Chaudhary, P. Huembeli, I. MacCormack, T.L. Patti, J. Kossaifi, **A. Galda**, Towards a scalable discrete quantum generative adversarial neural network, *Quantum Science and Technology* 8, 035002 (2023).
29. M. Pandey, T. Zaborniak, H. Melo, **A. Galda**, V.K. Mulligan, Multibody molecular docking on a quantum annealer, arXiv:2210.11401 (2022).
28. M. Chalupnik, H. Melo, Y. Alexeev, **A. Galda**, Augmenting QAOA Ansatz with Multiparameter Problem-Independent Layer, 2022 IEEE QCE, 97 (2022).
27. A. Kakkar, J. Larson, **A. Galda**, R. Shaydulin, Characterizing Error Mitigation by Symmetry Verification in QAOA, 2022 IEEE QCE, 635 (2022).
26. K. Smith, G.S. Ravi, T. Alexander, N.T. Bronn, A. Carvalho, A. Cervera-Lierta, F.T. Chong, J.M. Chow, M. Cubeddu, A. Hashim, L. Jiang, O. Lanes, M.J. Otten, D.I. Schuster, P. Gokhale, N. Earnest, **A. Galda**, Programming physical quantum systems with pulse-level control, *Frontiers in Physics* 10, 900099 (2022).
25. A. Cervera-Lierta, M. Krenn, A. Aspuru-Guzik, **A. Galda**, Experimental high-dimensional Greenberger-Horne-Zeilinger entanglement with superconducting transmon qutrits, *Physical Review Applied* 17, 024062 (2022).
24. I. MacCormack, C. Delaney, **A. Galda**, N. Aggarwal, P. Narang, *Branching Quantum Convolutional Neural Networks*, *Physical Review Research* 4, 013117 (2022).
23. T.J. Maldonado, J. Flick, S. Krastanov, **A. Galda**, Error rate reduction of single-qubit gates via noise-aware decomposition into native gates, *Nature Scientific Reports* 12, 6379 (2022).
22. I. MacCormack, **A. Galda**, A.L. Lyon, Simulating Large PEPs Tensor Networks on Small Quantum Devices, arXiv:2110.00507 (2021).
21. **A. Galda**, M. Cubeddu, N. Kanazawa, P. Narang, N. Earnest-Noble, Implementing a Ternary Decomposition of the Toffoli Gate on Fixed-Frequency Transmon Qutrits, arXiv:2109.00558 (2021).

20. **A. Galda**, X. Lin, D. Lykov, Y. Alexeev, I. Safro, Transferability of QAOA parameters between random graphs, *2021 IEEE QCE*, 171 (2021).
19. R. Shaydulin, **A. Galda**, Error Mitigation for Deep Quantum Optimization Circuits by Leveraging Problem Symmetries, *2021 IEEE QCE*, 291 (2021).
18. C. Delaney, K. P. Seshadreesan, I. MacCormack, **A. Galda**, S. Guha, P. Narang, *Demonstration of quantum advantage by a joint detection receiver for optical communications using quantum belief propagation on a trapped-ion device*, *arXiv:2102.13052* (2021).
17. Z. B. Tan, A. Laitinen, N. S. Kirsanov, **A. Galda**, M. Haque, A. Savin, D. S. Golubev, V. M. Vinokur, G. B. Lesovik, P. J. Hakonen, *Thermoelectric current in a graphene Cooper pair splitter*, *Nature Communications* 12, 138 (2021).
16. D. Lykov, R. Schutski, **A. Galda**, V. Vinokur, Y. Alexeev, *Tensor Network Quantum Simulator With Step-Dependent Parallelization*, *arXiv:2012.12430* (2020).
15. Yu. Tikhonov, S. Kondovych, J. Mangeri, M. Pavlenko, L. Baudry, A. Sené, **A. Galda**, S. Nakhmanson, O. Heinonen, A. Razumnaya, I. Luk'yanchuk & V.M. Vinokur, *Controllable skyrmion chirality in ferroelectrics*, *Nature Scientific Reports* 10, 8657 (2020).
14. X. Zhang, **A. Galda**, X. Han, D. Jin, V.M. Vinokur, *Broadband Nonreciprocity Enabled by Strong Coupling of Magnons and Microwave Photons* *Physical Review Applied* 13, 044039 (2020).
13. **A. Galda**, V.M. Vinokur, *Exceptional points in classical spin dynamics*, *Nature Scientific Reports* 9, 17484 (2019).
12. **A. Galda**, V.M. Vinokur, *Parity-time symmetry breaking in spin chains*, *Physical Review B* 97, 201411(R) (2018).
11. [Review] A.A. Varlamov, **A. Galda**, A. Glatz, *Fluctuation spectroscopy: From Rayleigh-Jeans waves to Abrikosov vortex clusters*, *Reviews of Modern Physics* 90, 015009 (2018).
10. M. Lankhorst *et al.*, *Scaling universality at the dynamic vortex Mott transition*, *Physical Review B* 97, 020504(R) (2018).
9. **A. Galda**, V.M. Vinokur, *Linear dynamics of classical spin as Möbius transformation*, *Nature Scientific Reports* 7, 1168 (2017).
8. L. Rademaker, V.M. Vinokur, **A. Galda**, *Universality and critical behavior of the dynamical Mott transition in a system with long-range interactions*, *Nature Scientific Reports* 7, 44044 (2017).
7. **A. Galda**, V.M. Vinokur, *Parity-time symmetry breaking in magnetic systems*, *Physical Review B* 94, 020408(R) (2016).
6. V. Tripathi, **A. Galda**, H. Barban, V.M. Vinokur, *Parity-time symmetry-breaking mechanism of dynamic Mott transition in dissipative systems*, *Physical Review B* 94, 041104(R) (2016).
5. Glatz, **A. Galda**, A.A. Varlamov, *Effect of fluctuations on the NMR relaxation beyond the Abrikosov vortex lattice*, *Physical Review B* 92, 054513 (2015).
4. **A. Galda**, A.S. Mel'nikov, V.M. Vinokur, *Resonant tunneling of fluctuation Cooper pairs*, *Featured in DOE's Science Highlights and Argonne's Featured Stories*, *Nature Scientific Reports* 5, 8315 (2015).
3. V. Yurkevich, **A. Galda**, O.M. Yevtushenko, Igor V. Lerner, *Duality of weak and strong scatterer in a Luttinger liquid coupled to massless bosons*, *Physical Review Letters* 110, 136405 (2013).
2. **A. Galda**, I.V. Yurkevich, Igor V. Lerner, *Effect of electron-phonon coupling on transmission through Luttinger liquid hybridized with resonant level*, *Europhysics Letters* 93, 17009 (2011).
1. **A. Galda**, I.V. Yurkevich, Igor V. Lerner, *Impurity Scattering in a Luttinger liquid with electron phonon coupling*, *Featured as Editor's Suggestion*, *Physical Review B* 83, 041106(R) (2011).