
References

- [1] Aaronson, S. (2015). Read the fine print. *Nat. Phys.*, **11**, 291–293. doi:[10.1038/nphys3272](https://doi.org/10.1038/nphys3272).
- [2] Aaronson, S. (2018). Shadow tomography of quantum states. Pages 325–338 of: *STOC*. doi:[10.1145/3188745.3188802](https://doi.org/10.1145/3188745.3188802). arXiv:[1711.01053](https://arxiv.org/abs/1711.01053).
- [3] Aaronson, S. (2021). Open problems related to quantum query complexity. *ACM Trans. Quantum Comput.*, **2**. doi:[10.1145/3488559](https://doi.org/10.1145/3488559). arXiv:[2109.06917](https://arxiv.org/abs/2109.06917).
- [4] Aaronson, S., and Gottesman, D. (2004). Improved simulation of stabilizer circuits. *Phys. Rev. A*, **70**, 052328. doi:[10.1103/PhysRevA.70.052328](https://doi.org/10.1103/PhysRevA.70.052328). arXiv:[quant-ph/0406196](https://arxiv.org/abs/quant-ph/0406196).
- [5] Aaronson, S., Chen, X., Hazan, E., et al. (2019). Online learning of quantum states. *J. Stat. Mech. Theory Exp.*, **2019**, 124019. doi:[10.1088/1742-5468/ab3988](https://doi.org/10.1088/1742-5468/ab3988). arXiv:[1802.09025](https://arxiv.org/abs/1802.09025).
- [6] Abbas, A., Ambainis, A., Augustino, B., et al. (2024). Challenges and opportunities in quantum optimization. *Nat. Rev. Phys.*, **6**, 718–735. doi:[10.1038/s42254-024-00770-9](https://doi.org/10.1038/s42254-024-00770-9). arXiv:[2312.02279](https://arxiv.org/abs/2312.02279).
- [7] Adachi, S. H., and Henderson, M. P. (2015). Application of quantum annealing to training of deep neural networks. arXiv:[1510.06356](https://arxiv.org/abs/1510.06356).
- [8] Aggarwal, D., Brennen, G., Lee, T., et al. (2018). Quantum attacks on bitcoin, and how to protect against them. *Ledger*, **3**. doi:[10.5195/ledger.2018.127](https://doi.org/10.5195/ledger.2018.127). arXiv:[1710.10377](https://arxiv.org/abs/1710.10377).
- [9] Agrawal, A. A., Wilson, T. L., Saadatmand, S., et al. (2024). Quantifying fault tolerant simulation of strongly correlated systems using the Fermi–Hubbard model. arXiv:[2406.06511](https://arxiv.org/abs/2406.06511).
- [10] Aharonov, D., and Ben-Or, M. (2008). Fault-tolerant quantum computation with constant error rate. *SIAM J. Comp.*, **38**, 1207–1282. doi:[10.1137/S0097539799359385](https://doi.org/10.1137/S0097539799359385). Earlier version in *STOC'97*. arXiv:[quant-ph/9906129](https://arxiv.org/abs/quant-ph/9906129).
- [11] Aharonov, D., and Ta-Shma, A. (2007). Adiabatic quantum state generation. *SIAM J. Comp.*, **37**, 47–82. doi:[10.1137/060648829](https://doi.org/10.1137/060648829). Earlier version in *STOC'03*. arXiv:[quant-ph/0301023](https://arxiv.org/abs/quant-ph/0301023).
- [12] Aharonov, D., Ben-Or, M., Impagliazzo, R., and Nisan, N. (1996). Limitations of noisy reversible computation. arXiv:[quant-ph/9611028](https://arxiv.org/abs/quant-ph/9611028).

- [13] Akhalwaya, I. Y., Ubaru, S., Clarkson, K. L., et al. (2022). Exponential advantage on noisy quantum computers. [arXiv:2209.09371](#).
- [14] Akhalwaya, I. Y., Connolly, A., Guichard, R., et al. (2023). A modular engine for quantum Monte Carlo integration. [arXiv:2308.06081](#).
- [15] Alagic, G., Apon, D., Cooper, D., et al. (2022). *Status report on the third round of the NIST post-quantum cryptography standardization process*. Tech. rept. [NISTIR 8413](#). National Institute of Standards and Technology, Gaithersburg, MD. doi:[10.6028/NIST.IR.8413-upd1](#).
- [16] Albash, T., and Lidar, D. A. (2018). Adiabatic quantum computation. *Rev. Mod. Phys.*, **90**, 015002. doi:[10.1103/RevModPhys.90.015002](#). [arXiv:1611.04471](#).
- [17] Albert, V. V., and Faist, P. (eds). (2024). *The error correction zoo*. <https://errorcorrectionzoo.org/>, accessed: 2024-12-01.
- [18] Alexis, M., Lin, L., Mnatsakanyan, G., et al. (2024). Infinite quantum signal processing for arbitrary Szegő functions. [arXiv:2407.05634](#).
- [19] Alexis, M., Mnatsakanyan, G., and Thiele, C. (2024). Quantum signal processing and nonlinear Fourier analysis. *Rev. Mat. Complut.*, **37**, 655–694. doi:[10.1007/s13163-024-00494-5](#). [arXiv:2310.12683](#).
- [20] Aliferis, P., Gottesman, D., and Preskill, J. (2006). Quantum accuracy threshold for concatenated distance-3 codes. *Quantum Inf. Comput.*, **6**, 97–165. doi:[10.26421/QIC6.2-1](#). [arXiv:quant-ph/0504218](#).
- [21] Aliferis, P., Gottesman, D., and Preskill, J. (2008). Accuracy threshold for postselected quantum computation. *Quantum Inf. Comput.*, **8**, 181–244. doi:[10.26421/QIC8.3-4-1](#). [arXiv:quant-ph/0703264](#).
- [22] Altaisky, M. (2001). Quantum neural network. [arXiv:quant-ph/0107012](#).
- [23] Altshuler, B., Krovi, H., and Roland, J. (2010). Anderson localization makes adiabatic quantum optimization fail. *Proc. Natl. Acad. Sci.*, **107**, 12446–12450. doi:[10.1073/pnas.1002116107](#). [arXiv:0912.0746](#).
- [24] Ambainis, A. (2004). Quantum search algorithms. *SIGACT News*, **35**, 22–35. doi:[10.1145/992287.992296](#). [arXiv:quant-ph/0504012](#).
- [25] Ambainis, A. (2007). Quantum walk algorithm for element distinctness. *SIAM J. Comp.*, **37**, 210–239. doi:[10.1137/S0097539705447311](#). Earlier version in *FOCS'04*. [arXiv:quant-ph/0311001](#).
- [26] Ambainis, A. (2012). Variable time amplitude amplification and quantum algorithms for linear algebra problems. Pages 636–647 of: *STACS*. doi:[10.4230/LIPIcs.STACS.2012.636](#). [arXiv:1010.4458](#).
- [27] Ambainis, A., and Kokainis, M. (2017). Quantum algorithm for tree size estimation, with applications to backtracking and 2-player games. Pages 989–1002 of: *STOC*. doi:[10.1145/3055399.3055444](#). [arXiv:1704.06774](#).
- [28] Ambainis, A., Balodis, K., Iraids, J., et al. (2019). Quantum speedups for exponential-time dynamic programming algorithms. Pages 1783–1793 of: *SODA*. doi:[10.1137/1.9781611975482.107](#). [arXiv:2104.14384](#).
- [29] Ambainis, A., Kokainis, M., and Vihrovs, J. (2023). Improved algorithm and lower bound for variable time quantum search. [arXiv:2302.06749](#).
- [30] Amin, M. H., Andriyash, E., Rolfe, J., et al. (2018). Quantum Boltzmann machine. *Phys. Rev. X*, **8**, 021050. doi:[10.1103/PhysRevX.8.021050](#). [arXiv:1601.02036](#).

- [31] An, D., and Lin, L. (2022). Quantum linear system solver based on time-optimal adiabatic quantum computing and quantum approximate optimization algorithm. *ACM Trans. Quantum Comput.*, **3**. doi:[10.1145/3498331](https://doi.org/10.1145/3498331). arXiv:[1909.05500](https://arxiv.org/abs/1909.05500).
- [32] An, D., and Trivisa, K. (2023). Quantum algorithms for linear and non-linear fractional reaction–diffusion equations. arXiv:[2310.18900](https://arxiv.org/abs/2310.18900).
- [33] An, D., Linden, N., Liu, J.-P., et al. (2021). Quantum-accelerated multilevel Monte Carlo methods for stochastic differential equations in mathematical finance. *Quantum*, **5**, 481. doi:[10.22331/q-2021-06-24-481](https://doi.org/10.22331/q-2021-06-24-481). arXiv:[2012.06283](https://arxiv.org/abs/2012.06283).
- [34] An, D., Fang, D., and Lin, L. (2021). Time-dependent unbounded Hamiltonian simulation with vector norm scaling. *Quantum*, **5**, 459. doi:[10.22331/q-2021-05-26-459](https://doi.org/10.22331/q-2021-05-26-459). arXiv:[2012.13105](https://arxiv.org/abs/2012.13105).
- [35] An, D., Liu, J.-P., Wang, D., and Zhao, Q. (2022). A theory of quantum differential equation solvers: Limitations and fast-forwarding. arXiv:[2211.05246](https://arxiv.org/abs/2211.05246).
- [36] An, D., Liu, J.-P., and Lin, L. (2023). Linear combination of Hamiltonian simulation for nonunitary dynamics with optimal state preparation cost. *Phys. Rev. Lett.*, **131**, 150603. doi:[10.1103/PhysRevLett.131.150603](https://doi.org/10.1103/PhysRevLett.131.150603). arXiv:[2303.01029](https://arxiv.org/abs/2303.01029).
- [37] An, D., Childs, A. M., and Lin, L. (2023). Quantum algorithm for linear non-unitary dynamics with near-optimal dependence on all parameters. arXiv:[2312.03916](https://arxiv.org/abs/2312.03916).
- [38] Andersen, E. D., and Andersen, K. D. (2000). The Mosek interior point optimizer for linear programming: An implementation of the homogeneous algorithm. Pages 197–232 of: *High Performance Optimization*. doi:[10.1007/978-1-4757-3216-0_8](https://doi.org/10.1007/978-1-4757-3216-0_8).
- [39] Anschuetz, E., Olson, J., Aspuru-Guzik, A., and Cao, Y. (2019). Variational quantum factoring. Pages 74–85 of: *Quantum Technology and Optimization Problems*. doi:[10.1007/978-3-030-14082-3_7](https://doi.org/10.1007/978-3-030-14082-3_7). arXiv:[1808.08927](https://arxiv.org/abs/1808.08927).
- [40] Anschuetz, E. R., and Cao, Y. (2019). Realizing quantum Boltzmann machines through eigenstate thermalization. arXiv:[1903.01359](https://arxiv.org/abs/1903.01359).
- [41] Anschuetz, E. R., and Kiani, B. T. (2022). Quantum variational algorithms are swamped with traps. *Nat. Commun.*, **13**, 7760. doi:[10.1038/s41467-022-35364-5](https://doi.org/10.1038/s41467-022-35364-5). arXiv:[2205.05786](https://arxiv.org/abs/2205.05786).
- [42] Anwar, H., Brown, B. J., Campbell, E. T., and Browne, D. E. (2014). Fast decoders for qudit topological codes. *New J. Phys.*, **16**, 063038. doi:[10.1088/1367-2630/16/6/063038](https://doi.org/10.1088/1367-2630/16/6/063038). arXiv:[1311.4895](https://arxiv.org/abs/1311.4895).
- [43] Aoki, H., Tsuji, N., Eckstein, M., et al. (2014). Nonequilibrium dynamical mean-field theory and its applications. *Rev. Mod. Phys.*, **86**, 779–837. doi:[10.1103/RevModPhys.86.779](https://doi.org/10.1103/RevModPhys.86.779). arXiv:[1310.5329](https://arxiv.org/abs/1310.5329).
- [44] Aoki, Y., Blum, T., Colangelo, G., et al. (2022). FLAG review 2021. *Eur. Phys. J. C*, **82**, 869. arXiv:[2111.09849](https://arxiv.org/abs/2111.09849).
- [45] van Apeldoorn, J., and Gilyén, A. (2019). Improvements in quantum SDP-solving with applications. Pages 99:1–99:15 of: *ICALP*. doi:[10.4230/LIPIcs.ICALP.2019.99](https://doi.org/10.4230/LIPIcs.ICALP.2019.99). arXiv:[1804.05058](https://arxiv.org/abs/1804.05058).
- [46] van Apeldoorn, J., and Gilyén, A. (2019). Quantum algorithms for zero-sum games. arXiv:[1904.03180](https://arxiv.org/abs/1904.03180).

- [47] van Apeldoorn, J., Gilyén, A., Gribling, S., and de Wolf, R. (2020). Convex optimization using quantum oracles. *Quantum*, **4**, 220. doi:[10.22331/q-2020-01-13-220](https://doi.org/10.22331/q-2020-01-13-220). arXiv:[1809.00643](https://arxiv.org/abs/1809.00643).
- [48] van Apeldoorn, J., Gilyén, A., Gribling, S., and de Wolf, R. (2020). Quantum SDP-solvers: Better upper and lower bounds. *Quantum*, **4**, 230. doi:[10.22331/q-2020-02-14-230](https://doi.org/10.22331/q-2020-02-14-230). Earlier version in *FOCS'17*. arXiv:[1705.01843](https://arxiv.org/abs/1705.01843).
- [49] van Apeldoorn, J., Cornelissen, A., Gilyén, A., and Nannicini, G. (2023). Quantum tomography using state-preparation unitaries. Pages 1265–1318 of: *SODA*. doi:[10.1137/1.9781611977554.ch47](https://doi.org/10.1137/1.9781611977554.ch47). arXiv:[2207.08800](https://arxiv.org/abs/2207.08800).
- [50] Apers, S., and de Wolf, R. (2020). Quantum speedup for graph sparsification, cut approximation and Laplacian solving. Pages 637–648 of: *FOCS*. doi:[10.1109/FOCS46700.2020.00065](https://doi.org/10.1109/FOCS46700.2020.00065). arXiv:[1911.07306](https://arxiv.org/abs/1911.07306).
- [51] Apers, S., and Gribling, S. (2023). Quantum speedups for linear programming via interior point methods. arXiv:[2311.03215](https://arxiv.org/abs/2311.03215).
- [52] Apers, S., Gilyén, A., and Jeffery, S. (2021). A unified framework of quantum walk search. Pages 6:1–6:13 of: *STACS*. doi:[10.4230/LIPIcs.STACS.2021.6](https://doi.org/10.4230/LIPIcs.STACS.2021.6). arXiv:[1912.04233](https://arxiv.org/abs/1912.04233).
- [53] Apers, S., Gribling, S., Sen, S., and Szabó, D. (2023). A (simple) classical algorithm for estimating Betti numbers. *Quantum*, **7**, 1202. doi:[10.22331/q-2023-12-06-1202](https://doi.org/10.22331/q-2023-12-06-1202). arXiv:[2211.09618](https://arxiv.org/abs/2211.09618).
- [54] Arad, I., and Landau, Z. (2010). Quantum computation and the evaluation of tensor networks. *SIAM J. Comp.*, **39**, 3089–3121. doi:[10.1137/080739379](https://doi.org/10.1137/080739379). arXiv:[0805.0040](https://arxiv.org/abs/0805.0040).
- [55] Argüello-Luengo, J., González-Tudela, A., Shi, T., et al. (2019). Analogue quantum chemistry simulation. *Nature*, **574**, 215–218. doi:[10.1038/s41586-019-1614-4](https://doi.org/10.1038/s41586-019-1614-4). arXiv:[1807.09228](https://arxiv.org/abs/1807.09228).
- [56] Arora, S., and Kale, S. (2007). A combinatorial, primal-dual approach to semidefinite programs. Pages 227–236 of: *STOC*. doi:[10.1145/1250790.1250823](https://doi.org/10.1145/1250790.1250823).
- [57] Arora, S., Hazan, E., and Kale, S. (2005). Fast algorithms for approximate semidefinite programming using the multiplicative weights update method. Pages 339–348 of: *FOCS*. doi:[10.1109/SFCS.2005.35](https://doi.org/10.1109/SFCS.2005.35).
- [58] Arora, S., Hazan, E., and Kale, S. (2012). The multiplicative weights update method: a meta-algorithm and applications. *Theory Comput.*, **8**, 121–164. doi:[10.4086/toc.2012.v008a006](https://doi.org/10.4086/toc.2012.v008a006).
- [59] Arovas, D. P., Berg, E., Kivelson, S. A., and Raghu, S. (2022). The Hubbard model. *Annu. Rev. Condens. Matter Phys.*, **13**, 239–274. doi:[10.1146/annurev-conmatphys-031620-102024](https://doi.org/10.1146/annurev-conmatphys-031620-102024). arXiv:[2103.12097](https://arxiv.org/abs/2103.12097).
- [60] Arrasmith, A., Holmes, Z., Cerezo, M., and Coles, P. J. (2022). Equivalence of quantum barren plateaus to cost concentration and narrow gorges. *Quantum Sci. Technol.*, **7**, 045015. doi:[10.1088/2058-9565/ac7d06](https://doi.org/10.1088/2058-9565/ac7d06). arXiv:[2104.05868](https://arxiv.org/abs/2104.05868).
- [61] Arrazola, J. M., Delgado, A., Bardhan, B. R., and Lloyd, S. (2020). Quantum-inspired algorithms in practice. *Quantum*, **4**, 307. doi:[10.22331/q-2020-08-13-307](https://doi.org/10.22331/q-2020-08-13-307). arXiv:[1905.10415](https://arxiv.org/abs/1905.10415).

- [62] Arunachalam, S., Gheorghiu, V., Jochym-O'Connor, T., et al. (2015). On the robustness of bucket brigade quantum RAM. *New J. Phys.*, **17**, 123010. doi:[10.1088/1367-2630/17/12/123010](https://doi.org/10.1088/1367-2630/17/12/123010). arXiv:[1502.03450](https://arxiv.org/abs/1502.03450).
- [63] Arute, F., Arya, K., Babbush, R., et al. (2019). Quantum supremacy using a programmable superconducting processor. *Nature*, **574**, 505–510. doi:[10.1038/s41586-019-1666-5](https://doi.org/10.1038/s41586-019-1666-5).
- [64] Arute, F., Arya, K., Babbush, R., et al. (2020). Observation of separated dynamics of charge and spin in the Fermi–Hubbard model. arXiv:[2010.07965](https://arxiv.org/abs/2010.07965).
- [65] Ashikhmin, A., Lai, C. Y., and Brun, T. A. (2020). Quantum data-syndrome codes. *IEEE J. Sel. Areas Commun.*, **38**, 449–462. doi:[10.1109/JSAC.2020.2968997](https://doi.org/10.1109/JSAC.2020.2968997). arXiv:[1907.01393](https://arxiv.org/abs/1907.01393).
- [66] Aspuru-Guzik, A., Dutoi, A. D., Love, P. J., and Head-Gordon, M. (2005). Simulated quantum computation of molecular energies. *Science*, **309**, 1704–1707. doi:[10.1126/science.1113479](https://doi.org/10.1126/science.1113479). arXiv:[0604193](https://arxiv.org/abs/0604193).
- [67] Atas, Y. Y., Zhang, J., Lewis, R., et al. (2021). SU(2) hadrons on a quantum computer via a variational approach. *Nat. Commun.*, **12**, 6499. doi:[10.1038/s41467-021-26825-4](https://doi.org/10.1038/s41467-021-26825-4). arXiv:[2102.08920](https://arxiv.org/abs/2102.08920).
- [68] Augustino, B., Terlaky, T., and Zuluaga, L. F. (2022). *An inexact-feasible quantum interior point method for second-order cone optimization*. Tech. rept. [21T-009](https://arxiv.org/abs/21T-009). Department of Industrial and Systems Engineering, Lehigh University.
- [69] Augustino, B., Leng, J., Nannicini, G., et al. (2023). A quantum central path algorithm for linear optimization. arXiv:[2311.03977](https://arxiv.org/abs/2311.03977).
- [70] Augustino, B., Nannicini, G., Terlaky, T., and Zuluaga, L. F. (2023). Quantum interior point methods for semidefinite optimization. *Quantum*, **7**, 1110. doi:[10.22331/q-2023-09-11-1110](https://doi.org/10.22331/q-2023-09-11-1110). arXiv:[2112.06025](https://arxiv.org/abs/2112.06025).
- [71] Augustino, B., Nannicini, G., Terlaky, T., and Zuluaga, L. (2023). Solving the semidefinite relaxation of QUBOs in matrix multiplication time, and faster with a quantum computer. arXiv:[2301.04237](https://arxiv.org/abs/2301.04237).
- [72] Babbush, R., McClean, J., Wecker, D., et al. (2015). Chemical basis of Trotter–Suzuki errors in quantum chemistry simulation. *Phys. Rev. A*, **91**, 022311. doi:[10.1103/PhysRevA.91.022311](https://doi.org/10.1103/PhysRevA.91.022311). arXiv:[1410.8159](https://arxiv.org/abs/1410.8159).
- [73] Babbush, R., Berry, D. W., Kivlichan, I. D., et al. (2016). Exponentially more precise quantum simulation of fermions in second quantization. *New J. Phys.*, **18**, 033032. doi:[10.1088/1367-2630/18/3/033032](https://doi.org/10.1088/1367-2630/18/3/033032). arXiv:[1506.01020](https://arxiv.org/abs/1506.01020).
- [74] Babbush, R., Berry, D. W., Sanders, Y. R., et al. (2017). Exponentially more precise quantum simulation of fermions in the configuration interaction representation. *Quantum Sci. Technol.*, **3**, 015006. doi:[10.1088/2058-9565/aa9463](https://doi.org/10.1088/2058-9565/aa9463). arXiv:[1506.01029](https://arxiv.org/abs/1506.01029).
- [75] Babbush, R., Gidney, C., Berry, D. W., et al. (2018). Encoding electronic spectra in quantum circuits with linear T complexity. *Phys. Rev. X*, **8**, 041015. doi:[10.1103/PhysRevX.8.041015](https://doi.org/10.1103/PhysRevX.8.041015). arXiv:[1805.03662](https://arxiv.org/abs/1805.03662).
- [76] Babbush, R., Wiebe, N., McClean, J., et al. (2018). Low-depth quantum simulation of materials. *Phys. Rev. X*, **8**, 011044. doi:[10.1103/PhysRevX.8.011044](https://doi.org/10.1103/PhysRevX.8.011044). arXiv:[1706.00023](https://arxiv.org/abs/1706.00023).
- [77] Babbush, R., Berry, D. W., McClean, J. R., and Neven, H. (2019). Quantum simulation of chemistry with sublinear scaling in basis size. *npj Quant. Inf.*, **5**, 92. doi:[10.1038/s41534-019-0199-y](https://doi.org/10.1038/s41534-019-0199-y). arXiv:[1807.09802](https://arxiv.org/abs/1807.09802).

- [78] Babbush, R., Berry, D. W., and Neven, H. (2019). Quantum simulation of the Sachdev–Ye–Kitaev model by asymmetric qubitization. *Phys. Rev. A*, **99**, 040301. doi:[10.1103/PhysRevA.99.040301](https://doi.org/10.1103/PhysRevA.99.040301). arXiv:[1806.02793](https://arxiv.org/abs/1806.02793).
- [79] Babbush, R., McClean, J. R., Newman, M., et al. (2021). Focus beyond quadratic speedups for error-corrected quantum advantage. *PRX Quantum*, **2**, 010103. doi:[10.1103/PRXQuantum.2.010103](https://doi.org/10.1103/PRXQuantum.2.010103). arXiv:[2011.04149](https://arxiv.org/abs/2011.04149).
- [80] Babbush, R., Berry, D. W., Kothari, R., et al. (2023). Exponential quantum speedup in simulating coupled classical oscillators. arXiv:[2303.13012](https://arxiv.org/abs/2303.13012).
- [81] Babbush, R., Huggins, W. J., Berry, D. W., et al. (2023). Quantum simulation of exact electron dynamics can be more efficient than classical mean-field methods. *Nat. Commun.*, **14**, 4058. doi:[10.1038/s41467-023-39024-0](https://doi.org/10.1038/s41467-023-39024-0). arXiv:[2301.01203](https://arxiv.org/abs/2301.01203).
- [82] Bagherimehrab, M., Sanders, Y. R., Berry, D. W., et al. (2022). Nearly optimal quantum algorithm for generating the ground state of a free quantum field theory. *PRX Quantum*, **3**, 020364. doi:[10.1103/PRXQuantum.3.020364](https://doi.org/10.1103/PRXQuantum.3.020364). arXiv:[2110.05708](https://arxiv.org/abs/2110.05708).
- [83] Bagherimehrab, M., Nakaji, K., Wiebe, N., and Aspuru-Guzik, A. (2023). Fast quantum algorithm for differential equations. arXiv:[2306.11802](https://arxiv.org/abs/2306.11802).
- [84] Baiardi, A., Stein, C. J., Barone, V., and Reiher, M. (2017). Vibrational density matrix renormalization group. *J. Chem. Theory Comput.*, **13**, 3764–3777. doi:[10.1021/acs.jctc.7b00329](https://doi.org/10.1021/acs.jctc.7b00329). arXiv:[1703.09313](https://arxiv.org/abs/1703.09313).
- [85] Baker, J. S., and Radha, S. K. (2022). Wasserstein solution quality and the quantum approximate optimization algorithm: A portfolio optimization case study. arXiv:[2202.06782](https://arxiv.org/abs/2202.06782).
- [86] Bakshi, A., and Tang, E. (2024). An improved classical singular value transformation for quantum machine learning. Pages 2398–2453 of: *SODA*. doi:[10.1137/1.9781611977912.86](https://doi.org/10.1137/1.9781611977912.86). arXiv:[2303.01492](https://arxiv.org/abs/2303.01492).
- [87] Banaszek, K., Cramer, M., and Gross, D. (2013). Focus on quantum tomography. *New J. Phys.*, **15**, 125020. doi:[10.1088/1367-2630/15/12/125020](https://doi.org/10.1088/1367-2630/15/12/125020).
- [88] Banchi, L., Pereira, J., and Pirandola, S. (2021). Generalization in quantum machine learning: A quantum information standpoint. *PRX Quantum*, **2**, 040321. doi:[10.1103/PRXQuantum.2.040321](https://doi.org/10.1103/PRXQuantum.2.040321). arXiv:[2102.08991](https://arxiv.org/abs/2102.08991).
- [89] Banegas, G., and Bernstein, D. J. (2018). Low-communication parallel quantum multi-target preimage search. Pages 325–335 of: *SAC*. ePrint:[2017/789](https://arxiv.org/abs/2017.789).
- [90] Banuls, M.-C., Pérez-García, D., Wolf, M. M., et al. (2008). Sequentially generated states for the study of two-dimensional systems. *Phys. Rev. A*, **77**, 052306. doi:[10.1103/PhysRevA.77.052306](https://doi.org/10.1103/PhysRevA.77.052306). arXiv:[0802.2472](https://arxiv.org/abs/0802.2472).
- [91] Banuls, M. C., Cichy, K., Cirac, J. I., et al. (2019). Tensor networks and their use for lattice gauge theories. Page 022 of: *LATTICE*. doi:[10.22323/1.334.0022](https://doi.org/10.22323/1.334.0022). arXiv:[1810.12838](https://arxiv.org/abs/1810.12838).
- [92] Bañuls, M. C., Blatt, R., Catani, J., et al. (2020). Simulating lattice gauge theories within quantum technologies. *Eur. Phys. J. D*, **74**, 165. doi:[10.1140/epjd/e2020-100571-8](https://doi.org/10.1140/epjd/e2020-100571-8). arXiv:[1911.00003](https://arxiv.org/abs/1911.00003).
- [93] Bao, N., Hayden, P., Salton, G., and Thomas, N. (2015). Universal quantum computation by scattering in the Fermi–Hubbard model. *New J. Phys.*, **17**, 093028. doi:[10.1088/1367-2630/17/9/093028](https://doi.org/10.1088/1367-2630/17/9/093028). arXiv:[1409.3585](https://arxiv.org/abs/1409.3585).

- [94] Barahona, F. (1982). On the computational complexity of Ising spin glass models. *J. Phys. A*, **15**, 3241–3253. doi:[10.1088/0305-4470/15/10/028](https://doi.org/10.1088/0305-4470/15/10/028).
- [95] Barker, E. (2020). *Recommendation for key management: Part 1—general*. Tech. rept. **SP 800-57 Part 1 Rev. 5**. National Institute of Standards and Technology, Gaithersburg, MD. doi:[10.6028/NIST.SP.800-57pt1r5](https://doi.org/10.6028/NIST.SP.800-57pt1r5).
- [96] Barker, E., and Dang, Q. (2015). *Recommendation for key management, part 3: Application-specific key management guidance*. Tech. rept. **SP 800-57 Part 3 Rev. 1**. National Institute of Standards and Technology, Gaithersburg, MD. doi:[10.6028/NIST.SP.800-57pt3r1](https://doi.org/10.6028/NIST.SP.800-57pt3r1).
- [97] Barmes, I., and Bosch, B. (2019). *Quantum computers and the bitcoin blockchain*. <https://deloitte.com/nl/nl/pages/innovatie/artikelen/quantum-computers-and-the-bitcoin-blockchain.html>, accessed: 2023-09-30.
- [98] Barmes, I., Bosch, B., and Verdonk, M. (2022). *Quantum risk to the Ethereum blockchain—a bump in the road or a brick wall?* <https://deloitte.com/nl/nl/pages/risk/articles/quantum-risk-to-the-ethereum-blockchain.html>, accessed: 2023-09-30.
- [99] Barone, V., Alessandrini, S., Biczysko, M., et al. (2021). Computational molecular spectroscopy. *Nat. Rev. Methods Primers*, **1**, 38. doi:[10.1038/s43586-021-00034-1](https://doi.org/10.1038/s43586-021-00034-1).
- [100] Barrett, B. R., Navratil, P., and Vary, J. P. (2013). Ab initio no core shell model. *Prog. Part. Nucl. Phys.*, **69**, 131–181. doi:[10.1016/j.ppnp.2012.10.003](https://doi.org/10.1016/j.ppnp.2012.10.003).
- [101] Bärtschi, A., Caravelli, F., Coffrin, C., et al. (2024). Potential applications of quantum computing at Los Alamos National Laboratory. arXiv:[2406.06625](https://arxiv.org/abs/2406.06625).
- [102] Bauer, B., Bravyi, S., Motta, M., and Chan, G. K.-L. (2020). Quantum algorithms for quantum chemistry and quantum materials science. *Chem. Rev.*, **120**, 12685–12717. doi:[10.1021/acs.chemrev.9b00829](https://doi.org/10.1021/acs.chemrev.9b00829). arXiv:[2001.03685](https://arxiv.org/abs/2001.03685).
- [103] Bauer, C. W., Nachman, B., and Freytsis, M. (2021). Simulating collider physics on quantum computers using effective field theories. *Phys. Rev. Lett.*, **127**, 212001. doi:[10.1103/PhysRevLett.127.212001](https://doi.org/10.1103/PhysRevLett.127.212001). arXiv:[2102.05044](https://arxiv.org/abs/2102.05044).
- [104] Bauer, C. W., Davoudi, Z., Balantekin, A. B., et al. (2023). Quantum simulation for high-energy physics. *PRX Quantum*, **4**, 027001. doi:[10.1103/PRXQuantum.4.027001](https://doi.org/10.1103/PRXQuantum.4.027001). arXiv:[2204.03381](https://arxiv.org/abs/2204.03381).
- [105] Bauer, C. W., Davoudi, Z., Klco, N., and Savage, M. J. (2023). Quantum simulation of fundamental particles and forces. *Nat. Rev. Phys.*, **5**, 420–432. doi:[10.1038/s42254-023-00599-8](https://doi.org/10.1038/s42254-023-00599-8).
- [106] Bausch, J. (2022). Fast black-box quantum state preparation. *Quantum*, **6**. doi:[10.22331/q-2022-08-04-773](https://doi.org/10.22331/q-2022-08-04-773). arXiv:[2009.10709](https://arxiv.org/abs/2009.10709).
- [107] Bausch, J., Senior, A. W., Heras, F. J. H., et al. (2023). Learning to decode the surface code with a recurrent, transformer-based neural network. arXiv:[2310.05900](https://arxiv.org/abs/2310.05900).
- [108] Beane, S., Detmold, W., Orginos, K., and Savage, M. (2011). Nuclear physics from lattice QCD. *Prog. Part. Nuc. Phys.*, **66**, 1–40. doi:[10.1016/j.ppnp.2010.08.002](https://doi.org/10.1016/j.ppnp.2010.08.002). arXiv:[1004.2935](https://arxiv.org/abs/1004.2935).

- [109] Beauregard, S. (2003). Circuit for Shor's algorithm using $2n+3$ qubits. *Quantum Inf. Comput.*, **3**, 175–185. doi:[10.26421/QIC3.2-8](https://doi.org/10.26421/QIC3.2-8). arXiv:[quant-ph/0205095](https://arxiv.org/abs/quant-ph/0205095).
- [110] Beck, D., Carlson, J., Davoudi, Z., et al. (2023). Quantum information science and technology for nuclear physics: Input into U.S. long-range planning, 2023. arXiv:[2303.00113](https://arxiv.org/abs/2303.00113).
- [111] Beckman, D., Chari, A. N., Devabhaktuni, S., and Preskill, J. (1996). Efficient networks for quantum factoring. *Phys. Rev. A*, **54**, 1034–1063. doi:[10.1103/PhysRevA.54.1034](https://doi.org/10.1103/PhysRevA.54.1034). arXiv:[quant-ph/9602016](https://arxiv.org/abs/quant-ph/9602016).
- [112] Beer, K., Bondarenko, D., Farrelly, T., et al. (2020). Training deep quantum neural networks. *Nat. Commun.*, **11**, 808. doi:[10.1038/s41467-020-14454-2](https://doi.org/10.1038/s41467-020-14454-2). arXiv:[1902.10445](https://arxiv.org/abs/1902.10445).
- [113] Bellonzi, N., Kunitsa, A., Cantin, J. T., et al. (2024). Feasibility of accelerating homogeneous catalyst discovery with fault-tolerant quantum computers. arXiv:[2406.06335](https://arxiv.org/abs/2406.06335).
- [114] Ben-Or, M., Gottesman, D., and Hassidim, A. (2013). Quantum refrigerator. arXiv:[1301.1995](https://arxiv.org/abs/1301.1995).
- [115] Bender, M., Bernard, R., Bertsch, G., et al. (2020). Future of nuclear fission theory. *J. Phys. G*, **47**, 113002. doi:[10.1088/1361-6471/abab4f](https://doi.org/10.1088/1361-6471/abab4f). arXiv:[2005.10216](https://arxiv.org/abs/2005.10216).
- [116] Benedetti, M., Realpe-Gómez, J., Biswas, R., and Perdomo-Ortiz, A. (2017). Quantum-assisted learning of hardware-embedded probabilistic graphical models. *Phys. Rev. X*, **7**, 041052. doi:[10.1103/PhysRevX.7.041052](https://doi.org/10.1103/PhysRevX.7.041052). arXiv:[1609.02542](https://arxiv.org/abs/1609.02542).
- [117] Benedetti, M., Garcia-Pintos, D., Perdomo, O., et al. (2019). A generative modeling approach for benchmarking and training shallow quantum circuits. *npj Quant. Inf.*, **5**, 1–9. doi:[10.1038/s41534-019-0157-8](https://doi.org/10.1038/s41534-019-0157-8). arXiv:[1801.07686](https://arxiv.org/abs/1801.07686).
- [118] Benedetti, M., Lloyd, E., Sack, S., and Fiorentini, M. (2019). Parameterized quantum circuits as machine learning models. *Quantum Sci. Technol.*, **4**, 043001. doi:[10.1088/2058-9565/ab4eb5](https://doi.org/10.1088/2058-9565/ab4eb5). arXiv:[1906.07682](https://arxiv.org/abs/1906.07682).
- [119] Benedetti, M., Fiorentini, M., and Lubasch, M. (2021). Hardware-efficient variational quantum algorithms for time evolution. *Phys. Rev. Res.*, **3**, 033083. doi:[10.1103/PhysRevResearch.3.033083](https://doi.org/10.1103/PhysRevResearch.3.033083). arXiv:[2009.12361](https://arxiv.org/abs/2009.12361).
- [120] Benioff, P. (1980). The computer as a physical system: A microscopic quantum mechanical Hamiltonian model of computers as represented by Turing machines. *J. Stat. Phys.*, **22**, 563–591. doi:[10.1007/BF01011339](https://doi.org/10.1007/BF01011339).
- [121] Bennett, C. H., and Brassard, G. (2014). Quantum cryptography: Public key distribution and coin tossing. *Theor. Comput. Sci.*, **560**, 7–11. doi:[10.1016/j.tcs.2014.05.025](https://doi.org/10.1016/j.tcs.2014.05.025). arXiv:[2003.06557](https://arxiv.org/abs/2003.06557).
- [122] Bennett, C. H., Bernstein, E., Brassard, G., and Vazirani, U. (1997). Strengths and weaknesses of quantum computing. *SIAM J. Comp.*, **26**, 1510–1523. doi:[10.1137/S0097539796300933](https://doi.org/10.1137/S0097539796300933). arXiv:[quant-ph/9701001](https://arxiv.org/abs/quant-ph/9701001).
- [123] Bergholm, V., Izaac, J., Schuld, M., et al. (2018). PennyLane: Automatic differentiation of hybrid quantum-classical computations. arXiv:[1811.04968](https://arxiv.org/abs/1811.04968). <https://pennylane.ai/codebook>, accessed: 2024-12-01.

- [124] van den Berg, E., and Temme, K. (2020). Circuit optimization of Hamiltonian simulation by simultaneous diagonalization of Pauli clusters. *Quantum*, **4**, 322. doi:[10.22331/q-2020-09-12-322](https://doi.org/10.22331/q-2020-09-12-322). arXiv:[2003.13599](https://arxiv.org/abs/2003.13599).
- [125] Bermudez, A., Xu, X., Nigmatullin, R., et al. (2017). Assessing the progress of trapped-ion processors towards fault-tolerant quantum computation. *Phys. Rev. X*, **7**, 041061. doi:[10.1103/physrevx.7.041061](https://doi.org/10.1103/physrevx.7.041061). arXiv:[1705.02771](https://arxiv.org/abs/1705.02771).
- [126] Bernstein, D. J., and Lange, T. (2017). Post-quantum cryptography. *Nature*, **549**, 188–194. doi:[10.1038/nature23461](https://doi.org/10.1038/nature23461). ePrint:[2017/314](https://arxiv.org/abs/2017/314).
- [127] Bernstein, D. J., Engels, S., Lange, T., et al. (2016). Faster elliptic-curve discrete logarithms on FPGAs. ePrint:[2016/382](https://arxiv.org/abs/2016/382).
- [128] Bernstein, D. J., Biasse, J.-F., and Mosca, M. (2017). A low-resource quantum factoring algorithm. Pages 330–346 of: *PQCrypto*. doi:[10.1007/978-3-319-59879-6_19](https://doi.org/10.1007/978-3-319-59879-6_19). ePrint:[2017/352](https://arxiv.org/abs/2017/352).
- [129] Bernstein, E., and Vazirani, U. (1997). Quantum complexity theory. *SIAM J. Comp.*, **26**, 1411–1473. doi:[10.1137/S0097539796300921](https://doi.org/10.1137/S0097539796300921). Earlier version in *STOC'93*.
- [130] Berntson, B. K., and Sünderhauf, C. (2024). Complementary polynomials in quantum signal processing. arXiv:[2406.04246](https://arxiv.org/abs/2406.04246).
- [131] Berry, D. W. (2014). High-order quantum algorithm for solving linear differential equations. *J. Phys. A*, **47**, 105301. doi:[10.1088/1751-8113/47/10/105301](https://doi.org/10.1088/1751-8113/47/10/105301).
- [132] Berry, D. W., and C. S. Costa, P. (2024). Quantum algorithm for time-dependent differential equations using Dyson series. *Quantum*, **8**, 1369. doi:[10.22331/q-2024-06-13-1369](https://doi.org/10.22331/q-2024-06-13-1369). arXiv:[2212.03544](https://arxiv.org/abs/2212.03544).
- [133] Berry, D. W., and Childs, A. M. (2012). Black-box Hamiltonian simulation and unitary implementation. *Quantum Inf. Comput.*, **12**, 29–62. doi:[10.26421/QIC12.1-2](https://doi.org/10.26421/QIC12.1-2). arXiv:[0910.4157](https://arxiv.org/abs/0910.4157).
- [134] Berry, D. W., Ahokas, G., Cleve, R., and Sanders, B. C. (2007). Efficient quantum algorithms for simulating sparse Hamiltonians. *Commun. Math. Phys.*, **270**, 359–371. doi:[10.1007/s00220-006-0150-x](https://doi.org/10.1007/s00220-006-0150-x). arXiv:[quant-ph/0508139](https://arxiv.org/abs/quant-ph/0508139).
- [135] Berry, D. W., Childs, A. M., Cleve, R., et al. (2014). Exponential improvement in precision for simulating sparse Hamiltonians. Pages 283–292 of: *STOC*. doi:[10.1145/2591796.2591854](https://doi.org/10.1145/2591796.2591854). arXiv:[1312.1414](https://arxiv.org/abs/1312.1414).
- [136] Berry, D. W., Childs, A. M., and Kothari, R. (2015). Hamiltonian simulation with nearly optimal dependence on all parameters. Pages 792–809 of: *FOCS*. doi:[10.1109/FOCS.2015.54](https://doi.org/10.1109/FOCS.2015.54). arXiv:[1501.01715](https://arxiv.org/abs/1501.01715).
- [137] Berry, D. W., Childs, A. M., Cleve, R., et al. (2015). Simulating Hamiltonian dynamics with a truncated Taylor series. *Phys. Rev. Lett.*, **114**, 090502. doi:[10.1103/PhysRevLett.114.090502](https://doi.org/10.1103/PhysRevLett.114.090502). arXiv:[1412.4687](https://arxiv.org/abs/1412.4687).
- [138] Berry, D. W., Childs, A. M., Ostrander, A., and Wang, G. (2017). Quantum algorithm for linear differential equations with exponentially improved dependence on precision. *Commun. Math. Phys.*, **356**, 1057–1081. doi:[10.1007/s00220-017-3002-y](https://doi.org/10.1007/s00220-017-3002-y). arXiv:[1701.03684](https://arxiv.org/abs/1701.03684).
- [139] Berry, D. W., Kieferová, M., Scherer, A., et al. (2018). Improved techniques for preparing eigenstates of fermionic Hamiltonians. *npj Quant. Inf.*, **4**, 22. doi:[10.1038/s41534-018-0071-5](https://doi.org/10.1038/s41534-018-0071-5). arXiv:[1711.10460](https://arxiv.org/abs/1711.10460).

- [140] Berry, D. W., Gidney, C., Motta, M., et al. (2019). Qubitization of arbitrary basis quantum chemistry leveraging sparsity and low rank factorization. *Quantum*, **3**, 208. doi:[10.22331/q-2019-12-02-208](https://doi.org/10.22331/q-2019-12-02-208). arXiv:[1902.02134](https://arxiv.org/abs/1902.02134).
- [141] Berry, D. W., Childs, A. M., Su, Y., et al. (2020). Time-dependent Hamiltonian simulation with L^1 -norm scaling. *Quantum*, **4**, 254. doi:[10.22331/q-2020-04-20-254](https://doi.org/10.22331/q-2020-04-20-254). arXiv:[1906.07115](https://arxiv.org/abs/1906.07115).
- [142] Berry, D. W., Rubin, N. C., Elnabawy, A. O., et al. (2023). Quantum simulation of realistic materials in first quantization using non-local pseudopotentials. arXiv:[2312.07654](https://arxiv.org/abs/2312.07654).
- [143] Berry, D. W., Su, Y., Gyurik, C., et al. (2024). Analyzing prospects for quantum advantage in topological data analysis. *PRX Quantum*, **5**, 010319. doi:[10.1103/PRXQuantum.5.010319](https://doi.org/10.1103/PRXQuantum.5.010319). arXiv:[2209.13581](https://arxiv.org/abs/2209.13581).
- [144] Berry, D. W., Tong, Y., Khattar, T., et al. (2024). Rapid initial state preparation for the quantum simulation of strongly correlated molecules. arXiv:[2409.11748](https://arxiv.org/abs/2409.11748).
- [145] Beullens, W. (2022). Breaking rainbow takes a weekend on a laptop. Pages 464–479 of: *CRYPTO*. doi:[10.1007/978-3-031-15979-4_16](https://doi.org/10.1007/978-3-031-15979-4_16). ePrint:[2022/214](https://arxiv.org/abs/2022.214).
- [146] Beverland, M. E., Kubica, A., and Svore, K. M. (2021). Cost of universality: A comparative study of the overhead of state distillation and code switching with color codes. *PRX Quantum*, **2**, 020341. doi:[10.1103/PRXQuantum.2.020341](https://doi.org/10.1103/PRXQuantum.2.020341). arXiv:[2101.02211](https://arxiv.org/abs/2101.02211).
- [147] Beverland, M. E., Murali, P., Troyer, M., et al. (2022). Assessing requirements to scale to practical quantum advantage. arXiv:[2211.07629](https://arxiv.org/abs/2211.07629).
- [148] Bharti, K., Cervera-Lierta, A., Kyaw, T. H., et al. (2022). Noisy intermediate-scale quantum algorithms. *Rev. Mod. Phys.*, **94**, 015004. doi:[10.1103/RevModPhys.94.015004](https://doi.org/10.1103/RevModPhys.94.015004). arXiv:[2101.08448](https://arxiv.org/abs/2101.08448).
- [149] Bhaskar, M. K., Hadfield, S., Papageorgiou, A., and Petras, I. (2016). Quantum algorithms and circuits for scientific computing. *Quantum Inf. Comput.*, **16**. doi:[10.26421/QIC16.3-4-2](https://doi.org/10.26421/QIC16.3-4-2). arXiv:[1511.08253](https://arxiv.org/abs/1511.08253).
- [150] Biamonte, J., and Bergholm, V. (2017). Tensor networks in a nutshell. arXiv:[1708.00006](https://arxiv.org/abs/1708.00006).
- [151] Biamonte, J., Wittek, P., Pancotti, N., et al. (2017). Quantum machine learning. *Nature*, **549**, 195–202. doi:[10.1038/nature23474](https://doi.org/10.1038/nature23474). arXiv:[1611.09347](https://arxiv.org/abs/1611.09347).
- [152] Bilgin, E., and Boixo, S. (2010). Preparing thermal states of quantum systems by dimension reduction. *Phys. Rev. Lett.*, **105**, 170405. doi:[10.1103/PhysRevLett.105.170405](https://doi.org/10.1103/PhysRevLett.105.170405). arXiv:[1008.4162](https://arxiv.org/abs/1008.4162).
- [153] Binder, S., Ekström, A., Hagen, G., et al. (2016). Effective field theory in the harmonic oscillator basis. *Phys. Rev. C*, **93**, 044332. doi:[10.1103/PhysRevC.93.044332](https://doi.org/10.1103/PhysRevC.93.044332). arXiv:[1512.03802](https://arxiv.org/abs/1512.03802).
- [154] Bittel, L., and Kliesch, M. (2021). Training variational quantum algorithms is NP-hard. *Phys. Rev. Lett.*, **127**, 120502. doi:[10.1103/PhysRevLett.127.120502](https://doi.org/10.1103/PhysRevLett.127.120502). arXiv:[2101.07267](https://arxiv.org/abs/2101.07267).
- [155] Blais, A., Grimsmo, A. L., Girvin, S. M., and Wallraff, A. (2021). Circuit quantum electrodynamics. *Rev. Mod. Phys.*, **93**, 025005. doi:[10.1103/RevModPhys.93.025005](https://doi.org/10.1103/RevModPhys.93.025005). arXiv:[2005.12667](https://arxiv.org/abs/2005.12667).

- [156] Blanchet, J., Szegedy, M., and Wang, G. (2024). Quadratic speed-up in infinite variance quantum Monte Carlo. [arXiv:2401.07497](#).
- [157] Bloch, I., Dalibard, J., and Nascimbène, S. (2012). Quantum simulations with ultracold quantum gases. *Nat. Phys.*, **8**, 267–276. doi:[10.1038/nphys2259](#).
- [158] Blunt, N. S., Camps, J., Crawford, O., et al. (2022). Perspective on the current state-of-the-art of quantum computing for drug discovery applications. *J. Chem. Theory Comput.*, **18**, 7001–7023. doi:[10.1021/acs.jctc.2c00574](#). [arXiv:2206.00551](#).
- [159] Blunt, N. S., Caune, L., Izsák, R., et al. (2023). Statistical phase estimation and error mitigation on a superconducting quantum processor. *PRX Quantum*, **4**, 040341. doi:[10.1103/PRXQuantum.4.040341](#). [arXiv:2304.05126](#).
- [160] Bogdanov, A., Khovratovich, D., and Rechberger, C. (2011). Biclique cryptanalysis of the full AES. Pages 344–371 of: *ASIACRYPT*. doi:[10.1007/978-3-642-25385-0_19](#). ePrint:[2011/449](#).
- [161] Boixo, S., and Somma, R. D. (2010). Necessary condition for the quantum adiabatic approximation. *Phys. Rev. A*, **81**, 032308. doi:[10.1103/PhysRevA.81.032308](#). [arXiv:0911.1362](#).
- [162] Boixo, S., Knill, E., and Somma, R. D. (2010). Fast quantum algorithms for traversing paths of eigenstates. [arXiv:1005.3034](#).
- [163] Bolte, J., Boustany, R., Pauwels, E., and Pesquet-Popescu, B. (2022). Non-smooth automatic differentiation: A cheap gradient principle and other complexity results. [arXiv:2206.01730](#).
- [164] Bolusani, S., Besançon, M., Bestuzheva, K., et al. (2024). The SCIP optimization suite 9.0. [arXiv:2402.17702](#).
- [165] Bombín, H. (2015). Gauge color codes: Optimal transversal gates and gauge fixing in topological stabilizer codes. *New J. Phys.*, **17**, 083002. doi:[10.1088/1367-2630/17/8/083002](#). [arXiv:1311.0879](#).
- [166] Bombín, H. (2015). Single-shot fault-tolerant quantum error correction. *Phys. Rev. X*, **5**, 031043. doi:[10.1103/physrevx.5.031043](#). [arXiv:1404.5504](#).
- [167] Bombín, H. (2018). 2D quantum computation with 3D topological codes. [arXiv:1810.09571](#).
- [168] Bombín, H., and Martin-Delgado, M. (2007). Exact topological quantum order in $d = 3$ and beyond: Branyons and brane-net condensates. *Phys. Rev. B*, **75**, 075103. doi:[10.1103/PhysRevB.75.075103](#). [arXiv:cond-mat/0607736](#).
- [169] Bombín, H., and Martin-Delgado, M. A. (2006). Topological quantum distillation. *Phys. Rev. Lett.*, **97**, 180501. doi:[10.1103/PhysRevLett.97.180501](#). [arXiv:quant-ph/0605138](#).
- [170] Bombín, H., Dawson, C., Liu, Y.-H., et al. (2023). Modular decoding: Parallelizable real-time decoding for quantum computers. [arXiv:2303.04846](#).
- [171] Bombín, H. G. D.-C., and Poulin, D. (2012). Universal topological phase of two-dimensional stabilizer codes. *New J. Phys.*, **14**, 073048. doi:[10.1088/1367-2630/14/7/073048](#). [arXiv:1103.4606](#).
- [172] Bonfà, P., Frassinetti, J., Isah, M. M., et al. (2021). UNDI: An open-source library to simulate muon-nuclear interactions in solids. *Comput. Phys. Commun.*, **260**, 107719. doi:[10.1016/j.cpc.2020.107719](#).

- [173] Bonilla Ataides, J. P., Tuckett, D. K., Bartlett, S. D., et al. (2021). The XZZX surface code. *Nat. Commun.*, **12**, 2172. doi:[10.1038/s41467-021-22274-1](https://doi.org/10.1038/s41467-021-22274-1). arXiv:[2009.07851](https://arxiv.org/abs/2009.07851).
- [174] Bosse, J. L., and Montanaro, A. (2022). Probing ground-state properties of the kagome antiferromagnetic Heisenberg model using the variational quantum eigensolver. *Phys. Rev. B*, **105**, 094409. doi:[10.1103/PhysRevB.105.094409](https://doi.org/10.1103/PhysRevB.105.094409). arXiv:[2108.08086](https://arxiv.org/abs/2108.08086).
- [175] Boudot, F., Gaudry, P., Guillevis, A., et al. (2020). Comparing the difficulty of factorization and discrete logarithm: A 240-digit experiment. Pages 62–91 of: *CRYPTO*. doi:[10.1007/978-3-030-56880-1_3](https://doi.org/10.1007/978-3-030-56880-1_3). arXiv:[2006.06197](https://arxiv.org/abs/2006.06197).
- [176] Bouland, A., van Dam, W., Joorati, H., et al. (2020). Prospects and challenges of quantum finance. arXiv:[2011.06492](https://arxiv.org/abs/2011.06492).
- [177] Bouland, A., Dandapani, A., and Prakash, A. (2023). A quantum spectral method for simulating stochastic processes, with applications to Monte Carlo. arXiv:[2303.06719](https://arxiv.org/abs/2303.06719).
- [178] Bouland, A., Getachew, Y. M., Jin, Y., et al. (2023). Quantum speedups for zero-sum games via improved dynamic Gibbs sampling. Pages 2932–2952 of: *ICML*. arXiv:[2301.03763](https://arxiv.org/abs/2301.03763).
- [179] Boulebnane, S., and Montanaro, A. (2024). Solving Boolean satisfiability problems with the quantum approximate optimization algorithm. *PRX Quantum*, **5**, 030348. doi:[10.1103/PRXQuantum.5.030348](https://doi.org/10.1103/PRXQuantum.5.030348). arXiv:[2208.06909](https://arxiv.org/abs/2208.06909).
- [180] Boyd, S., and Vandenberghe, L. (2004). *Convex optimization*. Cambridge University Press. doi:[10.1017/CB09780511804441](https://doi.org/10.1017/CB09780511804441).
- [181] Brandão, F. G. S. L., and Svore, K. M. (2017). Quantum speed-ups for solving semidefinite programs. Pages 415–426 of: *FOCS*. doi:[10.1109/FOCS.2017.45](https://doi.org/10.1109/FOCS.2017.45). arXiv:[1609.05537](https://arxiv.org/abs/1609.05537).
- [182] Brandão, F. G. S. L., Kaveh, A., Li, T., et al. (2019). Quantum SDP solvers: Large speed-ups, optimality, and applications to quantum learning. Pages 27:1–27:14 of: *ICALP*. doi:[10.4230/LIPIcs.ICALP.2019.27](https://doi.org/10.4230/LIPIcs.ICALP.2019.27). arXiv:[1710.02581](https://arxiv.org/abs/1710.02581).
- [183] Brandão, F. G. S. L., Kueng, R., and França, D. S. (2022). Faster quantum and classical SDP approximations for quadratic binary optimization. *Quantum*, **6**, 625. doi:[10.22331/q-2022-01-20-625](https://doi.org/10.22331/q-2022-01-20-625). arXiv:[1909.04613](https://arxiv.org/abs/1909.04613).
- [184] Brandhofer, S., Braun, D., Dehn, V., et al. (2023). Benchmarking the performance of portfolio optimization with QAOA. *Quantum Inf. Process.*, **22**, 1–27. doi:[10.1007/s11128-022-03766-5](https://doi.org/10.1007/s11128-022-03766-5). arXiv:[2207.10555](https://arxiv.org/abs/2207.10555).
- [185] van den Brand, J., Lee, Y. T., Sidford, A., and Song, Z. (2020). Solving tall dense linear programs in nearly linear time. Pages 775–788 of: *STOC*. doi:[10.1145/3357713.3384309](https://doi.org/10.1145/3357713.3384309). arXiv:[2002.02304](https://arxiv.org/abs/2002.02304).
- [186] Brassard, G., Høyer, P., Mosca, M., and Tapp, A. (2002). Quantum amplitude amplification and estimation. Pages 53–74 of: *Quantum computation and quantum information: A millennium volume*, vol. 305. doi:[10.1090/conm/305/05215](https://doi.org/10.1090/conm/305/05215). arXiv:[quant-ph/0005055](https://arxiv.org/abs/quant-ph/0005055).
- [187] Bravo-Prieto, C., LaRose, R., Cerezo, M., et al. (2019). Variational quantum linear solver. arXiv:[1909.05820](https://arxiv.org/abs/1909.05820).

- [188] Bravyi, S. (2015). Monte Carlo simulation of stoquastic Hamiltonians. *Quantum Inf. Comput.*, **15**, 1122–1140. doi:[10.26421/QIC15.13-14-3](https://doi.org/10.26421/QIC15.13-14-3). arXiv:[1402.2295](https://arxiv.org/abs/1402.2295).
- [189] Bravyi, S., and Cross, A. (2015). Doubled color codes. arXiv:[1509.03239](https://arxiv.org/abs/1509.03239).
- [190] Bravyi, S., and Kitaev, A. (2005). Universal quantum computation with ideal Clifford gates and noisy ancillas. *Phys. Rev. A*, **71**, 022316. doi:[10.1103/physreva.71.022316](https://doi.org/10.1103/physreva.71.022316). arXiv:[quant-ph/0403025](https://arxiv.org/abs/quant-ph/0403025).
- [191] Bravyi, S., and Terhal, B. (2010). Complexity of stoquastic frustration-free Hamiltonians. *SIAM J. Comp.*, **39**, 1462–1485. doi:[10.1137/08072689X](https://doi.org/10.1137/08072689X). arXiv:[0806.1746](https://arxiv.org/abs/0806.1746).
- [192] Bravyi, S., Suchara, M., and Vargo, A. (2014). Efficient algorithms for maximum likelihood decoding in the surface code. *Phys. Rev. A*, **90**, 032326. doi:[10.1103/PhysRevA.90.032326](https://doi.org/10.1103/PhysRevA.90.032326). arXiv:[1405.4883](https://arxiv.org/abs/1405.4883).
- [193] Bravyi, S., Englbrecht, M., König, R., and Peard, N. (2018). Correcting coherent errors with surface codes. *npj Quant. Inf.*, **4**. doi:[10.1038/s41534-018-0106-y](https://doi.org/10.1038/s41534-018-0106-y).
- [194] Bravyi, S., Kliesch, A., Koenig, R., and Tang, E. (2020). Obstacles to variational quantum optimization from symmetry protection. *Phys. Rev. Lett.*, **125**, 260505. doi:[10.1103/PhysRevLett.125.260505](https://doi.org/10.1103/PhysRevLett.125.260505). arXiv:[1910.08980](https://arxiv.org/abs/1910.08980).
- [195] Bravyi, S., Chowdhury, A., Gosset, D., and Wocjan, P. (2022). Quantum Hamiltonian complexity in thermal equilibrium. *Nat. Phys.*, **18**, 1367–1370. doi:[10.1038/s41567-022-01742-5](https://doi.org/10.1038/s41567-022-01742-5). arXiv:[2110.15466](https://arxiv.org/abs/2110.15466).
- [196] Bravyi, S. B., and Kitaev, A. Y. (1998). Quantum codes on a lattice with boundary. arXiv:[quant-ph/9811052](https://arxiv.org/abs/quant-ph/9811052).
- [197] Bravyi, S. B., and Kitaev, A. Y. (2002). Fermionic quantum computation. *Ann. Phys.*, **298**, 210–226. doi:[10.1006/aphy.2002.6254](https://doi.org/10.1006/aphy.2002.6254). arXiv:[quant-ph/0003137](https://arxiv.org/abs/quant-ph/0003137).
- [198] Brenner, S. C., and Scott, L. R. (2008). *The mathematical theory of finite element methods*. Springer. doi:[10.1007/978-0-387-75934-0](https://doi.org/10.1007/978-0-387-75934-0).
- [199] Breuckmann, N. P., and Eberhardt, J. N. (2021). Balanced product quantum codes. *IEEE Trans. Inf. Theory*, **67**, 6653–6674. doi:[10.1109/tit.2021.3097347](https://doi.org/10.1109/tit.2021.3097347). arXiv:[2012.09271](https://arxiv.org/abs/2012.09271).
- [200] Breuckmann, N. P., Duivenvoorden, K., Michels, D., and Terhal, B. M. (2017). Local decoders for the 2D and 4D toric code. *Quantum Inf. Comput.*, **17**, 0181. doi:[10.26421/QIC17.3-4-1](https://doi.org/10.26421/QIC17.3-4-1). arXiv:[1609.00510](https://arxiv.org/abs/1609.00510).
- [201] Bridgeman, J. C., and Chubb, C. T. (2017). Hand-waving and interpretive dance: An introductory course on tensor networks. *J. Phys. A*, **50**, 223001. doi:[10.1088/1751-8121/aa6dc3](https://doi.org/10.1088/1751-8121/aa6dc3). arXiv:[1603.03039](https://arxiv.org/abs/1603.03039).
- [202] Bridgeman, J. C., Kubica, A., and Vasmer, M. (2024). Lifting topological codes: Three-dimensional subsystem codes from two-dimensional anyon models. *PRX Quantum*, **5**. doi:[10.1103/prxquantum.5.020310](https://doi.org/10.1103/prxquantum.5.020310). arXiv:[2305.06365](https://arxiv.org/abs/2305.06365).
- [203] Browaeys, A., and Lahaye, T. (2020). Many-body physics with individually controlled Rydberg atoms. *Nat. Phys.*, **16**, 132–142. doi:[10.1038/s41567-019-0733-z](https://doi.org/10.1038/s41567-019-0733-z). arXiv:[2002.07413](https://arxiv.org/abs/2002.07413).

- [204] Brown, A. R., Gharibyan, H., Leichenauer, S., et al. (2023). Quantum gravity in the lab. I. Teleportation by size and traversable wormholes. *PRX Quantum*, **4**, 010320. doi:[10.1103/PRXQuantum.4.010320](https://doi.org/10.1103/PRXQuantum.4.010320). arXiv:[1911.06314](https://arxiv.org/abs/1911.06314).
- [205] Brown, B. J. (2023). Conservation laws and quantum error correction: Towards a generalised matching decoder. *IEEE BITS Inf. Theory Mag.*, 1–12. doi:[10.1109/MBITS.2023.3246025](https://doi.org/10.1109/MBITS.2023.3246025). arXiv:[2207.06428](https://arxiv.org/abs/2207.06428).
- [206] Brown, B. J., Laubscher, K., Kesselring, M. S., and Wootton, J. R. (2017). Poking holes and cutting corners to achieve Clifford gates with the surface code. *Phys. Rev. X*, **7**, 021029. doi:[10.1103/PhysRevX.7.021029](https://doi.org/10.1103/PhysRevX.7.021029). arXiv:[1609.04673](https://arxiv.org/abs/1609.04673).
- [207] Brüstle, N., and Wiebe, N. (2024). Quantum and classical algorithms for non-linear unitary dynamics. arXiv:[2407.07685](https://arxiv.org/abs/2407.07685).
- [208] Bruzewicz, C. D., Chiaverini, J., McConnell, R., and Sage, J. M. (2019). Trapped-ion quantum computing: Progress and challenges. *Appl. Phys. Rev.*, **6**, 021314. doi:[10.1063/1.5088164](https://doi.org/10.1063/1.5088164). arXiv:[1904.04178](https://arxiv.org/abs/1904.04178).
- [209] Bădescu, C., and O'Donnell, R. (2021). Improved quantum data analysis. Pages 1398–1411 of: *STOC*. doi:[10.1145/3406325.3451109](https://doi.org/10.1145/3406325.3451109). arXiv:[2011.10908](https://arxiv.org/abs/2011.10908).
- [210] Buhrman, H., Patro, S., and Speelman, F. (2021). A framework of quantum strong exponential-time hypotheses. Pages 19:1–19:19 of: *STACS*, vol. 187. doi:[10.4230/LIPIcs.STACS.2021.19](https://doi.org/10.4230/LIPIcs.STACS.2021.19). arXiv:[1911.05686](https://arxiv.org/abs/1911.05686).
- [211] Bürgisser, P., Franks, C., Garg, A., et al. (2018). Efficient algorithms for tensor scaling, quantum marginals, and moment polytopes. Pages 883–897 of: *FOCS*. doi:[10.1109/FOCS.2018.00088](https://doi.org/10.1109/FOCS.2018.00088). arXiv:[1804.04739](https://arxiv.org/abs/1804.04739).
- [212] von Burg, V., Low, G. H., Häner, T., et al. (2021). Quantum computing enhanced computational catalysis. *Phys. Rev. Res.*, **3**, 033055. doi:[10.1103/PhysRevResearch.3.033055](https://doi.org/10.1103/PhysRevResearch.3.033055). arXiv:[2007.14460](https://arxiv.org/abs/2007.14460).
- [213] Byrnes, T., and Yamamoto, Y. (2006). Simulating lattice gauge theories on a quantum computer. *Phys. Rev. A*, **73**, 022328. doi:[10.1103/PhysRevA.73.022328](https://doi.org/10.1103/PhysRevA.73.022328). arXiv:[quant-ph/0510027](https://arxiv.org/abs/quant-ph/0510027).
- [214] Cade, C., and Crichigno, P. M. (2021). Complexity of supersymmetric systems and the cohomology problem. arXiv:[2107.00011](https://arxiv.org/abs/2107.00011).
- [215] Cade, C., Mineh, L., Montanaro, A., and Stanisic, S. (2020). Strategies for solving the Fermi–Hubbard model on near-term quantum computers. *Phys. Rev. B*, **102**, 235122. doi:[10.1103/PhysRevB.102.235122](https://doi.org/10.1103/PhysRevB.102.235122). arXiv:[1912.06007](https://arxiv.org/abs/1912.06007).
- [216] Cade, C., Folkertsma, M., Niesen, I., and Weggemans, J. (2022). Quantum algorithms for community detection and their empirical run-times. arXiv:[2203.06208](https://arxiv.org/abs/2203.06208).
- [217] Cade, C., Folkertsma, M., Niesen, I., and Weggemans, J. (2023). Quantifying Grover speed-ups beyond asymptotic analysis. *Quantum*, **7**, 1133. doi:[10.22331/q-2023-10-10-1133](https://doi.org/10.22331/q-2023-10-10-1133). arXiv:[2203.04975](https://arxiv.org/abs/2203.04975).
- [218] Cai, Z. (2020). Resource estimation for quantum variational simulations of the Hubbard model. *Phys. Rev. Appl.*, **14**, 014059. doi:[10.1103/PhysRevApplied.14.014059](https://doi.org/10.1103/PhysRevApplied.14.014059). arXiv:[1910.02719](https://arxiv.org/abs/1910.02719).
- [219] Calabrese, P., and Cardy, J. (2005). Evolution of entanglement entropy in one-dimensional systems. *J. Stat. Mech. Theory Exp.*, 04010. doi:[10.1088/1742-5468/2005/04/P04010](https://doi.org/10.1088/1742-5468/2005/04/P04010). arXiv:[cond-mat/0503393](https://arxiv.org/abs/cond-mat/0503393).

- [220] Calabro, C., Impagliazzo, R., and Paturi, R. (2009). The complexity of satisfiability of small depth circuits. Pages 75–85 of: *Parameterized and Exact Computation*. doi:[10.1007/978-3-642-11269-0_6](https://doi.org/10.1007/978-3-642-11269-0_6).
- [221] Calderbank, A. R., and Shor, P. W. (1996). Good quantum error-correcting codes exist. *Phys. Rev. A*, **54**, 1098–1105. doi:[10.1103/physreva.54.1098](https://doi.org/10.1103/physreva.54.1098). arXiv:[quant-ph/9512032](https://arxiv.org/abs/quant-ph/9512032).
- [222] Campbell, E. (2019). Random compiler for fast Hamiltonian simulation. *Phys. Rev. Lett.*, **123**. doi:[10.1103/physrevlett.123.070503](https://doi.org/10.1103/physrevlett.123.070503). arXiv:[1811.08017](https://arxiv.org/abs/1811.08017).
- [223] Campbell, E., Khurana, A., and Montanaro, A. (2019). Applying quantum algorithms to constraint satisfaction problems. *Quantum*, **3**, 167. doi:[10.22331/q-2019-07-18-167](https://doi.org/10.22331/q-2019-07-18-167). arXiv:[1810.05582](https://arxiv.org/abs/1810.05582).
- [224] Campbell, E. T. (2019). A theory of single-shot error correction for adversarial noise. *Quantum Sci. Technol.*, **4**, 025006. doi:[10.1088/2058-9565/aafc8f](https://doi.org/10.1088/2058-9565/aafc8f). arXiv:[1805.09271](https://arxiv.org/abs/1805.09271).
- [225] Campbell, E. T. (2021). Early fault-tolerant simulations of the Hubbard model. *Quantum Sci. Technol.*, **7**, 015007. doi:[10.1088/2058-9565/ac3110](https://doi.org/10.1088/2058-9565/ac3110). arXiv:[2012.09238](https://arxiv.org/abs/2012.09238).
- [226] Campbell, E. T., Terhal, B. M., and Vuillot, C. (2017). Roads towards fault-tolerant universal quantum computation. *Nature*, **549**, 172–179. doi:[10.1038/nature23460](https://doi.org/10.1038/nature23460). arXiv:[1612.07330](https://arxiv.org/abs/1612.07330).
- [227] Camps, D., Lin, L., Van Beeumen, R., and Yang, C. (2024). Explicit quantum circuits for block encodings of certain sparse matrices. *SIAM J. Matrix Anal. Appl.*, **45**, 801–827. doi:[10.1137/22M1484298](https://doi.org/10.1137/22M1484298). arXiv:[2203.10236](https://arxiv.org/abs/2203.10236).
- [228] Cao, Y., Papageorgiou, A., Petras, I., et al. (2013). Quantum algorithm and circuit design solving the poisson equation. *New J. Phys.*, **15**, 013021. doi:[10.1088/1367-2630/15/1/013021](https://doi.org/10.1088/1367-2630/15/1/013021). arXiv:[1207.2485](https://arxiv.org/abs/1207.2485).
- [229] Cao, Y., Romero, J., Olson, J. P., et al. (2019). Quantum chemistry in the age of quantum computing. *Chem. Rev.*, **119**, 10856–10915. doi:[10.1021/acs.chemrev.8b00803](https://doi.org/10.1021/acs.chemrev.8b00803). arXiv:[1812.09976](https://arxiv.org/abs/1812.09976).
- [230] Carbone, A., Cipollone, A., Barbieri, C., et al. (2013). Self-consistent Green's functions formalism with three-body interactions. *Phys. Rev. C*, **88**, 054326. doi:[10.1103/PhysRevC.88.054326](https://doi.org/10.1103/PhysRevC.88.054326). arXiv:[1310.3688](https://arxiv.org/abs/1310.3688).
- [231] Carena, M., Lamm, H., Li, Y.-Y., and Liu, W. (2021). Lattice renormalization of quantum simulations. *Phys. Rev. D*, **104**, 094519. doi:[10.1103/PhysRevD.104.094519](https://doi.org/10.1103/PhysRevD.104.094519). arXiv:[2107.01166](https://arxiv.org/abs/2107.01166).
- [232] Carlson, J., Gandolfi, S., Pederiva, F., et al. (2015). Quantum Monte Carlo methods for nuclear physics. *Rev. Mod. Phys.*, **87**, 1067. doi:[10.1103/RevModPhys.87.1067](https://doi.org/10.1103/RevModPhys.87.1067). arXiv:[1412.3081](https://arxiv.org/abs/1412.3081).
- [233] Carlson, J., Savage, M. J., Gerber, R., et al. (2017). *Nuclear physics exascale requirements review: An Office of Science review sponsored jointly by Advanced Scientific Computing Research and Nuclear Physics, June 15–17, 2016, Gaithersburg, Maryland*. Tech. rept. [OSTI 1906717](https://arxiv.org/abs/1906.717). U.S. Department of Energy Office of Scientific and Technical Information. doi:[10.2172/1369223](https://doi.org/10.2172/1369223).
- [234] Caro, M. C., Gil-Fuster, E., Meyer, J. J., et al. (2021). Encoding-dependent generalization bounds for parametrized quantum circuits. *Quantum*, **5**, 582. doi:[10.22331/q-2021-11-17-582](https://doi.org/10.22331/q-2021-11-17-582). arXiv:[2106.03880](https://arxiv.org/abs/2106.03880).

- [235] Caro, M. C., Huang, H.-Y., Cerezo, M., et al. (2022). Generalization in quantum machine learning from few training data. *Nat. Commun.*, **13**, 4919. doi:[10.1038/s41467-022-32550-3](https://doi.org/10.1038/s41467-022-32550-3). arXiv:[2111.05292](https://arxiv.org/abs/2111.05292).
- [236] Caro, M. C., Huang, H.-Y., Ezzell, N., et al. (2023). Out-of-distribution generalization for learning quantum dynamics. *Nat. Commun.*, **14**, 3751. doi:[10.1038/s41467-023-39381-w](https://doi.org/10.1038/s41467-023-39381-w). arXiv:[2204.10268](https://arxiv.org/abs/2204.10268).
- [237] Carrington Jr, T. (2017). Perspective: Computing (ro-)vibrational spectra of molecules with more than four atoms. *J. Chem. Phys.*, **146**, 120902. doi:[10.1063/1.4979117](https://doi.org/10.1063/1.4979117).
- [238] Casares, P. A. M., Campos, R., and Martin-Delgado, M. A. (2022). TFermion: A non-Clifford gate cost assessment library of quantum phase estimation algorithms for quantum chemistry. *Quantum*, **6**, 768. doi:[10.22331/q-2022-07-20-768](https://doi.org/10.22331/q-2022-07-20-768). arXiv:[2110.05899](https://arxiv.org/abs/2110.05899).
- [239] Castryck, W., and Decru, T. (2023). An efficient key recovery attack on SIDH. Pages 423–447 of: *EUROCRYPT*. doi:[10.1007/978-3-031-30589-4_15](https://doi.org/10.1007/978-3-031-30589-4_15). ePrint:[2022/975](https://eprint.iacr.org/2022/975).
- [240] Cerezo, M., Sone, A., Volkoff, T., et al. (2021). Cost function dependent barren plateaus in shallow parametrized quantum circuits. *Nat. Commun.*, **12**, 1–12. doi:[10.1038/s41467-021-21728-w](https://doi.org/10.1038/s41467-021-21728-w). arXiv:[2001.00550](https://arxiv.org/abs/2001.00550).
- [241] Cerezo, M., Arrasmith, A., Babbush, R., et al. (2021). Variational quantum algorithms. *Nat. Rev. Phys.*, 625–644. doi:[10.1038/s42254-021-00348-9](https://doi.org/10.1038/s42254-021-00348-9). arXiv:[2012.09265](https://arxiv.org/abs/2012.09265).
- [242] Cerezo, M., Verdon, G., Huang, H.-Y., et al. (2022). Challenges and opportunities in quantum machine learning. *Nat. Comput. Sci.*, **2**, 567–576. doi:[10.1038/s43588-022-00311-3](https://doi.org/10.1038/s43588-022-00311-3). arXiv:[2303.09491](https://arxiv.org/abs/2303.09491).
- [243] Cerezo, M., Larocca, M., García-Martín, D., et al. (2023). Does provable absence of barren plateaus imply classical simulability? Or, why we need to rethink variational quantum computing. arXiv:[2312.09121](https://arxiv.org/abs/2312.09121).
- [244] Cerjan, C. (1993). *Numerical grid methods and their application to Schrödinger's equation*. Vol. 412. Springer Science & Business Media. doi:[10.1007/978-94-015-8240-7](https://doi.org/10.1007/978-94-015-8240-7).
- [245] Chakrabarti, S., Childs, A. M., Li, T., and Wu, X. (2020). Quantum algorithms and lower bounds for convex optimization. *Quantum*, **4**, 221. doi:[10.22331/q-2020-01-13-221](https://doi.org/10.22331/q-2020-01-13-221). arXiv:[1809.01731](https://arxiv.org/abs/1809.01731).
- [246] Chakrabarti, S., Krishnakumar, R., Mazzola, G., et al. (2021). A threshold for quantum advantage in derivative pricing. *Quantum*, **5**, 463. doi:[10.22331/q-2021-06-01-463](https://doi.org/10.22331/q-2021-06-01-463). arXiv:[2012.03819](https://arxiv.org/abs/2012.03819).
- [247] Chakrabarti, S., Minssen, P., Yalovetzky, R., and Pistoia, M. (2022). Universal quantum speedup for branch-and-bound, branch-and-cut, and tree-search algorithms. arXiv:[2210.03210](https://arxiv.org/abs/2210.03210).
- [248] Chakraborty, S., Gilyén, A., and Jeffery, S. (2019). The power of block-encoded matrix powers: Improved regression techniques via faster Hamiltonian simulation. Pages 33:1–33:14 of: *ICALP*. doi:[10.4230/LIPIcs.ICALP.2019.33](https://doi.org/10.4230/LIPIcs.ICALP.2019.33). arXiv:[1804.01973](https://arxiv.org/abs/1804.01973).
- [249] Chamberland, C., and Cross, A. W. (2019). Fault-tolerant magic state preparation with flag qubits. *Quantum*, **3**, 143. doi:[10.22331/q-2019-05-20-143](https://doi.org/10.22331/q-2019-05-20-143). arXiv:[1811.00566](https://arxiv.org/abs/1811.00566).

- [250] Chamberland, C., Noh, K., Arrangoiz-Arriola, P., et al. (2022). Building a fault-tolerant quantum computer using concatenated cat codes. *PRX Quantum*, **3**, 010329. doi:[10.1103/PRXQuantum.3.010329](https://doi.org/10.1103/PRXQuantum.3.010329). arXiv:[2012.04108](https://arxiv.org/abs/2012.04108).
- [251] Chamberland, C., Gonçalves, L., Sivarajah, P., et al. (2023). Techniques for combining fast local decoders with global decoders under circuit-level noise. *Quantum Sci. Technol.*, **8**, 045011. doi:[10.1088/2058-9565/ace64d](https://doi.org/10.1088/2058-9565/ace64d). arXiv:[2208.01178](https://arxiv.org/abs/2208.01178).
- [252] Chan, G. K.-L. (2024). Spiers memorial lecture: Quantum chemistry, classical heuristics, and quantum advantage. *Faraday Discuss.*, **254**, 11–52. doi:[10.1039/D4FD000141A](https://doi.org/10.1039/D4FD000141A). arXiv:[2407.11235](https://arxiv.org/abs/2407.11235).
- [253] Chan, H. H. S., Meister, R., Jones, T., et al. (2023). Grid-based methods for chemistry simulations on a quantum computer. *Sci. Adv.*, **9**, eabo7484. doi:[10.1126/sciadv.abo7484](https://doi.org/10.1126/sciadv.abo7484). arXiv:[2202.05864](https://arxiv.org/abs/2202.05864).
- [254] Chao, R., and Reichardt, B. W. (2020). Flag fault-tolerant error correction for any stabilizer code. *PRX Quantum*, **1**. doi:[10.1103/prxquantum.1.010302](https://doi.org/10.1103/prxquantum.1.010302). arXiv:[1912.09549](https://arxiv.org/abs/1912.09549).
- [255] Chao, R., Ding, D., Gilyén, A., et al. (2020). Finding angles for quantum signal processing with machine precision. arXiv:[2003.02831](https://arxiv.org/abs/2003.02831).
- [256] Chen, C.-F., and Brandão, F. G. S. L. (2021). Fast thermalization from the eigenstate thermalization hypothesis. arXiv:[2112.07646](https://arxiv.org/abs/2112.07646).
- [257] Chen, C.-F., and Brandão, F. G. S. L. (2024). Average-case speedup for product formulas. *Commun. Math. Phys.*, **405**, 32. doi:[10.1007/s00220-023-04912-5](https://doi.org/10.1007/s00220-023-04912-5). arXiv:[2111.05324](https://arxiv.org/abs/2111.05324).
- [258] Chen, C.-F., Huang, H.-Y., Kueng, R., and Tropp, J. A. (2021). Concentration for random product formulas. *PRX Quantum*, **2**. doi:[10.1103/prxquantum.2.040305](https://doi.org/10.1103/prxquantum.2.040305). arXiv:[2008.11751](https://arxiv.org/abs/2008.11751).
- [259] Chen, C.-F., Kastoryano, M. J., and Gilyén, A. (2023). An efficient and exact noncommutative quantum Gibbs sampler. arXiv:[2311.09207](https://arxiv.org/abs/2311.09207).
- [260] Chen, C.-F., Kastoryano, M. J., Brandão, F. G. S. L., and Gilyén, A. (2023). Quantum thermal state preparation. arXiv:[2303.18224](https://arxiv.org/abs/2303.18224).
- [261] Chen, C.-F., Lucas, A., and Yin, C. (2023). Speed limits and locality in many-body quantum dynamics. *Rep. Prog. Phys.*, **86**, 116001. doi:[10.1088/1361-6633/acfaae](https://doi.org/10.1088/1361-6633/acfaae). arXiv:[2303.07386](https://arxiv.org/abs/2303.07386).
- [262] Chen, J., Stoudenmire, E., and White, S. R. (2023). Quantum Fourier transform has small entanglement. *PRX Quantum*, **4**, 040318. doi:[10.1103/PRXQuantum.4.040318](https://doi.org/10.1103/PRXQuantum.4.040318). arXiv:[2210.08468](https://arxiv.org/abs/2210.08468).
- [263] Chen, L., Jordan, S., Liu, Y.-K., et al. (2016). *Report on post-quantum cryptography*. Tech. rept. [NISTIR 8105](https://nist.gov/publications/nistir/8105/nistir-8105.pdf). National Institute of Standards and Technology, Gaithersburg, MD. doi:[10.6028/NIST.IR.8105](https://doi.org/10.6028/NIST.IR.8105).
- [264] Chen, M.-H., Yu, C.-H., Gao, J.-L., et al. (2022). Quantum algorithm for Gaussian process regression. *Phys. Rev. A*, **106**, 012406. doi:[10.1103/PhysRevA.106.012406](https://doi.org/10.1103/PhysRevA.106.012406). arXiv:[2106.06701](https://arxiv.org/abs/2106.06701).
- [265] Chen, S., Cotler, J., Huang, H.-Y., and Li, J. (2022). Exponential separations between learning with and without quantum memory. Pages 574–585 of: *FOCS*. doi:[10.1109/FOCS52979.2021.000063](https://doi.org/10.1109/FOCS52979.2021.000063). arXiv:[2111.05881](https://arxiv.org/abs/2111.05881).

- [266] Chen, Y., and de Wolf, R. (2023). Quantum algorithms and lower bounds for linear regression with norm constraints. Pages 38:1–38:21 of: *ICALP*. doi:[10.4230/LIPIcs.ICALP.2023.38](https://doi.org/10.4230/LIPIcs.ICALP.2023.38). arXiv:[2110.13086](https://arxiv.org/abs/2110.13086).
- [267] Chen, Y., Gilyén, A., and de Wolf, R. (2025). A quantum speed-up for approximating the top eigenvectors of a matrix. In: *SODA*. Accepted, arXiv:[2405.14765](https://arxiv.org/abs/2405.14765).
- [268] Chen, Z.-Y., Xue, C., Chen, S.-M., et al. (2022). Quantum approach to accelerate finite volume method on steady computational fluid dynamics problems. *Quantum Inf. Process.*, **21**, 137. doi:[10.1007/s11128-022-03478-w](https://doi.org/10.1007/s11128-022-03478-w). arXiv:[2102.03557](https://arxiv.org/abs/2102.03557).
- [269] Chen, Z.-Y., Xue, C., Sun, T.-P., et al. (2023). An efficient and error-resilient protocol for quantum random access memory with generalized data size. arXiv:[2303.05207](https://arxiv.org/abs/2303.05207).
- [270] Chepurko, N., Clarkson, K., Horesh, L., et al. (2022). Quantum-inspired algorithms from randomized numerical linear algebra. Pages 3879–3900 of: *ICML*, vol. 162. arXiv:[2011.04125](https://arxiv.org/abs/2011.04125).
- [271] Chia, N.-H., Gilyén, A. P., Li, T., et al. (2022). Sampling-based sublinear low-rank matrix arithmetic framework for dequantizing quantum machine learning. *J. ACM*, **69**, 1–72. doi:[10.1145/3549524](https://doi.org/10.1145/3549524). Earlier version in *STOC'20*. arXiv:[1910.06151](https://arxiv.org/abs/1910.06151).
- [272] Chiang, C.-F., and Wocjan, P. (2010). Quantum algorithm for preparing thermal Gibbs states-detailed analysis. Pages 138–147 of: *Quantum Cryptography and Computing*, vol. 26. doi:[10.3233/978-1-60750-547-1-138](https://doi.org/10.3233/978-1-60750-547-1-138). arXiv:[1001.1130](https://arxiv.org/abs/1001.1130).
- [273] Chiesa, A., Tacchino, F., Grossi, M., et al. (2019). Quantum hardware simulating four-dimensional inelastic neutron scattering. *Nat. Phys.*, **15**, 455–459. doi:[10.1038/s41567-019-0437-4](https://doi.org/10.1038/s41567-019-0437-4). arXiv:[1809.07974](https://arxiv.org/abs/1809.07974).
- [274] Childs, A., Jao, D., and Soukharev, V. (2014). Constructing elliptic curve isogenies in quantum subexponential time. *J. Math. Cryptol.*, **8**, 1–29. doi:[10.1515/jmc-2012-0016](https://doi.org/10.1515/jmc-2012-0016). arXiv:[1012.4019](https://arxiv.org/abs/1012.4019).
- [275] Childs, A. M. (2010). On the relationship between continuous- and discrete-time quantum walk. *Commun. Math. Phys.*, **294**, 581–603. doi:[10.1007/s00220-009-0930-1](https://doi.org/10.1007/s00220-009-0930-1). arXiv:[0810.0312](https://arxiv.org/abs/0810.0312).
- [276] Childs, A. M. (2022). *Lecture notes on quantum algorithms*. <https://cs.umd.edu/~amchilds/qa/>, accessed: 2024-12-01.
- [277] Childs, A. M., and van Dam, W. (2010). Quantum algorithms for algebraic problems. *Rev. Mod. Phys.*, **82**, 1–52. doi:[10.1103/RevModPhys.82.1](https://doi.org/10.1103/RevModPhys.82.1). arXiv:[0812.0380](https://arxiv.org/abs/0812.0380).
- [278] Childs, A. M., and Kothari, R. (2011). Simulating sparse Hamiltonians with star decompositions. Pages 94–103 of: *TQC*. doi:[10.1007/978-3-642-18073-6_8](https://doi.org/10.1007/978-3-642-18073-6_8). arXiv:[1003.3683](https://arxiv.org/abs/1003.3683).
- [279] Childs, A. M., and Liu, J.-P. (2020). Quantum spectral methods for differential equations. *Commun. Math. Phys.*, **375**, 1427–1457. doi:[10.1007/s00220-020-03699-z](https://doi.org/10.1007/s00220-020-03699-z). arXiv:[1901.00961](https://arxiv.org/abs/1901.00961).
- [280] Childs, A. M., and Su, Y. (2019). Nearly optimal lattice simulation by product formulas. *Phys. Rev. Lett.*, **123**, 050503. doi:[10.1103/PhysRevLett.123.050503](https://doi.org/10.1103/PhysRevLett.123.050503). arXiv:[1901.00564](https://arxiv.org/abs/1901.00564).

- [281] Childs, A. M., and Wiebe, N. (2012). Hamiltonian simulation using linear combinations of unitary operations. *Quantum Inf. Comput.*, **12**, 901–924. doi:[10.26421/QIC12.11-12](https://doi.org/10.26421/QIC12.11-12). arXiv:[1202.5822](https://arxiv.org/abs/1202.5822).
- [282] Childs, A. M., Kothari, R., and Somma, R. D. (2017). Quantum algorithm for systems of linear equations with exponentially improved dependence on precision. *SIAM J. Comp.*, **46**, 1920–1950. doi:[10.1137/16M1087072](https://doi.org/10.1137/16M1087072). arXiv:[1511.02306](https://arxiv.org/abs/1511.02306).
- [283] Childs, A. M., Maslov, D., Nam, Y., et al. (2018). Toward the first quantum simulation with quantum speedup. *Proc. Natl. Acad. Sci.*, **115**, 9456–9461. doi:[10.1073/pnas.1801723115](https://doi.org/10.1073/pnas.1801723115). arXiv:[1711.10980](https://arxiv.org/abs/1711.10980).
- [284] Childs, A. M., Ostrander, A., and Su, Y. (2019). Faster quantum simulation by randomization. *Quantum*, **3**, 182. doi:[10.22331/q-2019-09-02-182](https://doi.org/10.22331/q-2019-09-02-182). arXiv:[1805.08385](https://arxiv.org/abs/1805.08385).
- [285] Childs, A. M., Liu, J.-P., and Ostrander, A. (2021). High-precision quantum algorithms for partial differential equations. *Quantum*, **5**, 574. doi:[10.22331/q-2021-11-10-574](https://doi.org/10.22331/q-2021-11-10-574). arXiv:[2002.07868](https://arxiv.org/abs/2002.07868).
- [286] Childs, A. M., Su, Y., Tran, M. C., et al. (2021). Theory of Trotter error with commutator scaling. *Phys. Rev. X*, **11**. doi:[10.1103/physrevx.11.011020](https://doi.org/10.1103/physrevx.11.011020). arXiv:[1912.08854](https://arxiv.org/abs/1912.08854).
- [287] Childs, A. M., Leng, J., Li, T., et al. (2022). Quantum simulation of real-space dynamics. *Quantum*, **6**, 860. doi:[10.22331/q-2022-11-17-860](https://doi.org/10.22331/q-2022-11-17-860). arXiv:[2203.17006](https://arxiv.org/abs/2203.17006).
- [288] Cho, C. H., Berry, D. W., and Hsieh, M.-H. (2022). Doubling the order of approximation via the randomized product formula. arXiv:[2210.11281](https://arxiv.org/abs/2210.11281).
- [289] Chowdhury, A. N., and Somma, R. D. (2017). Quantum algorithms for Gibbs sampling and hitting-time estimation. *Quantum Inf. Comput.*, **17**, 41–64. doi:[10.26421/QIC17.1-2](https://doi.org/10.26421/QIC17.1-2). arXiv:[1603.02940](https://arxiv.org/abs/1603.02940).
- [290] Chowdhury, A. N., Somma, R. D., and Subaşı, Y. (2021). Computing partition functions in the one-clean-qubit model. *Phys. Rev. A*, **103**, 032422. doi:[10.1103/PhysRevA.103.032422](https://doi.org/10.1103/PhysRevA.103.032422). arXiv:[1910.11842](https://arxiv.org/abs/1910.11842).
- [291] Chubb, C. T. (2021). General tensor network decoding of 2D Pauli codes. arXiv:[2101.04125](https://arxiv.org/abs/2101.04125).
- [292] Ciavarella, A., Klco, N., and Savage, M. J. (2021). Trailhead for quantum simulation of SU(3) Yang–Mills lattice gauge theory in the local multiplet basis. *Phys. Rev. D*, **103**, 094501. doi:[10.1103/PhysRevD.103.094501](https://doi.org/10.1103/PhysRevD.103.094501). arXiv:[2101.10227](https://arxiv.org/abs/2101.10227).
- [293] Ciliberto, C., Herbster, M., Ialongo, A. D., et al. (2018). Quantum machine learning: A classical perspective. *Proc. R. Soc. A*, **474**, 20170551. doi:[10.1098/rspa.2017.0551](https://doi.org/10.1098/rspa.2017.0551). arXiv:[1707.08561](https://arxiv.org/abs/1707.08561).
- [294] Cirstoiu, C., Holmes, Z., Iosue, J., et al. (2020). Variational fast forwarding for quantum simulation beyond the coherence time. *npj Quant. Inf.*, **6**, 82. doi:[10.1038/s41534-020-00302-0](https://doi.org/10.1038/s41534-020-00302-0). arXiv:[1910.04292](https://arxiv.org/abs/1910.04292).
- [295] Clader, B. D., Jacobs, B. C., and Sprouse, C. R. (2013). Preconditioned quantum linear system algorithm. *Phys. Rev. Lett.*, **110**, 250504. doi:[10.1103/PhysRevLett.110.250504](https://doi.org/10.1103/PhysRevLett.110.250504). arXiv:[1301.2340](https://arxiv.org/abs/1301.2340).

- [296] Clader, B. D., Dalzell, A. M., Stamatopoulos, N., et al. (2022). Quantum resources required to block-encode a matrix of classical data. *IEEE Trans. Quantum Eng.*, **3**, 1–23. doi:[10.1109/TQE.2022.3231194](https://doi.org/10.1109/TQE.2022.3231194). arXiv:[2206.03505](https://arxiv.org/abs/2206.03505).
- [297] Cleve, R., and Wang, C. (2017). Efficient quantum algorithms for simulating Lindblad evolution. Pages 17:1–17:14 of: *ICALP*. doi:[10.4230/LIPIcs.ICALP.2017.17](https://doi.org/10.4230/LIPIcs.ICALP.2017.17). arXiv:[1612.09512](https://arxiv.org/abs/1612.09512).
- [298] Cleve, R., and Watrous, J. (2000). Fast parallel circuits for the quantum Fourier transform. Pages 526–536 of: *FOCS*. doi:[10.1109/SFCS.2000.892140](https://doi.org/10.1109/SFCS.2000.892140). arXiv:[quant-ph/0006004](https://arxiv.org/abs/quant-ph/0006004).
- [299] Cleve, R., Ekert, A., Macchiavello, C., and Mosca, M. (1998). Quantum algorithms revisited. *Proc. R. Soc. A*, **454**, 339–354. doi:[10.1098/rspa.1998.0164](https://doi.org/10.1098/rspa.1998.0164). arXiv:[quant-ph/9708016](https://arxiv.org/abs/quant-ph/9708016).
- [300] Clinton, L., Bausch, J., and Cubitt, T. (2021). Hamiltonian simulation algorithms for near-term quantum hardware. *Nat. Commun.*, **12**, 4989. doi:[10.1038/s41467-021-25196-0](https://doi.org/10.1038/s41467-021-25196-0). arXiv:[2003.06886](https://arxiv.org/abs/2003.06886).
- [301] Clinton, L., Cubitt, T., Flynn, B., et al. (2024). Towards near-term quantum simulation of materials. *Nat. Commun.*, **15**, 211. doi:[10.1038/s41467-023-43479-6](https://doi.org/10.1038/s41467-023-43479-6). arXiv:[2205.15256](https://arxiv.org/abs/2205.15256).
- [302] Coecke, B., and Kissinger, A. (2017). *Picturing quantum processes*. Cambridge University Press. doi:[10.1017/9781316219317](https://doi.org/10.1017/9781316219317).
- [303] Cohen, L. Z., Kim, I. H., Bartlett, S. D., and Brown, B. J. (2022). Low-overhead fault-tolerant quantum computing using long-range connectivity. *Sci. Adv.*, **8**. doi:[10.1126/sciadv.abn1717](https://doi.org/10.1126/sciadv.abn1717).
- [304] Cohen, M. B., Lee, Y. T., and Song, Z. (2021). Solving linear programs in the current matrix multiplication time. *J. ACM*, **68**. doi:[10.1145/3424305](https://doi.org/10.1145/3424305). arXiv:[1810.07896](https://arxiv.org/abs/1810.07896).
- [305] Commeau, B., Cerezo, M., Holmes, Z., et al. (2020). Variational Hamiltonian diagonalization for dynamical quantum simulation. arXiv:[2009.02559](https://arxiv.org/abs/2009.02559).
- [306] Cong, I., Choi, S., and Lukin, M. D. (2019). Quantum convolutional neural networks. *Nat. Phys.*, **15**, 1273–1278. doi:[10.1038/s41567-019-0648-8](https://doi.org/10.1038/s41567-019-0648-8). arXiv:[1810.03787](https://arxiv.org/abs/1810.03787).
- [307] Coppersmith, D., Gamarnik, D., Hajiaghayi, M., and Sorkin, G. B. (2004). Random MAX SAT, random MAX CUT, and their phase transitions. *Rand. Struct. Algorithms*, **24**, 502–545. doi:[10.1002/rsa.20015](https://doi.org/10.1002/rsa.20015). Earlier version in *SODA'03*. arXiv:[math/0306047](https://arxiv.org/abs/math/0306047).
- [308] Cornelissen, A., and Hamoudi, Y. (2023). A sublinear-time quantum algorithm for approximating partition functions. Pages 1245–1264 of: *SODA*. doi:[10.1137/1.9781611977554.ch46](https://doi.org/10.1137/1.9781611977554.ch46). arXiv:[2207.08643](https://arxiv.org/abs/2207.08643).
- [309] Cornelissen, A., and Jerbi, S. (2021). Quantum algorithms for multivariate Monte Carlo estimation. arXiv:[2107.03410](https://arxiv.org/abs/2107.03410).
- [310] Cornelissen, A., Hamoudi, Y., and Jerbi, S. (2022). Near-optimal quantum algorithms for multivariate mean estimation. Pages 33–43 of: *STOC*. doi:[10.1145/3519935.3520045](https://doi.org/10.1145/3519935.3520045). arXiv:[2111.09787](https://arxiv.org/abs/2111.09787).
- [311] Cornuejols, G., and Tütüncü, R. (2006). *Optimization methods in finance*. Vol. 5. Cambridge University Press.

- [312] Costa, P. C., Jordan, S., and Ostrander, A. (2019). Quantum algorithm for simulating the wave equation. *Phys. Rev. A*, **99**, 012323. doi:[10.1103/PhysRevA.99.012323](https://doi.org/10.1103/PhysRevA.99.012323).
- [313] Costa, P. C., An, D., Sanders, Y. R., et al. (2022). Optimal scaling quantum linear-systems solver via discrete adiabatic theorem. *PRX Quantum*, **3**, 040303. doi:[10.1103/PRXQuantum.3.040303](https://doi.org/10.1103/PRXQuantum.3.040303). arXiv:[2111.08152](https://arxiv.org/abs/2111.08152).
- [314] Costa, P. C. S., An, D., Babbush, R., and Berry, D. (2023). The discrete adiabatic quantum linear system solver has lower constant factors than the randomized adiabatic solver. arXiv:[2312.07690](https://arxiv.org/abs/2312.07690).
- [315] Costa, P. C. S., Schleich, P., Morales, M. E. S., and Berry, D. W. (2023). Further improving quantum algorithms for nonlinear differential equations via higher-order methods and rescaling. arXiv:[2312.09518](https://arxiv.org/abs/2312.09518).
- [316] Cotler, J. S., Gur-Ari, G., Hanada, M., et al. (2017). Black holes and random matrices. *J. High Energy Phys.*, **2017**, 1–54. doi:[10.1007/JHEP05\(2017\)118](https://doi.org/10.1007/JHEP05(2017)118). arXiv:[1611.04650](https://arxiv.org/abs/1611.04650).
- [317] Cramer, M., Plenio, M. B., Flammia, S. T., et al. (2010). Efficient quantum state tomography. *Nat. Commun.*, **1**, 149. doi:[10.1038/ncomms1147](https://doi.org/10.1038/ncomms1147). arXiv:[1101.4366](https://arxiv.org/abs/1101.4366).
- [318] Cramer, R., Ducas, L., and Wesolowski, B. (2017). Short Stickelberger class relations and application to Ideal-SVP. Pages 324–348 of: *EUROCRYPT*. ePrint:[2016/885](https://eprint.iacr.org/2016/885).
- [319] Crichigno, M., and Kohler, T. (2022). Clique homology is QMA1-hard. arXiv:[2209.11793](https://arxiv.org/abs/2209.11793).
- [320] Criger, B., and Ashraf, I. (2018). Multi-path summation for decoding 2d topological codes. *Quantum*, **2**, 102. doi:[10.22331/q-2018-10-19-102](https://doi.org/10.22331/q-2018-10-19-102). arXiv:[1709.02154](https://arxiv.org/abs/1709.02154).
- [321] Crooks, G. E. (2019). Gradients of parameterized quantum gates using the parameter-shift rule and gate decomposition. arXiv:[1905.13311](https://arxiv.org/abs/1905.13311).
- [322] Crosson, E., and Harrow, A. W. (2016). Simulated quantum annealing can be exponentially faster than classical simulated annealing. Pages 714–723 of: *FOCS*. doi:[10.1109/FOCS.2016.81](https://doi.org/10.1109/FOCS.2016.81). arXiv:[1601.03030](https://arxiv.org/abs/1601.03030).
- [323] Crosson, E., and Lidar, D. (2021). Prospects for quantum enhancement with diabatic quantum annealing. *Nat. Rev. Phys.*, **3**, 466–489. doi:[10.1038/s42254-021-00313-6](https://doi.org/10.1038/s42254-021-00313-6). arXiv:[2008.09913](https://arxiv.org/abs/2008.09913).
- [324] Crosson, E., and Slezak, S. (2020). Classical simulation of high temperature quantum Ising models. doi:[10.48550/arXiv.2002.02232](https://doi.org/10.48550/arXiv.2002.02232). arXiv:[2002.02232](https://arxiv.org/abs/2002.02232).
- [325] Cunningham, J., and Roland, J. (2024). Eigenpath traversal by poisson-distributed phase randomisation. arXiv:[2406.03972](https://arxiv.org/abs/2406.03972).
- [326] Daley, A. J., Bloch, I., Kokail, C., et al. (2022). Practical quantum advantage in quantum simulation. *Nature*, **607**, 667–676. doi:[10.1038/s41586-022-04940-6](https://doi.org/10.1038/s41586-022-04940-6).
- [327] Dalzell, A. M. (2024). A shortcut to an optimal quantum linear system solver. arXiv:[2406.12086](https://arxiv.org/abs/2406.12086).

- [328] Dalzell, A. M., Clader, B. D., Salton, G., et al. (2023). End-to-end resource analysis for quantum interior-point methods and portfolio optimization. *PRX Quantum*, **4**, 040325. doi:[10.1103/PRXQuantum.4.040325](https://doi.org/10.1103/PRXQuantum.4.040325). arXiv:[2211.12489](https://arxiv.org/abs/2211.12489).
- [329] Dalzell, A. M., Pancotti, N., Campbell, E. T., and Brandão, F. G. (2023). Mind the gap: Achieving a super-Grover quantum speedup by jumping to the end. Pages 1131–1144 of: *STOC*. doi:[10.1145/3564246.3585203](https://doi.org/10.1145/3564246.3585203). arXiv:[2212.01513](https://arxiv.org/abs/2212.01513).
- [330] Damm, C., Holzer, M., and McKenzie, P. (2002). The complexity of tensor calculus. *Comput. Complex.*, **11**, 54–89. doi:[10.1007/s00037-000-0170-4](https://doi.org/10.1007/s00037-000-0170-4).
- [331] Darmawan, A. S., and Poulin, D. (2017). Tensor-network simulations of the surface code under realistic noise. *Phys. Rev. Lett.*, **119**, 040502. doi:[10.1103/PhysRevLett.119.040502](https://doi.org/10.1103/PhysRevLett.119.040502). arXiv:[1607.06460](https://arxiv.org/abs/1607.06460).
- [332] Davoudi, Z., Detmold, W., Shanahan, P., et al. (2021). Nuclear matrix elements from lattice QCD for electroweak and beyond-Standard-Model processes. *Phys. Rep.*, **900**, 1–74. doi:[10.1016/j.physrep.2020.10.004](https://doi.org/10.1016/j.physrep.2020.10.004).
- [333] Davoudi, Z., Neil, E. T., Bauer, C. W., et al. (2022). Report of the Snowmass 2021 topical group on lattice gauge theory. *Proceedings of the US Community Study on the Future of Particle Physics (Snowmass 2021)*. arXiv:[2209.10758](https://arxiv.org/abs/2209.10758).
- [334] Davoudi, Z., Shaw, A. F., and Stryker, J. R. (2023). General quantum algorithms for Hamiltonian simulation with applications to a non-abelian lattice gauge theory. *Quantum*, **7**, 1213. doi:[10.22331/q-2023-12-20-1213](https://doi.org/10.22331/q-2023-12-20-1213). arXiv:[2212.14030](https://arxiv.org/abs/2212.14030).
- [335] de Beaudrap, N., and Horsman, D. (2020). The ZX calculus is a language for surface code lattice surgery. *Quantum*, **4**, 218. doi:[10.22331/q-2020-01-09-218](https://doi.org/10.22331/q-2020-01-09-218). arXiv:[1704.08670](https://arxiv.org/abs/1704.08670).
- [336] De Palma, G., Marvian, M., Rouzé, C., and França, D. S. (2023). Limitations of variational quantum algorithms: A quantum optimal transport approach. *PRX Quantum*, **4**, 010309. doi:[10.1103/PRXQuantum.4.010309](https://doi.org/10.1103/PRXQuantum.4.010309). arXiv:[2204.03455](https://arxiv.org/abs/2204.03455).
- [337] Dean, D. J. (2007). Beyond the nuclear shell model. *Phys. Today*, **60**, 48–53. doi:[10.1063/1.2812123](https://doi.org/10.1063/1.2812123).
- [338] Delfosse, N., and Nickerson, N. H. (2021). Almost-linear time decoding algorithm for topological codes. *Quantum*, **5**, 595. doi:[10.22331/q-2021-12-02-595](https://doi.org/10.22331/q-2021-12-02-595). arXiv:[1709.06218](https://arxiv.org/abs/1709.06218).
- [339] Delfosse, N., Reichardt, B. W., and Svore, K. M. (2022). Beyond single-shot fault-tolerant quantum error correction. *IEEE Trans. Inf. Theory*, **68**, 287–301. doi:[10.1109/tit.2021.3120685](https://doi.org/10.1109/tit.2021.3120685). arXiv:[2002.05180](https://arxiv.org/abs/2002.05180).
- [340] Delgado, A., Hamilton, K. E., Date, P., et al. (2022). Quantum computing for data analysis in high-energy physics. arXiv:[2203.08805](https://arxiv.org/abs/2203.08805).
- [341] Delgado, A., Casares, P. A. M., dos Reis, R., et al. (2022). Simulating key properties of lithium-ion batteries with a fault-tolerant quantum computer. *Phys. Rev. A*, **106**, 032428. doi:[10.1103/PhysRevA.106.032428](https://doi.org/10.1103/PhysRevA.106.032428). arXiv:[2204.11890](https://arxiv.org/abs/2204.11890).
- [342] Deng, C., Sun, F., Qian, X., et al. (2019). TIE: Energy-efficient tensor train-based inference engine for deep neural network. Pages 264–278 of: *ISCA*. doi:[10.1145/3307650.3322258](https://doi.org/10.1145/3307650.3322258).

- [343] Dennis, E., Kitaev, A., Landahl, A., and Preskill, J. (2002). Topological quantum memory. *J. Math. Phys.*, **43**, 4452–4505. doi:[10.1063/1.1499754](https://doi.org/10.1063/1.1499754). arXiv:[quant-ph/0110143](https://arxiv.org/abs/quant-ph/0110143).
- [344] Derby, C., Klassen, J., Bausch, J., and Cubitt, T. (2021). Compact fermion to qubit mappings. *Phys. Rev. B*, **104**, 035118. doi:[10.1103/PhysRevB.104.035118](https://doi.org/10.1103/PhysRevB.104.035118). arXiv:[2003.06939](https://arxiv.org/abs/2003.06939).
- [345] Derrida, B. (1980). Random-energy model: Limit of a family of disordered models. *Phys. Rev. Lett.*, **45**, 79–82. doi:[10.1103/PhysRevLett.45.79](https://doi.org/10.1103/PhysRevLett.45.79).
- [346] Deutsch, D. (1985). Quantum theory, the Church–Turing principle and the universal quantum computer. *Proc. R. Soc. A*, **400**, 97–117. doi:[10.1098/rspa.1985.0070](https://doi.org/10.1098/rspa.1985.0070).
- [347] Deutsch, D., and Jozsa, R. (1992). Rapid solution of problems by quantum computation. *Proc. R. Soc. A*, **439**, 553–558. doi:[10.1098/rspa.1992.0167](https://doi.org/10.1098/rspa.1992.0167).
- [348] Devoret, M. H., and Schoelkopf, R. J. (2013). Superconducting circuits for quantum information: An outlook. *Science*, **339**, 1169–1174. doi:[10.1126/science.123193](https://doi.org/10.1126/science.123193).
- [349] Di Matteo, O., Gheorghiu, V., and Mosca, M. (2020). Fault-tolerant resource estimation of quantum random-access memories. *IEEE Trans. Quantum Eng.*, **1**, 1–13. doi:[10.1109/TQE.2020.2965803](https://doi.org/10.1109/TQE.2020.2965803). arXiv:[1902.01329](https://arxiv.org/abs/1902.01329).
- [350] Ding, C., Bao, T.-Y., and Huang, H.-L. (2022). Quantum-inspired support vector machine. *IEEE Trans. Neural Netw. Learn. Syst.*, **33**, 7210–7222. doi:[10.1109/TNNLS.2021.3084467](https://doi.org/10.1109/TNNLS.2021.3084467). arXiv:[1906.08902](https://arxiv.org/abs/1906.08902).
- [351] Ding, Z., Chen, C.-F., and Lin, L. (2024). Single-ancilla ground state preparation via Lindbladians. *Phys. Rev. Res.*, **6**, 033147. doi:[10.1103/PhysRevResearch.6.033147](https://doi.org/10.1103/PhysRevResearch.6.033147). arXiv:[2308.15676](https://arxiv.org/abs/2308.15676).
- [352] Dinur, I., Evra, S., Livne, R., et al. (2022). Locally testable codes with constant rate, distance, and locality. Pages 357–374 of: *STOC*. doi:[10.1145/3519935.3520024](https://doi.org/10.1145/3519935.3520024). arXiv:[2111.04808](https://arxiv.org/abs/2111.04808).
- [353] DiVincenzo, D. P., and Aliferis, P. (2007). Effective fault-tolerant quantum computation with slow measurements. *Phys. Rev. Lett.*, **98**. doi:[10.1103/physrevlett.98.020501](https://doi.org/10.1103/physrevlett.98.020501).
- [354] Dodin, I. Y., and Startsev, E. A. (2021). On applications of quantum computing to plasma simulations. *Phys. Plasmas*, **28**, 092101. doi:[10.1063/5.0056974](https://doi.org/10.1063/5.0056974). arXiv:[2005.14369](https://arxiv.org/abs/2005.14369).
- [355] Domahidi, A., Chu, E., and Boyd, S. (2013). ECOS: An SOCP solver for embedded systems. Pages 3071–3076 of: *ECC*. doi:[10.23919/ECC.2013.6669541](https://doi.org/10.23919/ECC.2013.6669541).
- [356] Dong, Y., Meng, X., Whaley, K. B., and Lin, L. (2021). Efficient phase-factor evaluation in quantum signal processing. *Phys. Rev. A*, **103**, 042419. doi:[10.1103/PhysRevA.103.042419](https://doi.org/10.1103/PhysRevA.103.042419). arXiv:[2002.11649](https://arxiv.org/abs/2002.11649).
- [357] Dong, Y., Gross, J., and Niu, M. Y. (2022). Beyond Heisenberg limit quantum metrology through quantum signal processing. arXiv:[2209.11207](https://arxiv.org/abs/2209.11207).
- [358] Dong, Y., Lin, L., and Tong, Y. (2022). Ground-state preparation and energy estimation on early fault-tolerant quantum computers via quantum eigenvalue transformation of unitary matrices. *PRX Quantum*, **3**, 040305. doi:[10.1103/PRXQuantum.3.040305](https://doi.org/10.1103/PRXQuantum.3.040305). arXiv:[2204.05955](https://arxiv.org/abs/2204.05955).

- [359] Dong, Y., Lin, L., Ni, H., and Wang, J. (2022). Infinite quantum signal processing. arXiv:[2209.10162](#).
- [360] Dong, Y., Lin, L., Ni, H., and Wang, J. (2023). Robust iterative method for symmetric quantum signal processing in all parameter regimes. arXiv:[2307.12468](#).
- [361] Doriguello, J. a. F., Luongo, A., Bao, J., et al. (2022). Quantum algorithm for stochastic optimal stopping problems with applications in finance. Pages 2:1–2:24 of: *TQC*. doi:[10.4230/LIPIcs.TQC.2022.2](#). arXiv:[2111.15332](#).
- [362] Du, Y., Hsieh, M.-H., Liu, T., and Tao, D. (2020). Expressive power of parametrized quantum circuits. *Phys. Rev. Res.*, **2**, 033125. doi:[10.1103/PhysRevResearch.2.033125](#). arXiv:[1810.11922](#).
- [363] Dua, A., Kubica, A., Jiang, L., et al. (2024). Clifford-deformed surface codes. *PRX Quantum*, **5**. doi:[10.1103/prxquantum.5.010347](#). arXiv:[2201.07802](#).
- [364] Duclos-Cianci, G., and Poulin, D. (2010). Fast decoders for topological quantum codes. *Phys. Rev. Lett.*, **104**, 050504. doi:[10.1103/PhysRevLett.104.050504](#). arXiv:[0911.0581](#).
- [365] Dukalski, M. (2021). Toward an application of quantum computing in geophysics. Pages 1–5 of: *Fifth EAGE Workshop on High Performance Computing for Upstream*, vol. 2021. doi:[10.3997/2214-4609.2021612005](#).
- [366] Dumitrescu, E. F., McCaskey, A. J., Hagen, G., et al. (2018). Cloud quantum computing of an atomic nucleus. *Phys. Rev. Lett.*, **120**, 210501. doi:[10.1103/PhysRevLett.120.210501](#). arXiv:[1801.03897](#).
- [367] Dürr, C., and Høyer, P. (1996). A quantum algorithm for finding the minimum. arXiv:[quant-ph/9607014](#).
- [368] Dürr, C., Heiligman, M., Høyer, P., and Mhalla, M. (2006). Quantum query complexity of some graph problems. *SIAM J. Comp.*, **35**, 1310–1328. doi:[10.1137/050644719](#). Earlier version in *ICALP'04*. arXiv:[quant-ph/0401091](#).
- [369] Dürr, S., Fodor, Z., Frison, J., et al. (2008). Ab initio determination of light hadron masses. *Science*, **322**, 1224–1227. doi:[10.1126/science.1163233](#). arXiv:[0906.3599](#).
- [370] Eastin, B., and Knill, E. (2009). Restrictions on transversal encoded quantum gate sets. *Phys. Rev. Lett.*, **102**, 110502. doi:[10.1103/physrevlett.102.110502](#). arXiv:[0811.4262](#).
- [371] Ebadi, S., Wang, T. T., Levine, H., et al. (2021). Quantum phases of matter on a 256-atom programmable quantum simulator. *Nature*, **595**, 227. doi:[10.1038/s41586-021-03582-4](#). arXiv:[2012.12281](#).
- [372] Edmonds, J. (1965). Paths, trees, and flowers. *Can. J. Math.*, **17**, 449–467. doi:[10.4153/CJM-1965-045-4](#).
- [373] Elben, A., Flammia, S. T., Huang, H.-Y., et al. (2023). The randomized measurement toolbox. *Nat. Rev. Phys.*, **5**, 9–24. doi:[10.1038/s42254-022-00535-2](#). arXiv:[2203.11374](#).
- [374] Elenewski, J. E., Camara, C. M., and Kalev, A. (2024). Prospects for NMR spectral prediction on fault-tolerant quantum computers. arXiv:[2406.09340](#).
- [375] Elfving, V. E., Broer, B. W., Webber, M., et al. (2020). How will quantum computers provide an industrially relevant computational advantage in quantum chemistry? arXiv:[2009.12472](#).

- [376] Elgart, A., and Hagedorn, G. A. (2012). A note on the switching adiabatic theorem. *J. Math. Phys.*, **53**, 102202. doi:[10.1063/1.4748968](https://doi.org/10.1063/1.4748968). arXiv:[1204.2318](https://arxiv.org/abs/1204.2318).
- [377] Engel, A., Smith, G., and Parker, S. E. (2019). Quantum algorithm for the Vlasov equation. *Phys. Rev. A*, **100**, 062315. doi:[10.1103/PhysRevA.100.062315](https://doi.org/10.1103/PhysRevA.100.062315). arXiv:[1907.09418](https://arxiv.org/abs/1907.09418).
- [378] Engineering, S., and (SEAR), A. (2024). *iMessage with PQ3: The new state of the art in quantum-secure messaging at scale*. <https://security.apple.com/blog/imessage-pq3/>, accessed: 2024-06-05.
- [379] Fang, D., Lin, L., and Tong, Y. (2023). Time-marching based quantum solvers for time-dependent linear differential equations. *Quantum*, **7**, 955. doi:[10.22331/q-2023-03-20-955](https://doi.org/10.22331/q-2023-03-20-955). arXiv:[2208.06941](https://arxiv.org/abs/2208.06941).
- [380] Farhi, E., and Harrow, A. W. (2016). Quantum supremacy through the quantum approximate optimization algorithm. arXiv:[1602.07674](https://arxiv.org/abs/1602.07674).
- [381] Farhi, E., and Neven, H. (2018). Classification with quantum neural networks on near term processors. arXiv:[1802.06002](https://arxiv.org/abs/1802.06002).
- [382] Farhi, E., Goldstone, J., Gutmann, S., and Sipser, M. (2000). Quantum computation by adiabatic evolution. arXiv:[quant-ph/0001106](https://arxiv.org/abs/quant-ph/0001106).
- [383] Farhi, E., Goldstone, J., Gosset, D., et al. (2009). Quantum adiabatic algorithms, small gaps, and different paths. *Quantum Inf. Comput.*, **11**, 181–214. doi:[10.26421/QIC11.3-4-1](https://doi.org/10.26421/QIC11.3-4-1). arXiv:[0909.4766](https://arxiv.org/abs/0909.4766).
- [384] Farhi, E., Goldstone, J., and Gutmann, S. (2014). A quantum approximate optimization algorithm. arXiv:[1411.4028](https://arxiv.org/abs/1411.4028).
- [385] Farhi, E., Gamarnik, D., and Gutmann, S. (2020). The quantum approximate optimization algorithm needs to see the whole graph: A typical case. arXiv:[2004.09002](https://arxiv.org/abs/2004.09002).
- [386] Farhi, E., Gamarnik, D., and Gutmann, S. (2020). The quantum approximate optimization algorithm needs to see the whole graph: Worst case examples. arXiv:[2005.08747](https://arxiv.org/abs/2005.08747).
- [387] Farrell, R. C., Illa, M., Ciavarella, A. N., and Savage, M. J. (2024). Quantum simulations of hadron dynamics in the Schwinger model using 112 qubits. arXiv:[2401.08044](https://arxiv.org/abs/2401.08044).
- [388] Fawzi, O., Grospellier, A., and Leverrier, A. (2018). Constant overhead quantum fault-tolerance with quantum expander codes. In: *FOCS*. doi:[10.1109/focs.2018.00076](https://doi.org/10.1109/focs.2018.00076). arXiv:[1808.03821](https://arxiv.org/abs/1808.03821).
- [389] Felser, T., Silvi, P., Collura, M., and Montangero, S. (2020). Two-dimensional quantum-link lattice quantum electrodynamics at finite density. *Phys. Rev. X*, **10**, 041040. doi:[10.1103/PhysRevX.10.041040](https://doi.org/10.1103/PhysRevX.10.041040). arXiv:[1911.09693](https://arxiv.org/abs/1911.09693).
- [390] Felser, T., Trenti, M., Sestini, L., et al. (2021). Quantum-inspired machine learning on high-energy physics data. *npj Quant. Inf.*, **7**, 111. doi:[10.1038/s41534-021-00443-w](https://doi.org/10.1038/s41534-021-00443-w). arXiv:[2004.13747](https://arxiv.org/abs/2004.13747).
- [391] Feynman, R. P. (1982). Simulating physics with computers. *Int. J. Th. Phys.*, **21**, 467–488. doi:[10.1007/BF02650179](https://doi.org/10.1007/BF02650179).
- [392] Flannigan, S., Pearson, N., Low, G. H., et al. (2022). Propagation of errors and quantitative quantum simulation with quantum advantage. *Quantum Sci. Technol.*, **7**, 045025. doi:[10.1088/2058-9565/ac88f5](https://doi.org/10.1088/2058-9565/ac88f5). arXiv:[2204.13644](https://arxiv.org/abs/2204.13644).

- [393] Focardi, S., Fabozzi, F. J., and Mazza, D. (2020). Quantum option pricing and quantum finance. *J. Deriv.*, **28**, 79–98. doi:[10.3905/jod.2020.1.111](https://doi.org/10.3905/jod.2020.1.111).
- [394] Fomichev, S., Hejazi, K., Zini, M. S., et al. (2024). Initial state preparation for quantum chemistry on quantum computers. *PRX Quantum*, **5**, 040339. doi:[10.1103/PRXQuantum.5.040339](https://doi.org/10.1103/PRXQuantum.5.040339). arXiv:[2310.18410](https://arxiv.org/abs/2310.18410).
- [395] Fomichev, S., Hejazi, K., Loaiza, I., et al. (2024). Simulating X-ray absorption spectroscopy of battery materials on a quantum computer. arXiv:[2405.11015](https://arxiv.org/abs/2405.11015).
- [396] Fontana, E., Herman, D., Chakrabarti, S., et al. (2024). Characterizing barren plateaus in quantum ansätze with the adjoint representation. *Nat. Commun.*, **15**, 7171. doi:[10.1038/s41467-024-49910-w](https://doi.org/10.1038/s41467-024-49910-w). arXiv:[2309.07902](https://arxiv.org/abs/2309.07902).
- [397] Fowler, A. G., and Gidney, C. (2018). Low overhead quantum computation using lattice surgery. arXiv:[1808.06709](https://arxiv.org/abs/1808.06709).
- [398] Fowler, A. G., Mariantoni, M., Martinis, J. M., and Cleland, A. N. (2012). Surface codes: Towards practical large-scale quantum computation. *Phys. Rev. A*, **86**, 032324. doi:[10.1103/PhysRevA.86.032324](https://doi.org/10.1103/PhysRevA.86.032324). arXiv:[1208.0928](https://arxiv.org/abs/1208.0928).
- [399] Fradkin, E., Kivelson, S. A., and Tranquada, J. M. (2015). Colloquium: Theory of intertwined orders in high temperature superconductors. *Rev. Mod. Phys.*, **87**, 457–482. doi:[10.1103/RevModPhys.87.457](https://doi.org/10.1103/RevModPhys.87.457). arXiv:[1407.4480](https://arxiv.org/abs/1407.4480).
- [400] França, D. S., and Garcia-Patron, R. (2021). Limitations of optimization algorithms on noisy quantum devices. *Nat. Phys.*, **17**, 1221–1227. doi:[10.1038/s41567-021-01356-3](https://doi.org/10.1038/s41567-021-01356-3). arXiv:[2009.05532](https://arxiv.org/abs/2009.05532).
- [401] Franz, M., and Rozali, M. (2018). Mimicking black hole event horizons in atomic and solid-state systems. *Nat. Rev. Mater.*, **3**, 491–501. doi:[10.1038/s41578-018-0058-z](https://doi.org/10.1038/s41578-018-0058-z). arXiv:[1808.00541](https://arxiv.org/abs/1808.00541).
- [402] Fraxanet, J., Salamon, T., and Lewenstein, M. (2023). The coming decades of quantum simulation. Pages 85–125 of: *Sketches of Physics: The Celebration Collection*. doi:[10.1007/978-3-031-32469-7_4](https://doi.org/10.1007/978-3-031-32469-7_4). arXiv:[2204.08905](https://arxiv.org/abs/2204.08905).
- [403] Friedman, J. (1998). Computing Betti numbers via combinatorial Laplacians. *Algorithmica*, **21**, 331–346. doi:[10.1007/PL00009218](https://doi.org/10.1007/PL00009218).
- [404] Funcke, L., Hartung, T., Jansen, K., and Kühn, S. (2023). Review on quantum computing for lattice field theory. Page 228 of: *LATTICE*, vol. 430. doi:[10.22323/1.430.0228](https://doi.org/10.22323/1.430.0228). arXiv:[2302.00467](https://arxiv.org/abs/2302.00467).
- [405] Gaitan, F. (2020). Finding flows of a Navier–Stokes fluid through quantum computing. *npj Quant. Inf.*, **6**, 61. doi:[10.1038/s41534-020-00291-0](https://doi.org/10.1038/s41534-020-00291-0).
- [406] Gaitan, F. (2021). Finding solutions of the Navier–Stokes equations through quantum computing—recent progress, a generalization, and next steps forward. *Adv. Quantum Technol.*, **4**, 2100055. doi:[10.1002/qute.202100055](https://doi.org/10.1002/qute.202100055).
- [407] García-Álvarez, L., Egusquiza, I. L., Lamata, L., et al. (2017). Digital quantum simulation of minimal AdS/CFT. *Phys. Rev. Lett.*, **119**, 040501. doi:[10.1103/PhysRevLett.119.040501](https://doi.org/10.1103/PhysRevLett.119.040501). arXiv:[1607.08560](https://arxiv.org/abs/1607.08560).
- [408] García-García, A. M., and Verbaarschot, J. J. M. (2016). Spectral and thermodynamic properties of the Sachdev–Ye–Kitaev model. *Phys. Rev. D*, **94**, 126010. doi:[10.1103/PhysRevD.94.126010](https://doi.org/10.1103/PhysRevD.94.126010). arXiv:[1610.03816](https://arxiv.org/abs/1610.03816).
- [409] Garg, A., Kothari, R., Netrapalli, P., and Sherif, S. (2021). Near-optimal lower bounds for convex optimization for all orders of smoothness. Pages 29874–29884 of: *NeurIPS*, vol. 34. arXiv:[2112.01118](https://arxiv.org/abs/2112.01118).

- [410] Garg, A., Kothari, R., Netrapalli, P., and Sherif, S. (2021). No quantum speedup over gradient descent for non-smooth convex optimization. Pages 53:1–53:20 of: *ITCS*, vol. 185. doi:[10.4230/LIPICs.ITCS.2021.53](https://doi.org/10.4230/LIPICs.ITCS.2021.53). arXiv:[2010.01801](https://arxiv.org/abs/2010.01801).
- [411] Ge, Y., Molnár, A., and Cirac, J. I. (2016). Rapid adiabatic preparation of injective projected entangled pair states and Gibbs states. *Phys. Rev. Lett.*, **116**, 080503. doi:[10.1103/PhysRevLett.116.080503](https://doi.org/10.1103/PhysRevLett.116.080503). arXiv:[1508.00570](https://arxiv.org/abs/1508.00570).
- [412] Ge, Y., Tura, J., and Cirac, J. I. (2019). Faster ground state preparation and high-precision ground energy estimation with fewer qubits. *J. Math. Phys.*, **60**, 022202. doi:[10.1063/1.5027484](https://doi.org/10.1063/1.5027484). arXiv:[1712.03193](https://arxiv.org/abs/1712.03193).
- [413] Gehrman, T., and Malaescu, B. (2022). Precision QCD physics at the LHC. *Annu. Rev. Nucl. Part. Sci.*, **72**, 233–258. doi:[10.1146/annurev-nucl-101920-014923](https://doi.org/10.1146/annurev-nucl-101920-014923). arXiv:[2111.02319](https://arxiv.org/abs/2111.02319).
- [414] Gentinetta, G., Sutter, D., Zoufal, C., et al. (2023). Quantum kernel alignment with stochastic gradient descent. Pages 256–262 of: *QCE*, vol. 01. doi:[10.1109/QCE57702.2023.00036](https://doi.org/10.1109/QCE57702.2023.00036). arXiv:[2304.09899](https://arxiv.org/abs/2304.09899).
- [415] Gentinetta, G., Thomsen, A., Sutter, D., and Woerner, S. (2024). The complexity of quantum support vector machines. *Quantum*, **8**, 1225. doi:[10.22331/q-2024-01-11-1225](https://doi.org/10.22331/q-2024-01-11-1225). arXiv:[2203.00031](https://arxiv.org/abs/2203.00031).
- [416] Georges, T. N., Bothe, M., Sünderhauf, C., et al. (2024). Quantum simulations of chemistry in first quantization with any basis set. arXiv:[2408.03145](https://arxiv.org/abs/2408.03145).
- [417] Georgescu, I. M., Ashhab, S., and Nori, F. (2014). Quantum simulation. *Rev. Mod. Phys.*, **86**, 153–185. doi:[10.1103/RevModPhys.86.153](https://doi.org/10.1103/RevModPhys.86.153). arXiv:[1308.6253](https://arxiv.org/abs/1308.6253).
- [418] Gharibian, S. (2024). *Quantum complexity theory*. https://groups.uni-paderborn.de/fg-qi/data/QCT_Masterfile.pdf, accessed: 2024-11-19.
- [419] Gharibian, S., and Le Gall, F. (2022). Dequantizing the quantum singular value transformation: Hardness and applications to quantum chemistry and the quantum PCP conjecture. Pages 19–32 of: *STOC*. doi:[10.1145/3519935.3519991](https://doi.org/10.1145/3519935.3519991). arXiv:[2111.09079](https://arxiv.org/abs/2111.09079).
- [420] Gibbs, J., Gili, K., Holmes, Z., et al. (2022). Long-time simulations for fixed input states on quantum hardware. *npj Quant. Inf.*, **8**, 135. doi:[10.1038/s41534-022-00625-0](https://doi.org/10.1038/s41534-022-00625-0). arXiv:[2102.04313](https://arxiv.org/abs/2102.04313).
- [421] Gidney, C. (2018). Halving the cost of quantum addition. *Quantum*, **2**, 74. doi:[10.22331/q-2018-06-18-74](https://doi.org/10.22331/q-2018-06-18-74). arXiv:[1709.06648](https://arxiv.org/abs/1709.06648).
- [422] Gidney, C. (2021). Stim: A fast stabilizer circuit simulator. *Quantum*, **5**, 497. doi:[10.22331/q-2021-07-06-497](https://doi.org/10.22331/q-2021-07-06-497). arXiv:[2103.02202](https://arxiv.org/abs/2103.02202).
- [423] Gidney, C. (2024). Inplace access to the surface code Y basis. *Quantum*, **8**, 1310. doi:[10.22331/q-2024-04-08-1310](https://doi.org/10.22331/q-2024-04-08-1310). arXiv:[2302.07395](https://arxiv.org/abs/2302.07395).
- [424] Gidney, C., and Ekerå, M. (2021). How to factor 2048 bit RSA integers in 8 hours using 20 million noisy qubits. *Quantum*, **5**, 433. doi:[10.22331/q-2021-04-15-433](https://doi.org/10.22331/q-2021-04-15-433). arXiv:[1905.09749](https://arxiv.org/abs/1905.09749).
- [425] Gil-Fuster, E., Eisert, J., and Dunjko, V. (2023). On the expressivity of embedding quantum kernels. *Mach. Learn.: Sci. Technol.*, **5**, 025003. doi:[10.1088/2632-2153/ad2f51](https://doi.org/10.1088/2632-2153/ad2f51). arXiv:[2309.14419](https://arxiv.org/abs/2309.14419).

- [426] Giles, M. B. (2015). Multilevel Monte Carlo methods. *Acta Numer.*, **24**, 259–328. doi:[10.1017/S096249291500001X](https://doi.org/10.1017/S096249291500001X). arXiv:[1304.5472](https://arxiv.org/abs/1304.5472).
- [427] Gilyén, A. (2014). *Quantum walk based search methods and algorithmic applications*. Master's thesis, Eötvös Loránd University.
- [428] Gilyén, A. (2019). *Quantum singular value transformation & its algorithmic applications*. PhD thesis, University of Amsterdam.
- [429] Gilyén, A., Su, Y., Low, G. H., and Wiebe, N. (2018). Quantum singular value transformation and beyond: Exponential improvements for quantum matrix arithmetics [full version]. arXiv:[1806.01838](https://arxiv.org/abs/1806.01838).
- [430] Gilyén, A., Arunachalam, S., and Wiebe, N. (2019). Optimizing quantum optimization algorithms via faster quantum gradient computation. Pages 1425–1444 of: *SODA*. doi:[10.1137/1.9781611975482.87](https://doi.org/10.1137/1.9781611975482.87). arXiv:[1711.00465](https://arxiv.org/abs/1711.00465).
- [431] Gilyén, A., Su, Y., Low, G. H., and Wiebe, N. (2019). Quantum singular value transformation and beyond: Exponential improvements for quantum matrix arithmetics. Pages 193–204 of: *STOC*. doi:[10.1145/3313276.3316366](https://doi.org/10.1145/3313276.3316366). arXiv:[1806.01838](https://arxiv.org/abs/1806.01838).
- [432] Gilyén, A., Hastings, M. B., and Vazirani, U. (2021). (Sub)Exponential advantage of adiabatic quantum computation with no sign problem. Pages 1357–1369 of: *STOC*. doi:[10.1145/3406325.3451060](https://doi.org/10.1145/3406325.3451060). arXiv:[2011.09495](https://arxiv.org/abs/2011.09495).
- [433] Gilyén, A., Song, Z., and Tang, E. (2022). An improved quantum-inspired algorithm for linear regression. *Quantum*, **6**, 754. doi:[10.22331/q-2022-06-30-754](https://doi.org/10.22331/q-2022-06-30-754). arXiv:[2009.07268](https://arxiv.org/abs/2009.07268).
- [434] Giovannetti, V., Lloyd, S., and Maccone, L. (2008). Quantum random access memory. *Phys. Rev. Lett.*, **100**, 160501. doi:[10.1103/PhysRevLett.100.160501](https://doi.org/10.1103/PhysRevLett.100.160501). arXiv:[0708.1879](https://arxiv.org/abs/0708.1879).
- [435] Glasserman, P. (2004). *Monte Carlo methods in financial engineering*. Vol. 53. Springer. doi:[10.1007/978-0-387-21617-1](https://doi.org/10.1007/978-0-387-21617-1).
- [436] Glick, J. R., Gujarati, T. P., Córcoles, A. D., et al. (2024). Covariant quantum kernels for data with group structure. *Nat. Phys.*, **20**, 479–483. doi:[10.1038/s41567-023-02340-9](https://doi.org/10.1038/s41567-023-02340-9). arXiv:[2105.03406](https://arxiv.org/abs/2105.03406).
- [437] Goings, J. J., White, A., Lee, J., et al. (2022). Reliably assessing the electronic structure of cytochrome P450 on today's classical computers and tomorrow's quantum computers. *Proc. Natl. Acad. Sci.*, **119**, e2203533119. doi:[10.1073/pnas.2203533119](https://doi.org/10.1073/pnas.2203533119). arXiv:[2202.01244](https://arxiv.org/abs/2202.01244).
- [438] Gondzio, J. (2012). Interior point methods 25 years later. *Eur. J. Oper. Res.*, **218**, 587–601. doi:[10.1016/j.ejor.2011.09.017](https://doi.org/10.1016/j.ejor.2011.09.017).
- [439] Gong, W., Zhang, C., and Li, T. (2022). Robustness of quantum algorithms for nonconvex optimization. arXiv:[2212.02548](https://arxiv.org/abs/2212.02548).
- [440] Gonthier, J. F., Radin, M. D., Buda, C., et al. (2022). Measurements as a roadblock to near-term practical quantum advantage in chemistry: Resource analysis. *Phys. Rev. Res.*, **4**, 033154. doi:[10.1103/PhysRevResearch.4.033154](https://doi.org/10.1103/PhysRevResearch.4.033154).
- [441] Gonzalez-Conde, J., Rodríguez-Rozas, Á., Solano, E., and Sanz, M. (2021). Simulating option price dynamics with exponential quantum speedup. arXiv:[2101.04023](https://arxiv.org/abs/2101.04023).
- [442] Google AI Quantum, Arute, F., Arya, K., et al. (2020). Hartree–Fock on a superconducting qubit quantum computer. *Science*, **369**, 1084–1089. doi:[10.1126/science.abb9811](https://doi.org/10.1126/science.abb9811). arXiv:[2004.04174](https://arxiv.org/abs/2004.04174).

- [443] Gorman, D. J., Hemmerling, B., Megidish, E., et al. (2018). Engineering vibrationally assisted energy transfer in a trapped-ion quantum simulator. *Phys. Rev. X*, **8**, 011038. doi:[10.1103/PhysRevX.8.011038](https://doi.org/10.1103/PhysRevX.8.011038). arXiv:[1709.04064](https://arxiv.org/abs/1709.04064).
- [444] Gottesman, D. (1996). Class of quantum error-correcting codes saturating the quantum Hamming bound. *Phys. Rev. A*, **54**, 1862–1868. doi:[10.1103/PhysRevA.54.1862](https://doi.org/10.1103/PhysRevA.54.1862). arXiv:[quant-ph/9604038](https://arxiv.org/abs/quant-ph/9604038).
- [445] Gottesman, D. (1998). The Heisenberg representation of quantum computers. arXiv:[quant-ph/9807006](https://arxiv.org/abs/quant-ph/9807006).
- [446] Gottesman, D. (2010). An introduction to quantum error correction and fault-tolerant quantum computation. Pages 13–58 of: *Proceedings of Symposia in Applied Mathematics*, vol. 68. arXiv:[0904.2557](https://arxiv.org/abs/0904.2557).
- [447] Gottesman, D. (2014). Fault-tolerant quantum computation with constant overhead. *Quantum Inf. Comput.*, **14**, 1338–1372. doi:[10.26421/QIC14.15-16-5](https://doi.org/10.26421/QIC14.15-16-5). arXiv:[1310.2984](https://arxiv.org/abs/1310.2984).
- [448] Gottesman, D., and Chuang, I. L. (1999). Demonstrating the viability of universal quantum computation using teleportation and single-qubit operations. *Nature*, **402**, 390–393. doi:[10.1038/46503](https://doi.org/10.1038/46503).
- [449] Gourianov, N., Lubasch, M., Dolgov, S., et al. (2022). A quantum-inspired approach to exploit turbulence structures. *Nat. Comput. Sci.*, **2**, 30–37. doi:[10.1038/s43588-021-00181-1](https://doi.org/10.1038/s43588-021-00181-1). arXiv:[2106.05782](https://arxiv.org/abs/2106.05782).
- [450] Gouzien, E., Ruiz, D., Le Régent, F.-M., et al. (2023). Performance analysis of a repetition cat code architecture: Computing 256-bit elliptic curve logarithm in 9 hours with 126133 cat qubits. *Phys. Rev. Lett.*, **131**, 040602. doi:[10.1103/PhysRevLett.131.040602](https://doi.org/10.1103/PhysRevLett.131.040602). arXiv:[2302.06639](https://arxiv.org/abs/2302.06639).
- [451] Grant, E., Benedetti, M., Cao, S., et al. (2018). Hierarchical quantum classifiers. *npj Quant. Inf.*, **4**, 65. doi:[10.1038/s41534-018-0116-9](https://doi.org/10.1038/s41534-018-0116-9). arXiv:[1804.03680](https://arxiv.org/abs/1804.03680).
- [452] Grant, E., Humble, T. S., and Stump, B. (2021). Benchmarking quantum annealing controls with portfolio optimization. *Phys. Rev. Appl.*, **15**, 014012. doi:[10.1103/PhysRevApplied.15.014012](https://doi.org/10.1103/PhysRevApplied.15.014012). arXiv:[2007.03005](https://arxiv.org/abs/2007.03005).
- [453] Grassl, M., Langenberg, B., Roetteler, M., and Steinwandt, R. (2016). Applying Grover’s algorithm to AES: Quantum resource estimates. Pages 29–43 of: *PQCrypto*. doi:[10.1007/978-3-319-29360-8_3](https://doi.org/10.1007/978-3-319-29360-8_3). arXiv:[1512.04965](https://arxiv.org/abs/1512.04965).
- [454] Gray, J., and Chan, G. K.-L. (2024). Hyperoptimized approximate contraction of tensor networks with arbitrary geometry. *Phys. Rev. X*, **14**, 011009. doi:[10.1103/PhysRevX.14.011009](https://doi.org/10.1103/PhysRevX.14.011009). arXiv:[2206.07044](https://arxiv.org/abs/2206.07044).
- [455] Gray, J., and Kourtis, S. (2021). Hyper-optimized tensor network contraction. *Quantum*, **5**, 410. doi:[10.22331/q-2021-03-15-410](https://doi.org/10.22331/q-2021-03-15-410). arXiv:[2002.01935](https://arxiv.org/abs/2002.01935).
- [456] Greenaway, S., Pol, W., and Sim, S. (2024). A case study against QSVT: Assessment of quantum phase estimation improved by signal processing techniques. arXiv:[2404.01396](https://arxiv.org/abs/2404.01396).
- [457] Griewank, A., and Walther, A. (2008). *Evaluating derivatives: Principles and techniques of algorithmic differentiation*. SIAM. doi:[10.1137/1.9780898717761](https://doi.org/10.1137/1.9780898717761).
- [458] Griffiths, R. B., and Niu, C.-S. (1996). Semiclassical Fourier transform for quantum computation. *Phys. Rev. Lett.*, **76**, 3228. doi:[10.1103/PhysRevLett.76.3228](https://doi.org/10.1103/PhysRevLett.76.3228). arXiv:[quant-ph/9511007](https://arxiv.org/abs/quant-ph/9511007).

- [459] Grigoriadis, M. D., and Khachiyan, L. G. (1995). A sublinear-time randomized approximation algorithm for matrix games. *Oper. Res. Lett.*, **18**, 53–58. doi:[10.1016/0167-6377\(95\)00032-0](https://doi.org/10.1016/0167-6377(95)00032-0).
- [460] Grinko, D., Gacon, J., Zoufal, C., and Woerner, S. (2021). Iterative quantum amplitude estimation. *npj Quant. Inf.*, **7**, 52. doi:[10.1038/s41534-021-00379-1](https://doi.org/10.1038/s41534-021-00379-1). arXiv:[1912.05559](https://arxiv.org/abs/1912.05559).
- [461] Gross, C., and Bloch, I. (2017). Quantum simulations with ultracold atoms in optical lattices. *Science*, **357**, 995–1001. doi:[10.1126/science.aal3837](https://doi.org/10.1126/science.aal3837).
- [462] Gross, D., Liu, Y.-K., Flammia, S. T., et al. (2010). Quantum state tomography via compressed sensing. *Phys. Rev. Lett.*, **105**, 150401. doi:[10.1103/PhysRevLett.105.150401](https://doi.org/10.1103/PhysRevLett.105.150401). arXiv:[0909.3304](https://arxiv.org/abs/0909.3304).
- [463] Grover, L., and Rudolph, T. (2002). Creating superpositions that correspond to efficiently integrable probability distributions. arXiv:[quant-ph/0208112](https://arxiv.org/abs/quant-ph/0208112).
- [464] Grover, L. K. (1996). A fast quantum mechanical algorithm for database search. Pages 212–219 of: *STOC*. doi:[10.1145/237814.237866](https://doi.org/10.1145/237814.237866). arXiv:[quant-ph/9605043](https://arxiv.org/abs/quant-ph/9605043).
- [465] Grover, L. K. (2000). Synthesis of quantum superpositions by quantum computation. *Phys. Rev. Lett.*, **85**, 1334. doi:[10.1103/PhysRevLett.85.1334](https://doi.org/10.1103/PhysRevLett.85.1334).
- [466] Grover, L. K. (2005). Fixed-point quantum search. *Phys. Rev. Lett.*, **95**, 150501. doi:[10.1103/PhysRevLett.95.150501](https://doi.org/10.1103/PhysRevLett.95.150501). arXiv:[quant-ph/0503205](https://arxiv.org/abs/quant-ph/0503205).
- [467] Gu, S., Retzker, A., and Kubica, A. (2023). Fault-tolerant quantum architectures based on erasure qubits. arXiv:[2312.14060](https://arxiv.org/abs/2312.14060).
- [468] Gui, K., Dalzell, A. M., Achille, A., et al. (2024). Spacetime-efficient low-depth quantum state preparation with applications. *Quantum*, **8**, 1257. doi:[10.22331/q-2024-02-15-1257](https://doi.org/10.22331/q-2024-02-15-1257). arXiv:[2303.02131](https://arxiv.org/abs/2303.02131).
- [469] Gunn, S., and Kornerup, N. (2019). Review of a quantum algorithm for Betti numbers. arXiv:[1906.07673](https://arxiv.org/abs/1906.07673).
- [470] Gurobi Optimization. (2024). *Gurobi optimizer reference manual*. Version [11.0](https://www.gurobi.com/versions/11.0/), accessed: 2024-05-09.
- [471] Guta, M., Kahn, J., Kueng, R., and Tropp, J. A. (2020). Fast state tomography with optimal error bounds. *J. Phys. A*, **53**, 204001. doi:[10.1088/1751-8121/ab8111](https://doi.org/10.1088/1751-8121/ab8111). arXiv:[1809.11162](https://arxiv.org/abs/1809.11162).
- [472] Gysbers, P., Hagen, G., Holt, J. D., et al. (2019). Discrepancy between experimental and theoretical β -decay rates resolved from first principles. *Nat. Phys.*, **15**, 428–431. doi:[10.1038/s41567-019-0450-7](https://doi.org/10.1038/s41567-019-0450-7). arXiv:[1903.00047](https://arxiv.org/abs/1903.00047).
- [473] Gyurik, C., and Dunjko, V. (2023). Exponential separations between classical and quantum learners. arXiv:[2306.16028](https://arxiv.org/abs/2306.16028).
- [474] Gyurik, C., Cade, C., and Dunjko, V. (2022). Towards quantum advantage via topological data analysis. *Quantum*, **6**, 855. doi:[10.22331/q-2022-11-10-855](https://doi.org/10.22331/q-2022-11-10-855).
- [475] Gyurik, C., Dunjko, V., et al. (2023). Structural risk minimization for quantum linear classifiers. *Quantum*, **7**, 893. doi:[10.22331/q-2023-01-13-893](https://doi.org/10.22331/q-2023-01-13-893). arXiv:[2105.05566](https://arxiv.org/abs/2105.05566).
- [476] Ha, J., Lee, J., and Heo, J. (2022). Resource analysis of quantum computing with noisy qubits for Shor’s factoring algorithms. *Quantum Inf. Process.*, **21**, 60. doi:[10.1007/s11128-021-03398-1](https://doi.org/10.1007/s11128-021-03398-1).

- [477] Haah, J. (2019). Product decomposition of periodic functions in quantum signal processing. *Quantum*, **3**, 190. doi:[10.22331/q-2019-10-07-190](https://doi.org/10.22331/q-2019-10-07-190). arXiv:[1806.10236](https://arxiv.org/abs/1806.10236).
- [478] Haah, J., Harrow, A. W., Ji, Z., et al. (2017). Sample-optimal tomography of quantum states. *IEEE Trans. Inf. Theory*, **63**, 5628–5641. doi:[10.1109/TIT.2017.2719044](https://doi.org/10.1109/TIT.2017.2719044). arXiv:[1508.01797](https://arxiv.org/abs/1508.01797).
- [479] Haah, J., Hastings, M. B., Kothari, R., and Low, G. H. (2018). Quantum algorithm for simulating real time evolution of lattice Hamiltonians. Pages 350–360 of: *FOCS*. doi:[10.1109/FOCS.2018.00041](https://doi.org/10.1109/FOCS.2018.00041). arXiv:[1801.03922](https://arxiv.org/abs/1801.03922).
- [480] Haah, J., Kothari, R., O'Donnell, R., and Tang, E. (2023). Query-optimal estimation of unitary channels in diamond distance. arXiv:[2302.14066](https://arxiv.org/abs/2302.14066).
- [481] Hackbusch, W. (2016). *Iterative solution of large sparse systems of equations*. 2nd edn. Vol. 95. Springer. doi:[10.1007/978-3-319-28483-5](https://doi.org/10.1007/978-3-319-28483-5).
- [482] Hadfield, S., Wang, Z., O'Gorman, B., et al. (2019). From the quantum approximate optimization algorithm to a quantum alternating operator ansatz. *Algorithms*, **12**, 34. doi:[10.3390/a12020034](https://doi.org/10.3390/a12020034). arXiv:[1709.03489](https://arxiv.org/abs/1709.03489).
- [483] Haferkamp, J., Hangleiter, D., Eisert, J., and Gluza, M. (2020). Contracting projected entangled pair states is average-case hard. *Phys. Rev. Res.*, **2**, 013010. doi:[10.1103/PhysRevResearch.2.013010](https://doi.org/10.1103/PhysRevResearch.2.013010). arXiv:[1810.00738](https://arxiv.org/abs/1810.00738).
- [484] Hagan, M., and Wiebe, N. (2022). Composite quantum simulations. arXiv:[2206.06409](https://arxiv.org/abs/2206.06409).
- [485] Hagen, G., Papenbrock, T., Hjorth-Jensen, M., and Dean, D. J. (2014). Coupled-cluster computations of atomic nuclei. *Rep. Prog. Phys.*, **77**, 096302. doi:[10.1088/0034-4885/77/9/096302](https://doi.org/10.1088/0034-4885/77/9/096302). arXiv:[1312.7872](https://arxiv.org/abs/1312.7872).
- [486] Hales, L., and Hallgren, S. (2000). An improved quantum Fourier transform algorithm and applications. Pages 515–525 of: *FOCS*. doi:[10.1109/SFCS.2000.892139](https://doi.org/10.1109/SFCS.2000.892139).
- [487] Halimeh, J. C., Lang, H., Mildenerberger, J., et al. (2021). Gauge-symmetry protection using single-body terms. *PRX Quantum*, **2**, 040311. doi:[10.1103/PRXQuantum.2.040311](https://doi.org/10.1103/PRXQuantum.2.040311). arXiv:[2007.00668](https://arxiv.org/abs/2007.00668).
- [488] Halkier, A., Helgaker, T., Jørgensen, P., et al. (1998). Basis-set convergence in correlated calculations on Ne, N₂, and H₂O. *Chem. Phys. Lett.*, **286**, 243–252. doi:[10.1016/S0009-2614\(98\)00111-0](https://doi.org/10.1016/S0009-2614(98)00111-0).
- [489] Hammer, H.-W., König, S., and van Kolck, U. (2020). Nuclear effective field theory: Status and perspectives. *Rev. Mod. Phys.*, **92**, 025004. doi:[10.1103/RevModPhys.92.025004](https://doi.org/10.1103/RevModPhys.92.025004).
- [490] Hamoudi, Y., and Magniez, F. (2019). Quantum Chebyshev's inequality and applications. Pages 69:1–69:16 of: *ICALP*. doi:[10.4230/LIPIcs.ICALP.2019.69](https://doi.org/10.4230/LIPIcs.ICALP.2019.69). arXiv:[1807.06456](https://arxiv.org/abs/1807.06456).
- [491] Han, J. Y., and Rebertrost, P. (2022). Quantum advantage for multi-option portfolio pricing and valuation adjustments. arXiv:[2203.04924](https://arxiv.org/abs/2203.04924).
- [492] Häner, T., and Steiger, D. S. (2017). 0.5 petabyte simulation of a 45-qubit quantum circuit. In: *SC*. doi:[10.1145/3126908.3126947](https://doi.org/10.1145/3126908.3126947). arXiv:[1704.01127](https://arxiv.org/abs/1704.01127).
- [493] Häner, T., Roetteler, M., and Svore, K. M. (2017). Factoring using $2n + 2$ qubits with Toffoli based modular multiplication. *Quantum Inf. Comput.*, **17**, 673–684. doi:[10.26421/QIC17.7-8-7](https://doi.org/10.26421/QIC17.7-8-7). arXiv:[1611.07995](https://arxiv.org/abs/1611.07995).

- [494] Häner, T., Roetteler, M., and Svore, K. M. (2018). Optimizing quantum circuits for arithmetic. arXiv:1805.12445.
- [495] Häner, T., Jaques, S., Naehrig, M., et al. (2020). Improved quantum circuits for elliptic curve discrete logarithms. Pages 425–444 of: *PQCrypto*. doi:10.1007/978-3-030-44223-1_23. arXiv:2001.09580.
- [496] Hann, C. T., Lee, G., Girvin, S., and Jiang, L. (2021). Resilience of quantum random access memory to generic noise. *PRX Quantum*, **2**, 020311. doi:10.1103/PRXQuantum.2.020311. arXiv:2012.05340.
- [497] Hansen, T. D., Kaplan, H., Zamir, O., and Zwick, U. (2019). Faster k -SAT algorithms using biased-PPSZ. Pages 578–589 of: *STOC*. doi:10.1145/3313276.3316359.
- [498] Harrow, A. W. (2020). Small quantum computers and large classical data sets. arXiv:2004.00026.
- [499] Harrow, A. W., and Wei, A. Y. (2020). Adaptive quantum simulated annealing for Bayesian inference and estimating partition functions. Pages 193–212 of: *SODA*. doi:10.1137/1.9781611975994.12. arXiv:1907.09965.
- [500] Harrow, A. W., Hassidim, A., and Lloyd, S. (2009). Quantum algorithm for linear systems of equations. *Phys. Rev. Lett.*, **103**, 150502. doi:10.1103/PhysRevLett.103.150502. arXiv:0811.3171.
- [501] Hart, O., Gopalakrishnan, S., and Castelnovo, C. (2021). Logarithmic entanglement growth from disorder-free localization in the two-leg compass ladder. *Phys. Rev. Lett.*, **126**, 227202. doi:10.1103/PhysRevLett.126.227202. arXiv:2009.00618.
- [502] Harvey, D., and van der Hoeven, J. (2021). Integer multiplication in time $o(n \log n)$. *Ann. Math.*, **193**, 563–617. doi:10.4007/annals.2021.193.2.4.
- [503] Hastings, M. (2010). *Theoretical computer science stack exchange: The complexity of area-lawed Hamiltonians*. <https://cstheory.stackexchange.com/questions/3083/the-complexity-of-area-lawed-hamiltonians>, accessed: 2024-10-29.
- [504] Hastings, M. B. (2007). An area law for one-dimensional quantum systems. *J. Stat. Mech. Theory Exp.*, **2007**, P08024. doi:10.1088/1742-5468/2007/08/P08024. arXiv:0705.2024.
- [505] Hastings, M. B. (2018). A short path quantum algorithm for exact optimization. *Quantum*, **2**, 78. doi:10.22331/q-2018-07-26-78. arXiv:1802.10124.
- [506] Hastings, M. B. (2018). Weaker assumptions for the short path optimization algorithm. doi:10.48550/arXiv.1807.03758. arXiv:1807.03758.
- [507] Hastings, M. B. (2019). Classical and quantum bounded depth approximation algorithms. arXiv:1905.07047.
- [508] Hastings, M. B. (2019). The short path algorithm applied to a toy model. *Quantum*, **3**, 145. doi:10.22331/q-2019-05-20-145. arXiv:1901.03884.
- [509] Hastings, M. B. (2020). Classical and quantum algorithms for tensor principal component analysis. *Quantum*, **4**, 237. doi:10.22331/q-2020-02-27-237. arXiv:1907.12724.
- [510] Hastings, M. B. (2020). The power of adiabatic quantum computation with no sign problem. arXiv:2005.03791.

- [511] Hastings, M. B., and O'Donnell, R. (2022). Optimizing strongly interacting fermionic Hamiltonians. Pages 776–789 of: *STOC*. doi:[10.1145/3519935.3519960](https://doi.org/10.1145/3519935.3519960). arXiv:[2110.10701](https://arxiv.org/abs/2110.10701).
- [512] Hastings, W. K. (1970). Monte Carlo sampling methods using Markov chains and their applications. *Biometrika*, **57**, 97–109. doi:[10.1093/biomet/57.1.97](https://doi.org/10.1093/biomet/57.1.97).
- [513] Havlíček, V., Córcoles, A. D., Temme, K., et al. (2019). Supervised learning with quantum-enhanced feature spaces. *Nature*, **567**, 209–212. doi:[10.1038/s41586-019-0980-2](https://doi.org/10.1038/s41586-019-0980-2). arXiv:[1804.11326](https://arxiv.org/abs/1804.11326).
- [514] Hayakawa, R. (2022). Quantum algorithm for persistent Betti numbers and topological data analysis. *Quantum*, **6**, 873. doi:[10.22331/q-2022-12-07-873](https://doi.org/10.22331/q-2022-12-07-873). arXiv:[2111.00433](https://arxiv.org/abs/2111.00433).
- [515] Heinrich, S. (2002). Quantum summation with an application to integration. *J. Complex.*, **18**, 1–50. doi:[10.1006/jcom.2001.0629](https://doi.org/10.1006/jcom.2001.0629). arXiv:[quant-ph/0105116](https://arxiv.org/abs/quant-ph/0105116).
- [516] Hejazi, K., Zini, M. S., and Arrazola, J. M. (2024). Better bounds for low-energy product formulas. arXiv:[2402.10362](https://arxiv.org/abs/2402.10362).
- [517] Hen, I., and Young, A. P. (2011). Exponential complexity of the quantum adiabatic algorithm for certain satisfiability problems. *Phys. Rev. E*, **84**, 061152. doi:[10.1103/PhysRevE.84.061152](https://doi.org/10.1103/PhysRevE.84.061152). arXiv:[1109.6872](https://arxiv.org/abs/1109.6872).
- [518] Henderson, J. M., Podzorova, M., Cerezo, M., et al. (2023). Quantum algorithms for geologic fracture networks. *Sci. Rep.*, **13**, 2906. doi:[10.1038/s41598-023-29643-4](https://doi.org/10.1038/s41598-023-29643-4). arXiv:[2210.11685](https://arxiv.org/abs/2210.11685).
- [519] Hensel, F., Moor, M., and Rieck, B. (2021). A survey of topological machine learning methods. *Front. Artif. Intell.*, **4**, 681108. doi:[10.3389/frai.2021.681108](https://doi.org/10.3389/frai.2021.681108).
- [520] Henstra, F. (2023). *The multiplicative weights method in quantum computing*. Master's thesis, Utrecht University.
- [521] Herbert, S. (2021). No quantum speedup with Grover–Rudolph state preparation for quantum Monte Carlo integration. *Phys. Rev. E*, **103**, 063302. doi:[10.1103/PhysRevE.103.063302](https://doi.org/10.1103/PhysRevE.103.063302). arXiv:[2101.02240](https://arxiv.org/abs/2101.02240).
- [522] Herbert, S. (2022). Quantum Monte Carlo integration: The full advantage in minimal circuit depth. *Quantum*, **6**, 823. doi:[10.22331/q-2022-09-29-823](https://doi.org/10.22331/q-2022-09-29-823). arXiv:[2105.09100](https://arxiv.org/abs/2105.09100).
- [523] Hergert, H. (2020). A guided tour of ab initio nuclear many-body theory. *Front. Phys.*, **8**. doi:[10.3389/fphy.2020.00379](https://doi.org/10.3389/fphy.2020.00379). arXiv:[2008.05061](https://arxiv.org/abs/2008.05061).
- [524] Herman, D., Shaydulin, R., Sun, Y., et al. (2022). Portfolio optimization via quantum Zeno dynamics on a quantum processor. arXiv:[2209.15024](https://arxiv.org/abs/2209.15024).
- [525] Herman, D., Googin, C., Liu, X., et al. (2023). Quantum computing for finance. *Nat. Rev. Phys.*, **5**, 450–465. doi:[10.1038/s42254-023-00603-1](https://doi.org/10.1038/s42254-023-00603-1). arXiv:[2201.02773](https://arxiv.org/abs/2201.02773).
- [526] Hertli, T. (2014). 3-SAT faster and simpler—Unique-SAT bounds for PPSZ hold in general. *SIAM J. Comp.*, **43**, 718–729. doi:[10.1137/120868177](https://doi.org/10.1137/120868177). arXiv:[1103.2165](https://arxiv.org/abs/1103.2165).
- [527] Hestenes, M. R., and Stiefel, E. (1952). Methods of conjugate gradients for solving linear systems. *J. Res. Natl. Bur. Stand.*, **49**, 409–435.

- [528] Higgott, O. (2022). Pymatching: A Python package for decoding quantum codes with minimum-weight perfect matching. *ACM Trans. Quantum Comput.*, **3**. doi:[10.1145/3505637](https://doi.org/10.1145/3505637). arXiv:[2105.13082](https://arxiv.org/abs/2105.13082).
- [529] Higgott, O., and Gidney, C. (2023). Sparse blossom: Correcting a million errors per core second with minimum-weight matching. arXiv:[2303.15933](https://arxiv.org/abs/2303.15933).
- [530] Higgott, O., Bohdanowicz, T. C., Kubica, A., et al. (2023). Improved decoding of circuit noise and fragile boundaries of tailored surface codes. *Phys. Rev. X*, **13**, 031007. doi:[10.1103/PhysRevX.13.031007](https://doi.org/10.1103/PhysRevX.13.031007). arXiv:[2203.04948](https://arxiv.org/abs/2203.04948).
- [531] Hinton, G. E. (2002). Training products of experts by minimizing contrastive divergence. *Neural Comput.*, **14**, 1771–1800. doi:[10.1162/089976602760128018](https://doi.org/10.1162/089976602760128018).
- [532] Hoeffler, T., Häner, T., and Troyer, M. (2023). Disentangling hype from practicality: On realistically achieving quantum advantage. *Commun. ACM*, **66**, 82–87. doi:[10.1145/3571725](https://doi.org/10.1145/3571725).
- [533] Hogben, H., Krzystyniak, M., Charnock, G., et al. (2011). Spinach—a software library for simulation of spin dynamics in large spin systems. *J. Magn. Reson.*, **208**, 179–194. doi:[10.1016/j.jmr.2010.11.008](https://doi.org/10.1016/j.jmr.2010.11.008).
- [534] Holmes, Z., Sharma, K., Cerezo, M., and Coles, P. J. (2022). Connecting ansatz expressibility to gradient magnitudes and barren plateaus. *PRX Quantum*, **3**, 010313. doi:[10.1103/PRXQuantum.3.010313](https://doi.org/10.1103/PRXQuantum.3.010313). arXiv:[2101.02138](https://arxiv.org/abs/2101.02138).
- [535] Horsman, D., Fowler, A. G., Devitt, S., and Meter, R. V. (2012). Surface code quantum computing by lattice surgery. *New J. Phys.*, **14**, 123011. doi:[10.1088/1367-2630/14/12/123011](https://doi.org/10.1088/1367-2630/14/12/123011). arXiv:[1111.4022](https://arxiv.org/abs/1111.4022).
- [536] Hoyle, D., and Rattay, M. (2003). PCA learning for sparse high-dimensional data. *Europhys. Lett.*, **62**, 117. doi:[10.1209/epl/i2003-00370-1](https://doi.org/10.1209/epl/i2003-00370-1).
- [537] Huang, B., Jiang, S., Song, Z., et al. (2022). A faster quantum algorithm for semidefinite programming via robust IPM framework. arXiv:[2207.11154](https://arxiv.org/abs/2207.11154).
- [538] Huang, B., Jiang, S., Song, Z., et al. (2022). Solving SDP faster: A robust IPM framework and efficient implementation. Pages 233–244 of: *FOCS*. doi:[10.1109/FOCS54457.2022.00029](https://doi.org/10.1109/FOCS54457.2022.00029). arXiv:[2101.08208](https://arxiv.org/abs/2101.08208).
- [539] Huang, B., Chen, Y.-T., Gupt, B., et al. (2024). Evaluating a quantum-classical quantum Monte Carlo algorithm with matchgate shadows. arXiv:[2404.18303](https://arxiv.org/abs/2404.18303).
- [540] Huang, H.-Y., Kueng, R., and Preskill, J. (2020). Predicting many properties of a quantum system from very few measurements. *Nat. Phys.*, **16**, 1050–1057. doi:[10.1038/s41567-020-0932-7](https://doi.org/10.1038/s41567-020-0932-7). arXiv:[2002.08953](https://arxiv.org/abs/2002.08953).
- [541] Huang, H.-Y., Bharti, K., and Rebentrost, P. (2021). Near-term quantum algorithms for linear systems of equations with regression loss functions. *New J. Phys.*, **23**, 113021. doi:[10.1088/1367-2630/ac325f](https://doi.org/10.1088/1367-2630/ac325f). arXiv:[1909.07344](https://arxiv.org/abs/1909.07344).
- [542] Huang, H.-Y., Broughton, M., Mohseni, M., et al. (2021). Power of data in quantum machine learning. *Nat. Commun.*, **12**, 2631. doi:[10.1038/s41467-021-22539-9](https://doi.org/10.1038/s41467-021-22539-9). arXiv:[2011.01938](https://arxiv.org/abs/2011.01938).
- [543] Huang, H.-Y., Broughton, M., Cotler, J., et al. (2022). Quantum advantage in learning from experiments. *Science*, **376**, 1182–1186. doi:[10.1126/science.abn7293](https://doi.org/10.1126/science.abn7293). arXiv:[2112.00778](https://arxiv.org/abs/2112.00778).
- [544] Huang, S., and Brown, K. R. (2021). Between Shor and Steane: A unifying construction for measuring error syndromes. *Phys. Rev. Lett.*, **127**. doi:[10.1103/physrevlett.127.090505](https://doi.org/10.1103/physrevlett.127.090505). arXiv:[2012.15403](https://arxiv.org/abs/2012.15403).

- [545] Huang, Y. (2021). Two-dimensional local Hamiltonian problem with area laws is QMA-complete. *J. Comput. Phys.*, **443**, 110534. doi:[10.1016/j.jcp.2021.110534](https://doi.org/10.1016/j.jcp.2021.110534). Earlier version in *ISIT'20*. arXiv:[1411.6614](https://arxiv.org/abs/1411.6614).
- [546] Hubbard, J., and Flowers, B. H. (1963). Electron correlations in narrow energy bands. *Proc. R. Soc. A*, **276**, 238–257. doi:[10.1098/rspa.1963.0204](https://doi.org/10.1098/rspa.1963.0204).
- [547] Hubregtsen, T., Wierichs, D., Gil-Fuster, E., et al. (2022). Training quantum embedding kernels on near-term quantum computers. *Phys. Rev. A*, **106**, 042431. doi:[10.1103/PhysRevA.106.042431](https://doi.org/10.1103/PhysRevA.106.042431). arXiv:[2105.02276](https://arxiv.org/abs/2105.02276).
- [548] Huggins, W., Patil, P., Mitchell, B., et al. (2019). Towards quantum machine learning with tensor networks. *Quantum Sci. Technol.*, **4**, 024001. doi:[10.1088/2058-9565/aaea94](https://doi.org/10.1088/2058-9565/aaea94). arXiv:[1803.11537](https://arxiv.org/abs/1803.11537).
- [549] Huggins, W. J., Wan, K., McClean, J., et al. (2022). Nearly optimal quantum algorithm for estimating multiple expectation values. *Phys. Rev. Lett.*, **129**, 240501. doi:[10.1103/PhysRevLett.129.240501](https://doi.org/10.1103/PhysRevLett.129.240501). arXiv:[2111.09283](https://arxiv.org/abs/2111.09283).
- [550] Huggins, W. J., O’Gorman, B. A., Rubin, N. C., et al. (2022). Unbiasing fermionic quantum Monte Carlo with a quantum computer. *Nature*, **603**, 416–420. doi:[10.1038/s41586-021-04351-z](https://doi.org/10.1038/s41586-021-04351-z). arXiv:[2106.16235](https://arxiv.org/abs/2106.16235).
- [551] Huggins, W. J., Leimkuhler, O., Stetina, T. F., and Whaley, K. B. (2024). Efficient state preparation for the quantum simulation of molecules in first quantization. arXiv:[2407.00249](https://arxiv.org/abs/2407.00249).
- [552] Huh, J. (2011). *Unified description of vibronic transitions with coherent states*. PhD thesis, Johann Wolfgang Goethe-Universität.
- [553] Huh, J., Guerreschi, G. G., Peropadre, B., et al. (2015). Boson sampling for molecular vibronic spectra. *Nat. Photonics*, **9**, 615–620. doi:[10.1038/nphoton.2015.153](https://doi.org/10.1038/nphoton.2015.153). arXiv:[1412.8427](https://arxiv.org/abs/1412.8427).
- [554] Hull, J. (2017). *Options, futures, and other derivatives*. Pearson.
- [555] Hunter-Jones, N. R. (2018). *Chaos and randomness in strongly-interacting quantum systems*. PhD thesis, California Institute of Technology. doi:[10.7907/BHZ5-HV76](https://doi.org/10.7907/BHZ5-HV76).
- [556] Huyghebaert, J., and Raedt, H. D. (1990). Product formula methods for time-dependent Schrodinger problems. *J. Phys. A*, **23**, 5777. doi:[10.1088/0305-4470/23/24/019](https://doi.org/10.1088/0305-4470/23/24/019).
- [557] Iijima, N., Imamura, S., Morita, M., et al. (2023). Towards accurate quantum chemical calculations on noisy quantum computers. arXiv:[2311.09634](https://arxiv.org/abs/2311.09634).
- [558] Impagliazzo, R., Paturi, R., and Zane, F. (2001). Which problems have strongly exponential complexity? *J. Comput. Syst. Sci.*, **63**, 512–530. doi:[10.1006/jcss.2001.1774](https://doi.org/10.1006/jcss.2001.1774).
- [559] Information Technology Laboratory. (2001). *Advanced Encryption Standard (AES)*. Tech. rept. [FIPS 197](https://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.197-upd1.pdf). National Institute of Standards and Technology, Gaithersburg, MD. doi:[10.6028/NIST.FIPS.197-upd1](https://doi.org/10.6028/NIST.FIPS.197-upd1).
- [560] Itani, W., Sreenivasan, K. R., and Succi, S. (2023). Quantum algorithm for lattice Boltzmann (QALB) simulation of incompressible fluids with a nonlinear collision term. arXiv:[2304.05915](https://arxiv.org/abs/2304.05915).
- [561] Ivanov, A. V., Sünderhauf, C., Holzmann, N., et al. (2023). Quantum computation for periodic solids in second quantization. *Phys. Rev. Res.*, **5**, 013200. doi:[10.1103/PhysRevResearch.5.013200](https://doi.org/10.1103/PhysRevResearch.5.013200). arXiv:[2210.02403](https://arxiv.org/abs/2210.02403).

- [562] Ivanov, A. V., Patterson, A., Bothe, M., et al. (2024). Quantum computation of electronic structure with projector augmented-wave method and plane wave basis set. arXiv:[2408.03159](#).
- [563] Iyer, P., and Poulin, D. (2015). Hardness of decoding quantum stabilizer codes. *IEEE Trans. Inf. Theory*, **61**, 5209–5223. doi:[10.1109/TIT.2015.2422294](#). arXiv:[1310.3235](#).
- [564] Iyer, P., and Poulin, D. (2018). A small quantum computer is needed to optimize fault-tolerant protocols. *Quantum Sci. Technol.*, **3**, 030504. doi:[10.1088/2058-9565/aab73c](#). arXiv:[1711.04736](#).
- [565] Jackson, A., Kapourniotis, T., and Datta, A. (2023). Partition-function estimation: Quantum and quantum-inspired algorithms. *Phys. Rev. A*, **107**, 012421. doi:[10.1103/PhysRevA.107.012421](#). arXiv:[2208.00930](#).
- [566] Jang, K., Baksi, A., Kim, H., et al. (2024). Quantum analysis of AES. Pages 51–90 of: *Implementation and Analysis of Ciphers in Quantum Computing*. doi:[10.1007/978-981-97-0025-7](#). ePrint:[2022/683](#).
- [567] Jansen, S., Ruskai, M.-B., and Seiler, R. (2007). Bounds for the adiabatic approximation with applications to quantum computation. *J. Math. Phys.*, **48**, 102111. doi:[10.1063/1.2798382](#). arXiv:[quant-ph/0603175](#).
- [568] Jaques, S., and Rattew, A. G. (2023). QRAM: A survey and critique. arXiv:[2305.10310](#).
- [569] Jarret, M., and Wan, K. (2018). Improved quantum backtracking algorithms using effective resistance estimates. *Phys. Rev. A*, **97**, 022337. doi:[10.1103/PhysRevA.97.022337](#). arXiv:[1711.05295](#).
- [570] Jarret, M., Jordan, S. P., and Lackey, B. (2016). Adiabatic optimization versus diffusion Monte Carlo methods. *Phys. Rev. A*, **94**, 042318. doi:[10.1103/PhysRevA.94.042318](#). arXiv:[1607.03389](#).
- [571] Jennings, D., Lostaglio, M., Lowrie, R. B., et al. (2023). The cost of solving linear differential equations on a quantum computer: Fast-forwarding to explicit resource counts. arXiv:[2309.07881](#).
- [572] Jennings, D., Lostaglio, M., Pallister, S., et al. (2023). Efficient quantum linear solver algorithm with detailed running costs. arXiv:[2305.11352](#).
- [573] Jerbi, S., Gyurik, C., Marshall, S., et al. (2021). Parametrized quantum policies for reinforcement learning. Pages 28362–28375 of: *NeurIPS*. arXiv:[2103.05577](#).
- [574] Jiang, H., Kathuria, T., Lee, Y. T., et al. (2020). A faster interior point method for semidefinite programming. Pages 910–918 of: *FOCS*. doi:[10.1109/FOCS46700.2020.00089](#). arXiv:[2009.10217](#).
- [575] Jiang, H., Lee, Y. T., Song, Z., and Wong, S. C.-W. (2020). An improved cutting plane method for convex optimization, convex-concave games, and its applications. Pages 944–953 of: *STOC*. doi:[10.1145/3357713.3384284](#). arXiv:[2004.04250](#).
- [576] Jiang, Z., Sung, K. J., Kechedzhi, K., et al. (2018). Quantum algorithms to simulate many-body physics of correlated fermions. *Phys. Rev. Appl.*, **9**, 44036. doi:[10.1103/PhysRevApplied.9.044036](#). arXiv:[1711.05395](#).
- [577] Jin, C., Netrapalli, P., and Jordan, M. I. (2018). Accelerated gradient descent escapes saddle points faster than gradient descent. Pages 1042–1085 of: *COLT*, vol. 75. arXiv:[1711.10456](#).

- [578] Jin, S., and Liu, N. (2022). Quantum algorithms for computing observables of nonlinear partial differential equations. *arXiv:2202.07834*.
- [579] Jin, S., Liu, N., and Yu, Y. (2022). Quantum simulation of partial differential equations via Schrödingerisation. *arXiv:2212.13969*.
- [580] Jin, S., Liu, N., and Yu, Y. (2022). Time complexity analysis of quantum difference methods for linear high dimensional and multiscale partial differential equations. *J. Comput. Phys.*, **471**, 111641. doi:[10.1016/j.jcp.2022.111641](https://doi.org/10.1016/j.jcp.2022.111641). *arXiv:2202.04537*.
- [581] Jin, S., Liu, N., and Yu, Y. (2023). Quantum simulation of partial differential equations: Applications and detailed analysis. *Phys. Rev. A*, **108**, 032603. doi:[10.1103/PhysRevA.108.032603](https://doi.org/10.1103/PhysRevA.108.032603). *arXiv:2212.14703*.
- [582] Jochym-O'Connor, T., and Bartlett, S. D. (2016). Stacked codes: Universal fault-tolerant quantum computation in a two-dimensional layout. *Phys. Rev. A*, **93**, 022323. doi:[10.1103/PhysRevA.93.022323](https://doi.org/10.1103/PhysRevA.93.022323). *arXiv:1509.04255*.
- [583] Jochym-O'Connor, T., Kubica, A., and Yoder, T. J. (2018). Disjointness of stabilizer codes and limitations on fault-tolerant logical gates. *Phys. Rev. X*, **8**, 021047. doi:[10.1103/physrevx.8.021047](https://doi.org/10.1103/physrevx.8.021047). *arXiv:1710.07256*.
- [584] Jóczik, S., Zimborás, Z., Majoros, T., and Kiss, A. (2022). A cost-efficient approach towards computational fluid dynamics simulations on quantum devices. *Appl. Sci.*, **12**, 2873. doi:[10.3390/app12062873](https://doi.org/10.3390/app12062873).
- [585] Joó, B., Jung, C., Christ, N. H., et al. (2019). Status and future perspectives for lattice gauge theory calculations to the exascale and beyond. *Eur. Phys. J. A*, **55**, 199. doi:[10.1140/epja/i2019-12919-7](https://doi.org/10.1140/epja/i2019-12919-7). *arXiv:1904.09725*.
- [586] Jordan, S. (2011). *Quantum algorithm zoo*. <https://quantumalgorithmzoo.org/>, accessed: 2024-10-29.
- [587] Jordan, S. P. (2005). Fast quantum algorithm for numerical gradient estimation. *Phys. Rev. Lett.*, **95**, 050501. doi:[10.1103/PhysRevLett.95.050501](https://doi.org/10.1103/PhysRevLett.95.050501). *arXiv:quant-ph/0405146*.
- [588] Jordan, S. P., Lee, K. S. M., and Preskill, J. (2012). Quantum algorithms for quantum field theories. *Science*, **336**, 1130–1133. doi:[10.1126/science.1217069](https://doi.org/10.1126/science.1217069). *arXiv:1111.3633*.
- [589] Jordan, S. P., Krovi, H., Lee, K. S. M., and Preskill, J. (2018). BQP-completeness of scattering in scalar quantum field theory. *Quantum*, **2**, 44. doi:[10.22331/q-2018-01-08-44](https://doi.org/10.22331/q-2018-01-08-44). *arXiv:1703.00454*.
- [590] Joseph, I. (2020). Koopman–von Neumann approach to quantum simulation of nonlinear classical dynamics. *Phys. Rev. Res.*, **2**, 043102. doi:[10.1103/PhysRevResearch.2.043102](https://doi.org/10.1103/PhysRevResearch.2.043102). *arXiv:2003.09980*.
- [591] Kadowaki, T., and Nishimori, H. (1998). Quantum annealing in the transverse Ising model. *Phys. Rev. E*, **58**, 5355–5363. doi:[10.1103/PhysRevE.58.5355](https://doi.org/10.1103/PhysRevE.58.5355). *arXiv:cond-mat/9804280*.
- [592] Kahanamoku-Meyer, G. D., and Yao, N. Y. (2024). Fast quantum integer multiplication with zero ancillas. *arXiv:2403.18006*.
- [593] Kan, A., and Nam, Y. (2021). Lattice quantum chromodynamics and electrodynamics on a universal quantum computer. *arXiv:2107.12769*.
- [594] Kanagawa, M., Hennig, P., Sejdinovic, D., and Sriperumbudur, B. K. (2018). Gaussian processes and kernel methods: A review on connections and equivalences. *arXiv:1807.02582*.

- [595] Kandala, A., Mezzacapo, A., Temme, K., et al. (2017). Hardware-efficient variational quantum eigensolver for small molecules and quantum magnets. *Nature*, **549**, 242–246. doi:[10.1038/nature23879](https://doi.org/10.1038/nature23879). arXiv:[1704.05018](https://arxiv.org/abs/1704.05018).
- [596] Kaneko, K., Miyamoto, K., Takeda, N., and Yoshino, K. (2022). Quantum pricing with a smile: Implementation of local volatility model on quantum computer. *EPJ Quantum Technol.*, **9**, 7. doi:[10.1140/epjqt/s40507-022-00125-2](https://doi.org/10.1140/epjqt/s40507-022-00125-2). arXiv:[2007.01467](https://arxiv.org/abs/2007.01467).
- [597] Kang, M., Nuomin, H., Chowdhury, S. N., et al. (2024). Seeking a quantum advantage with trapped-ion quantum simulations of condensed-phase chemical dynamics. *Nat. Rev. Chem.*, **8**, 340–358. doi:[10.1038/s41570-024-00595-1](https://doi.org/10.1038/s41570-024-00595-1). arXiv:[2305.03156](https://arxiv.org/abs/2305.03156).
- [598] Kaplan, D. B. (2011). Chiral symmetry and lattice fermions. Pages 223–272 of: *Modern perspectives in lattice QCD: Quantum field theory and high performance computing: Lecture notes of the Les Houches Summer School: Volume 93, August 2009*. doi:[10.1093/acprof:oso/9780199691609.003.0004](https://doi.org/10.1093/acprof:oso/9780199691609.003.0004). arXiv:[0912.2560](https://arxiv.org/abs/0912.2560).
- [599] Kaplan, M., Leurent, G., Leverrier, A., and Naya-Plasencia, M. (2016). Breaking symmetric cryptosystems using quantum period finding. Pages 207–237 of: *CRYPTO*. doi:[10.1007/978-3-662-53008-5_8](https://doi.org/10.1007/978-3-662-53008-5_8). arXiv:[1602.05973](https://arxiv.org/abs/1602.05973).
- [600] Karamlou, A. H., Simon, W. A., Katabarwa, A., et al. (2021). Analyzing the performance of variational quantum factoring on a superconducting quantum processor. *npj Quant. Inf.*, **7**, 156. doi:[10.1038/s41534-021-00478-z](https://doi.org/10.1038/s41534-021-00478-z). arXiv:[2012.07825](https://arxiv.org/abs/2012.07825).
- [601] Kassal, I., Jordan, S. P., Love, P. J., et al. (2008). Polynomial-time quantum algorithm for the simulation of chemical dynamics. *Proc. Natl. Acad. Sci.*, **105**, 18681–18686. doi:[10.1073/pnas.0808245105](https://doi.org/10.1073/pnas.0808245105). arXiv:[0801.2986](https://arxiv.org/abs/0801.2986).
- [602] Kastoryano, M., and Pancotti, N. (2022). A highly efficient tensor network algorithm for multi-asset Fourier options pricing. arXiv:[2203.02804](https://arxiv.org/abs/2203.02804).
- [603] Kastoryano, M. J., and Brandão, F. G. S. L. (2016). Quantum Gibbs samplers: The commuting case. *Commun. Math. Phys.*, **344**, 915–957. doi:[10.1007/s00220-016-2641-8](https://doi.org/10.1007/s00220-016-2641-8). arXiv:[1409.3435](https://arxiv.org/abs/1409.3435).
- [604] Kattemölle, J., and van Wezel, J. (2022). Variational quantum eigensolver for the Heisenberg antiferromagnet on the kagome lattice. *Phys. Rev. B*, **106**, 214429. doi:[10.1103/PhysRevB.106.214429](https://doi.org/10.1103/PhysRevB.106.214429).
- [605] Katz, J., and Lindell, Y. (2021). *Introduction to modern cryptography: Third edition*. CRC Press.
- [606] Kaye, P., Laflamme, R., and Mosca, M. (2006). *An introduction to quantum computing*. Oxford University Press. doi:[10.1093/oso/9780198570004.001.0001](https://doi.org/10.1093/oso/9780198570004.001.0001).
- [607] Kempe, J., Kitaev, A., and Regev, O. (2006). The complexity of the local Hamiltonian problem. *SIAM J. Comp.*, **35**, 1070–1097. doi:[10.1137/S009753970444522](https://doi.org/10.1137/S009753970444522). Earlier version in *FSTTCS'04*. arXiv:[quant-ph/0406180](https://arxiv.org/abs/quant-ph/0406180).
- [608] Kerenidis, I., and Prakash, A. (2017). Quantum recommendation systems. Pages 49:1–49:21 of: *ITCS*. doi:[10.4230/LIPIcs.ITCS.2017.49](https://doi.org/10.4230/LIPIcs.ITCS.2017.49). arXiv:[1603.08675](https://arxiv.org/abs/1603.08675).

- [609] Kerenidis, I., and Prakash, A. (2020). Quantum gradient descent for linear systems and least squares. *Phys. Rev. A*, **101**, 022316. doi:[10.1103/PhysRevA.101.022316](https://doi.org/10.1103/PhysRevA.101.022316). arXiv:[1704.04992](https://arxiv.org/abs/1704.04992).
- [610] Kerenidis, I., and Prakash, A. (2020). A quantum interior point method for LPs and SDPs. *ACM Trans. Quantum Comput.*, **1**. doi:[10.1145/3406306](https://doi.org/10.1145/3406306). arXiv:[1808.09266](https://arxiv.org/abs/1808.09266).
- [611] Kerenidis, I., Prakash, A., and Szilágyi, D. (2019). Quantum algorithms for portfolio optimization. Pages 147–155 of: *AFT*. doi:[10.1145/3318041.3355465](https://doi.org/10.1145/3318041.3355465). arXiv:[1908.08040](https://arxiv.org/abs/1908.08040).
- [612] Kerenidis, I., Prakash, A., and Szilágyi, D. (2021). Quantum algorithms for second-order cone programming and support vector machines. *Quantum*, **5**, 427. doi:[10.22331/q-2021-04-08-427](https://doi.org/10.22331/q-2021-04-08-427). arXiv:[1908.06720](https://arxiv.org/abs/1908.06720).
- [613] Khatri, S., LaRose, R., Poremba, A., et al. (2019). Quantum-assisted quantum compiling. *Quantum*, **3**, 140. doi:[10.22331/q-2019-05-13-140](https://doi.org/10.22331/q-2019-05-13-140). arXiv:[1807.00800](https://arxiv.org/abs/1807.00800).
- [614] Kieferová, M., and Wiebe, N. (2017). Tomography and generative training with quantum Boltzmann machines. *Phys. Rev. A*, **96**, 062327. doi:[10.1103/PhysRevA.96.062327](https://doi.org/10.1103/PhysRevA.96.062327). arXiv:[1612.05204](https://arxiv.org/abs/1612.05204).
- [615] Kieferová, M., Scherer, A., and Berry, D. W. (2019). Simulating the dynamics of time-dependent Hamiltonians with a truncated Dyson series. *Phys. Rev. A*, **99**, 042314. doi:[10.1103/PhysRevA.99.042314](https://doi.org/10.1103/PhysRevA.99.042314). arXiv:[1805.00582](https://arxiv.org/abs/1805.00582).
- [616] Kim, I. H., and Swingle, B. (2017). Robust entanglement renormalization on a noisy quantum computer. arXiv:[1711.07500](https://arxiv.org/abs/1711.07500).
- [617] Kim, I. H., Liu, Y.-H., Pallister, S., et al. (2022). Fault-tolerant resource estimate for quantum chemical simulations: Case study on Li-ion battery electrolyte molecules. *Phys. Rev. Res.*, **4**, 023019. doi:[10.1103/PhysRevResearch.4.023019](https://doi.org/10.1103/PhysRevResearch.4.023019). arXiv:[2104.10653](https://arxiv.org/abs/2104.10653).
- [618] Kim, S. K., McMahon, P. L., and Olukotun, K. (2010). A large-scale architecture for restricted Boltzmann machines. Pages 201–208 of: *FCCM*. doi:[10.1109/FCCM.2010.38](https://doi.org/10.1109/FCCM.2010.38).
- [619] Kimmel, S., Lin, C. Y.-Y., Low, G. H., et al. (2017). Hamiltonian simulation with optimal sample complexity. *npj Quant. Inf.*, **3**, 13. doi:[10.1038/s41534-017-0013-7](https://doi.org/10.1038/s41534-017-0013-7). arXiv:[1608.00281](https://arxiv.org/abs/1608.00281).
- [620] King, R., and Kohler, T. (2023). Promise clique homology on weighted graphs is QMA₁-hard and contained in QMA. arXiv:[2311.17234](https://arxiv.org/abs/2311.17234).
- [621] Kiss, O., Grossi, M., and Roggero, A. (2023). Importance sampling for stochastic quantum simulations. *Quantum*, **7**, 977. doi:[10.22331/q-2023-04-13-977](https://doi.org/10.22331/q-2023-04-13-977). arXiv:[2212.05952](https://arxiv.org/abs/2212.05952).
- [622] Kitaev, A. (2015). *A simple model of quantum holography*. Video of talk: <https://www.youtube.com/watch?v=wFH1huu9Jcs> (part 1), <https://www.youtube.com/watch?v=q8amZLOE1B0> (part 2), accessed: 2023-09-30.
- [623] Kitaev, A., and Webb, W. A. (2008). Wavefunction preparation and resampling using a quantum computer. arXiv:[0801.0342](https://arxiv.org/abs/0801.0342).
- [624] Kitaev, A. Y. (1995). Quantum measurements and the abelian stabilizer problem. arXiv:[quant-ph/9511026](https://arxiv.org/abs/quant-ph/9511026).

- [625] Kitaev, A. Y. (1997). Quantum computations: Algorithms and error correction. *Russ. Math. Surv.*, **52**, 1191. doi:[10.1070/RM1997v052n06ABEH002155](https://doi.org/10.1070/RM1997v052n06ABEH002155).
- [626] Kitaev, A. Y. (2003). Fault-tolerant quantum computation by anyons. *Ann. Phys.*, **303**, 2–30. doi:[10.1016/S0003-4916\(02\)00018-0](https://doi.org/10.1016/S0003-4916(02)00018-0). arXiv:[quant-ph/9707021](https://arxiv.org/abs/quant-ph/9707021).
- [627] Kitaev, A. Y., Shen, A., Vyalii, M. N., and Vyalii, M. N. (2002). *Classical and quantum computation*. American Mathematical Society.
- [628] Kivlichan, I. D., Wiebe, N., Babbush, R., and Aspuru-Guzik, A. (2017). Bounding the costs of quantum simulation of many-body physics in real space. *J. Phys. A*, **50**, 305301. doi:[10.1088/1751-8121/aa77b8](https://doi.org/10.1088/1751-8121/aa77b8). arXiv:[1608.05696](https://arxiv.org/abs/1608.05696).
- [629] Kivlichan, I. D., McClean, J., Wiebe, N., et al. (2018). Quantum simulation of electronic structure with linear depth and connectivity. *Phys. Rev. Lett.*, **120**, 110501. doi:[10.1103/PhysRevLett.120.110501](https://doi.org/10.1103/PhysRevLett.120.110501). arXiv:[1711.04789](https://arxiv.org/abs/1711.04789).
- [630] Kivlichan, I. D., Gidney, C., Berry, D. W., et al. (2020). Improved fault-tolerant quantum simulation of condensed-phase correlated electrons via Trotterization. *Quantum*, **4**, 296. doi:[10.22331/q-2020-07-16-296](https://doi.org/10.22331/q-2020-07-16-296). arXiv:[1902.10673](https://arxiv.org/abs/1902.10673).
- [631] Klco, N., Dumitrescu, E. F., McCaskey, A. J., et al. (2018). Quantum-classical computation of Schwinger model dynamics using quantum computers. *Phys. Rev. A*, **98**, 032331. doi:[10.1103/PhysRevA.98.032331](https://doi.org/10.1103/PhysRevA.98.032331). arXiv:[1803.03326](https://arxiv.org/abs/1803.03326).
- [632] Klco, N., Roggero, A., and Savage, M. J. (2022). Standard model physics and the digital quantum revolution: Thoughts about the interface. *Rep. Prog. Phys.*, **85**, 064301. doi:[10.1088/1361-6633/ac58a4](https://doi.org/10.1088/1361-6633/ac58a4). arXiv:[2107.04769](https://arxiv.org/abs/2107.04769).
- [633] Knill, E. (2004). Fault-tolerant postselected quantum computation: Schemes. arXiv:[quant-ph/0402171](https://arxiv.org/abs/quant-ph/0402171).
- [634] Knill, E. (2005). Quantum computing with realistically noisy devices. *Nature*, **434**, 39–44. doi:[10.1038/nature03350](https://doi.org/10.1038/nature03350). arXiv:[quant-ph/0410199](https://arxiv.org/abs/quant-ph/0410199).
- [635] Knill, E., and Laflamme, R. (1998). Power of one bit of quantum information. *Phys. Rev. Lett.*, **81**, 5672–5675. doi:[10.1103/PhysRevLett.81.5672](https://doi.org/10.1103/PhysRevLett.81.5672). arXiv:[quant-ph/9802037](https://arxiv.org/abs/quant-ph/9802037).
- [636] Knill, E., Laflamme, R., and Zurek, W. H. (1998). Resilient quantum computation: error models and thresholds. *Proc. R. Soc. A*, **454**, 365–384. doi:[10.1098/rspa.1998.0166](https://doi.org/10.1098/rspa.1998.0166). arXiv:[quant-ph/9702058](https://arxiv.org/abs/quant-ph/9702058).
- [637] Knill, E., Ortiz, G., and Somma, R. D. (2007). Optimal quantum measurements of expectation values of observables. *Phys. Rev. A*, **75**, 012328. doi:[10.1103/PhysRevA.75.012328](https://doi.org/10.1103/PhysRevA.75.012328). arXiv:[quant-ph/0607019](https://arxiv.org/abs/quant-ph/0607019).
- [638] Knysh, S., and Smelyanskiy, V. (2010). On the relevance of avoided crossings away from quantum critical point to the complexity of quantum adiabatic algorithm. doi:[10.48550/arXiv.1005.3011](https://doi.org/10.48550/arXiv.1005.3011). arXiv:[1005.3011](https://arxiv.org/abs/1005.3011).
- [639] Koblitz, N. (1987). Elliptic curve cryptosystems. *Math. Comput.*, **48**, 203–209. doi:[10.2307/2007884](https://doi.org/10.2307/2007884).
- [640] Kogut, J. B. (1979). An introduction to lattice gauge theory and spin systems. *Rev. Mod. Phys.*, **51**, 659–713. doi:[10.1103/RevModPhys.51.659](https://doi.org/10.1103/RevModPhys.51.659).
- [641] Kokail, C., Maier, C., van Bijnen, R., et al. (2019). Self-verifying variational quantum simulation of lattice models. *Nature*, **569**, 355–360. doi:[10.1038/s41586-019-1177-4](https://doi.org/10.1038/s41586-019-1177-4). arXiv:[1810.03421](https://arxiv.org/abs/1810.03421).

- [642] Kothari, R., and O'Donnell, R. (2023). Mean estimation when you have the source code; or, quantum Monte Carlo methods. Pages 1186–1215 of: *SODA*. doi:[10.1137/1.9781611977554.ch44](https://doi.org/10.1137/1.9781611977554.ch44). arXiv:[2208.07544](https://arxiv.org/abs/2208.07544).
- [643] Kovalev, A. A., and Pryadko, L. P. (2013). Fault tolerance of quantum low-density parity check codes with sublinear distance scaling. *Phys. Rev. A*, **87**. doi:[10.1103/physreva.87.020304](https://doi.org/10.1103/physreva.87.020304). arXiv:[1208.2317](https://arxiv.org/abs/1208.2317).
- [644] Kremenetski, V., Mejuto-Zaera, C., Cotton, S. J., and Tubman, N. M. (2021). Simulation of adiabatic quantum computing for molecular ground states. *J. Chem. Phys.*, **155**, 234106. doi:[10.1063/5.0060124](https://doi.org/10.1063/5.0060124). arXiv:[2103.12059](https://arxiv.org/abs/2103.12059).
- [645] Kret, E. (2023). *Quantum resistance and the Signal protocol*. <https://signal.org/blog/pqxdh/>, accessed: 2024-06-05.
- [646] Krovi, H. (2023). Improved quantum algorithms for linear and nonlinear differential equations. *Quantum*, **7**, 913. doi:[10.22331/q-2023-02-02-913](https://doi.org/10.22331/q-2023-02-02-913). arXiv:[2202.01054](https://arxiv.org/abs/2202.01054).
- [647] Kubica, A. (2018). *The ABCs of the color code: A study of topological quantum codes as toy models for fault-tolerant quantum computation and quantum phases of matter*. PhD thesis, Caltech. doi:[10.7907/059V-MG69](https://doi.org/10.7907/059V-MG69).
- [648] Kubica, A., and Beverland, M. E. (2015). Universal transversal gates with color codes: A simplified approach. *Phys. Rev. A*, **91**, 032330. doi:[10.1103/PhysRevA.91.032330](https://doi.org/10.1103/PhysRevA.91.032330). arXiv:[1410.0069](https://arxiv.org/abs/1410.0069).
- [649] Kubica, A., and Delfosse, N. (2023). Efficient color code decoders in $d \geq 2$ dimensions from toric code decoders. *Quantum*, **7**, 929. doi:[10.22331/q-2023-02-21-929](https://doi.org/10.22331/q-2023-02-21-929). arXiv:[1905.07393](https://arxiv.org/abs/1905.07393).
- [650] Kubica, A., and Demkowicz-Dobrzański, R. (2021). Using quantum metrological bounds in quantum error correction: A simple proof of the approximate Eastin–Knill theorem. *Phys. Rev. Lett.*, **126**, 150503. doi:[10.1103/physrevlett.126.150503](https://doi.org/10.1103/physrevlett.126.150503). arXiv:[2004.11893](https://arxiv.org/abs/2004.11893).
- [651] Kubica, A., and Preskill, J. (2019). Cellular-automaton decoders with provable thresholds for topological codes. *Phys. Rev. Lett.*, **123**, 020501. doi:[10.1103/PhysRevLett.123.020501](https://doi.org/10.1103/PhysRevLett.123.020501). arXiv:[1809.10145](https://arxiv.org/abs/1809.10145).
- [652] Kubica, A., and Vasmer, M. (2022). Single-shot quantum error correction with the three-dimensional subsystem toric code. *Nat. Commun.*, **13**, 6272. doi:[10.1038/s41467-022-33923-4](https://doi.org/10.1038/s41467-022-33923-4). arXiv:[2106.02621](https://arxiv.org/abs/2106.02621).
- [653] Kubica, A., Yoshida, B., and Pastawski, F. (2015). Unfolding the color code. *New J. Phys.*, **17**, 083026. doi:[10.1088/1367-2630/17/8/083026](https://doi.org/10.1088/1367-2630/17/8/083026). arXiv:[1503.02065](https://arxiv.org/abs/1503.02065).
- [654] Kubica, A., Haim, A., Vakin, Y., et al. (2023). Erasure qubits: Overcoming the T_1 limit in superconducting circuits. *Phys. Rev. X*, **13**. doi:[10.1103/physrevx.13.041022](https://doi.org/10.1103/physrevx.13.041022). arXiv:[2208.05461](https://arxiv.org/abs/2208.05461).
- [655] Kübler, J., Buchholz, S., and Schölkopf, B. (2021). The inductive bias of quantum kernels. Pages 12661–12673 of: *NeurIPS*. arXiv:[2106.03747](https://arxiv.org/abs/2106.03747).
- [656] Kueng, R., Rauhut, H., and Terstiege, U. (2017). Low rank matrix recovery from rank one measurements. *Appl. Comput. Harmon. Anal.*, **42**, 88–116. doi:[10.1016/j.acha.2015.07.007](https://doi.org/10.1016/j.acha.2015.07.007). arXiv:[1410.6913](https://arxiv.org/abs/1410.6913).
- [657] Labib, F., Clader, B. D., Stamatopoulos, N., and Zeng, W. J. (2024). Quantum amplitude estimation from classical signal processing. arXiv:[2405.14697](https://arxiv.org/abs/2405.14697).

- [658] Lähde, T. A., and Meißner, U.-G. (2019). *Nuclear lattice effective field theory: An introduction*. Vol. 957. Springer.
- [659] Landahl, A. J., and Ryan-Anderson, C. (2014). Quantum computing by color-code lattice surgery. arXiv:1407.5103.
- [660] Lao, L., van Wee, B., Ashraf, I., et al. (2018). Mapping of lattice surgery-based quantum circuits on surface code architectures. *Quantum Sci. Technol.*, **4**, 015005. doi:10.1088/2058-9565/aadd1a. arXiv:1805.11127.
- [661] Lapworth, L. (2022). A hybrid quantum-classical CFD methodology with benchmark HHL solutions. arXiv:2206.00419.
- [662] Larocca, M., Czarnik, P., Sharma, K., et al. (2022). Diagnosing barren plateaus with tools from quantum optimal control. *Quantum*, **6**, 824. doi:10.22331/q-2022-09-29-824. arXiv:2105.14377.
- [663] Larocca, M., Thanasilp, S., Wang, S., et al. (2024). A review of barren plateaus in variational quantum computing. arXiv:2405.00781.
- [664] LaRose, R., and Coyle, B. (2020). Robust data encodings for quantum classifiers. *Phys. Rev. A*, **102**, 032420. doi:10.1103/PhysRevA.102.032420. arXiv:2003.01695.
- [665] Larson, M. G., and Bengzon, F. (2013). *The finite element method: Theory, implementation, and applications*. Vol. 10. Springer Science & Business Media. doi:10.1007/978-3-642-33287-6.
- [666] LeBlanc, J. P. F., Antipov, A. E., Becca, F., et al. (2015). Solutions of the two-dimensional Hubbard model: Benchmarks and results from a wide range of numerical algorithms. *Phys. Rev. X*, **5**, 041041. doi:10.1103/PhysRevX.5.041041. arXiv:1505.02290.
- [667] Lee, D. (2009). Lattice simulations for few- and many-body systems. *Prog. Part. Nuc. Phys.*, **63**, 117–154. doi:10.1016/j.pnpnp.2008.12.001.
- [668] Lee, J., Huggins, W. J., Head-Gordon, M., and Whaley, K. B. (2018). Generalized unitary coupled cluster wave functions for quantum computation. *J. Chem. Theory Comput.*, **15**, 311–324. doi:10.1021/acs.jctc.8b01004. arXiv:1810.02327.
- [669] Lee, J., Berry, D. W., Gidney, C., et al. (2021). Even more efficient quantum computations of chemistry through tensor hypercontraction. *PRX Quantum*, **2**, 030305. doi:10.1103/PRXQuantum.2.030305. arXiv:2011.03494.
- [670] Lee, S., Lee, J., Zhai, H., et al. (2023). Evaluating the evidence for exponential quantum advantage in ground-state quantum chemistry. *Nat. Commun.*, **14**, 1952. doi:10.1038/s41467-023-37587-6. arXiv:2208.02199.
- [671] Lee, Y. T., Sidford, A., and Wong, S. C.-W. (2015). A faster cutting plane method and its implications for combinatorial and convex optimization. Pages 1049–1065 of: *FOCS*. doi:10.1109/FOCS.2015.68. arXiv:1508.04874.
- [672] Lee, Y. T., Sidford, A., and Vempala, S. S. (2018). Efficient convex optimization with membership oracles. Pages 1292–1294 of: *COLT*. arXiv:1706.07357.
- [673] Lemieux, J., Duclos-Cianci, G., Sénéchal, D., and Poulin, D. (2021). Resource estimate for quantum many-body ground-state preparation on a quantum computer. *Phys. Rev. A*, **103**, 052408. doi:10.1103/PhysRevA.103.052408. arXiv:2006.04650.
- [674] Leng, J., Zheng, Y., and Wu, X. (2023). A quantum-classical performance separation in nonconvex optimization. arXiv:2311.00811.

- [675] Leng, J., Hickman, E., Li, J., and Wu, X. (2023). Quantum Hamiltonian descent. arXiv:2303.01471.
- [676] Lenstra, A. K. (2006). Key lengths. In: *Handbook of information security*. <https://infoscience.epfl.ch/handle/20.500.14299/65745>, accessed: 2024-12-01.
- [677] Leong, F. Y., Ewe, W.-B., and Koh, D. E. (2022). Variational quantum evolution equation solver. *Sci. Rep.*, **12**, 10817. doi:10.1038/s41598-022-14906-3. arXiv:2204.02912.
- [678] Leverrier, A., and Zémor, G. (2022). Quantum Tanner codes. Pages 872–883 of: *FOCS*. doi:10.1109/FOCS54457.2022.00117. arXiv:2202.13641.
- [679] Leyton, S. K., and Osborne, T. J. (2008). A quantum algorithm to solve non-linear differential equations. arXiv:0812.4423.
- [680] Li, T., Chakrabarti, S., and Wu, X. (2019). Sublinear quantum algorithms for training linear and kernel-based classifiers. Pages 3815–3824 of: *ICML*, vol. 97. arXiv:1904.02276.
- [681] Li, T., Wang, C., Chakrabarti, S., and Wu, X. 2021 (5). Sublinear classical and quantum algorithms for general matrix games. Pages 8465–8473 of: *AAAI*, vol. 35. doi:10.1609/aaai.v35i10.17028. arXiv:2012.06519.
- [682] Li, X., Govind, N., Isborn, C., et al. (2020). Real-time time-dependent electronic structure theory. *Chem. Rev.*, **120**, 9951–9993. doi:10.1021/acs.chemrev.0c00223.
- [683] Li, X., Yin, X., Wiebe, N., et al. (2023). Potential quantum advantage for simulation of fluid dynamics. arXiv:2303.16550.
- [684] Li, Y., and Benjamin, S. C. (2017). Efficient variational quantum simulator incorporating active error minimization. *Phys. Rev. X*, **7**, 021050. doi:10.1103/PhysRevX.7.021050. arXiv:1611.09301.
- [685] Li, Y., and Neufeld, A. (2023). Quantum Monte Carlo algorithm for solving Black–Scholes PDEs for high-dimensional option pricing in finance and its proof of overcoming the curse of dimensionality. arXiv:2301.09241.
- [686] Lim, D., and Rebertrost, P. (2024). A quantum online portfolio optimization algorithm. *Quantum Inf. Process.*, **23**, 63. doi:10.1007/s11128-024-04256-6. arXiv:2208.14749.
- [687] Lin, L. (2022). Lecture notes on quantum algorithms for scientific computation. arXiv:2201.08309.
- [688] Lin, L., and Tong, Y. (2020). Near-optimal ground state preparation. *Quantum*, **4**, 372. doi:10.22331/q-2020-12-14-372. arXiv:2002.12508.
- [689] Lin, L., and Tong, Y. (2020). Optimal polynomial based quantum eigenstate filtering with application to solving quantum linear systems. *Quantum*, **4**, 361. doi:10.22331/q-2020-11-11-361. arXiv:1910.14596.
- [690] Lin, L., and Tong, Y. (2022). Heisenberg-limited ground-state energy estimation for early fault-tolerant quantum computers. *PRX Quantum*, **3**, 010318. doi:10.1103/PRXQuantum.3.010318. arXiv:2102.11340.
- [691] Linden, N., and de Wolf, R. (2021). Average-case verification of the quantum Fourier transform enables worst-case phase estimation. arXiv:2109.10215.
- [692] Linden, N., Montanaro, A., and Shao, C. (2022). Quantum vs. classical algorithms for solving the heat equation. *Commun. Math. Phys.*, **395**, 601–641. doi:10.1007/s00220-022-04442-6. arXiv:2004.06516.

- [693] Litinski, D. (2019). A game of surface codes: Large-scale quantum computing with lattice surgery. *Quantum*, **3**, 128. doi:[10.22331/q-2019-03-05-128](https://doi.org/10.22331/q-2019-03-05-128). arXiv:[1808.02892](https://arxiv.org/abs/1808.02892).
- [694] Litinski, D. (2019). Magic state distillation: Not as costly as you think. *Quantum*, **3**, 205. doi:[10.22331/q-2019-12-02-205](https://doi.org/10.22331/q-2019-12-02-205). arXiv:[1905.06903](https://arxiv.org/abs/1905.06903).
- [695] Litinski, D. (2023). How to compute a 256-bit elliptic curve private key with only 50 million Toffoli gates. arXiv:[2306.08585](https://arxiv.org/abs/2306.08585).
- [696] Litinski, D., and Nickerson, N. (2022). Active volume: An architecture for efficient fault-tolerant quantum computers with limited non-local connections. arXiv:[2211.15465](https://arxiv.org/abs/2211.15465).
- [697] Littlestone, N. (1988). Learning quickly when irrelevant attributes abound: A new linear-threshold algorithm. *Mach. Learn.*, **2**, 285–318. doi:[10.1007/BF00116827](https://doi.org/10.1007/BF00116827).
- [698] Liu, H., Ong, Y.-S., Shen, X., and Cai, J. (2020). When Gaussian process meets big data: A review of scalable GPs. *IEEE Trans. Neural Netw. Learn. Syst.*, **31**, 4405–4423. doi:[10.1109/TNNLS.2019.2957109](https://doi.org/10.1109/TNNLS.2019.2957109). arXiv:[1807.01065](https://arxiv.org/abs/1807.01065).
- [699] Liu, J., Li, Z., Zheng, H., et al. (2022). Towards a variational Jordan–Lee–Preskill quantum algorithm. *Mach. Learn.: Sci. Technol.*, **3**, 045030. doi:[10.1088/2632-2153/aca06b](https://doi.org/10.1088/2632-2153/aca06b). arXiv:[2109.05547](https://arxiv.org/abs/2109.05547).
- [700] Liu, J., Najafi, K., Sharma, K., et al. (2023). Analytic theory for the dynamics of wide quantum neural networks. *Phys. Rev. Lett.*, **130**, 150601. doi:[10.1103/PhysRevLett.130.150601](https://doi.org/10.1103/PhysRevLett.130.150601). arXiv:[2203.16711](https://arxiv.org/abs/2203.16711).
- [701] Liu, J., Liu, M., Liu, J.-P., et al. (2024). Towards provably efficient quantum algorithms for large-scale machine-learning models. *Nat. Commun.*, **15**, 434. doi:[10.1038/s41467-023-43957-x](https://doi.org/10.1038/s41467-023-43957-x). arXiv:[2303.03428](https://arxiv.org/abs/2303.03428).
- [702] Liu, J.-P., Kolden, H. Ø., Krovi, H. K., et al. (2021). Efficient quantum algorithm for dissipative nonlinear differential equations. *Proc. Natl. Acad. Sci.*, **118**, e2026805118. doi:[10.1073/pnas.2026805118](https://doi.org/10.1073/pnas.2026805118). arXiv:[2011.03185](https://arxiv.org/abs/2011.03185).
- [703] Liu, J.-P., An, D., Fang, D., et al. (2023). Efficient quantum algorithm for nonlinear reaction–diffusion equations and energy estimation. *Commun. Math. Phys.*, **404**, 963–1020. doi:[10.1007/s00220-023-04857-9](https://doi.org/10.1007/s00220-023-04857-9). arXiv:[2205.01141](https://arxiv.org/abs/2205.01141).
- [704] Liu, Y., Arunachalam, S., and Temme, K. (2021). A rigorous and robust quantum speed-up in supervised machine learning. *Nat. Phys.*, **17**, 1013–1017. doi:[10.1038/s41567-021-01287-z](https://doi.org/10.1038/s41567-021-01287-z). arXiv:[2010.02174](https://arxiv.org/abs/2010.02174).
- [705] Lloyd, S. (1996). Universal quantum simulators. *Science*, **273**, 1073–1078. doi:[10.1126/science.273.5278.1073](https://doi.org/10.1126/science.273.5278.1073).
- [706] Lloyd, S. (2018). Quantum approximate optimization is computationally universal. arXiv:[1812.11075](https://arxiv.org/abs/1812.11075).
- [707] Lloyd, S., Mohseni, M., and Rebentrost, P. (2013). Quantum algorithms for supervised and unsupervised machine learning. arXiv:[1307.0411](https://arxiv.org/abs/1307.0411).
- [708] Lloyd, S., Mohseni, M., and Rebentrost, P. (2014). Quantum principal component analysis. *Nat. Phys.*, **10**, 631–633. doi:[10.1038/nphys3029](https://doi.org/10.1038/nphys3029). arXiv:[1307.0401](https://arxiv.org/abs/1307.0401).
- [709] Lloyd, S., Garnerone, S., and Zanardi, P. (2016). Quantum algorithms for topological and geometric analysis of data. *Nat. Commun.*, **7**, 1–7. doi:[10.1038/ncomms10138](https://doi.org/10.1038/ncomms10138). arXiv:[1408.3106](https://arxiv.org/abs/1408.3106).

- [710] Lloyd, S., De Palma, G., Gokler, C., et al. (2020). Quantum algorithm for nonlinear differential equations. *arXiv:2011.06571*.
- [711] Lloyd, S., Schuld, M., Ijaz, A., et al. (2020). Quantum embeddings for machine learning. *arXiv:2001.03622*.
- [712] Loaiza, I., and Izmaylov, A. F. (2024). Majorana tensor decomposition: A unifying framework for decompositions of fermionic Hamiltonians to linear combination of unitaries. *arXiv:2407.06571*.
- [713] Lopes, P. C. F., Pereira, A. M. B., Clua, E. W. G., and Leiderman, R. (2022). A GPU implementation of the PCG method for large-scale image-based finite element analysis in heterogeneous periodic media. *Comput. Methods Appl. Mech. Eng.*, **399**, 115276. doi:[10.1016/j.cma.2022.115276](https://doi.org/10.1016/j.cma.2022.115276).
- [714] Low, G. H. (2019). Hamiltonian simulation with nearly optimal dependence on spectral norm. Pages 491–502 of: *STOC*. doi:[10.1145/3313276.3316386](https://doi.org/10.1145/3313276.3316386). *arXiv:1807.03967*.
- [715] Low, G. H., and Chuang, I. L. (2017). Hamiltonian simulation by uniform spectral amplification. *arXiv:1707.05391*.
- [716] Low, G. H., and Chuang, I. L. (2017). Optimal Hamiltonian simulation by quantum signal processing. *Phys. Rev. Lett.*, **118**, 010501. doi:[10.1103/PhysRevLett.118.010501](https://doi.org/10.1103/PhysRevLett.118.010501). *arXiv:1606.02685*.
- [717] Low, G. H., and Chuang, I. L. (2019). Hamiltonian simulation by qubitization. *Quantum*, **3**, 163. doi:[10.22331/q-2019-07-12-163](https://doi.org/10.22331/q-2019-07-12-163). *arXiv:1610.06546*.
- [718] Low, G. H., and Wiebe, N. (2018). Hamiltonian simulation in the interaction picture. *arXiv:1805.00675*.
- [719] Low, G. H., Yoder, T. J., and Chuang, I. L. (2016). Methodology of resonant equiangular composite quantum gates. *Phys. Rev. X*, **6**, 041067. doi:[10.1103/PhysRevX.6.041067](https://doi.org/10.1103/PhysRevX.6.041067). *arXiv:1603.03996*.
- [720] Low, G. H., Kliuchnikov, V., and Wiebe, N. (2019). Well-conditioned multi-product Hamiltonian simulation. *arXiv:1907.11679*.
- [721] Low, G. H., Su, Y., Tong, Y., and Tran, M. C. (2023). Complexity of implementing Trotter steps. *PRX Quantum*, **4**, 020323. doi:[10.1103/PRXQuantum.4.020323](https://doi.org/10.1103/PRXQuantum.4.020323). *arXiv:2211.09133*.
- [722] Low, G. H., Kliuchnikov, V., and Schaeffer, L. (2024). Trading T gates for dirty qubits in state preparation and unitary synthesis. *Quantum*, **8**, 1375. doi:[10.22331/q-2024-06-17-1375](https://doi.org/10.22331/q-2024-06-17-1375). *arXiv:1812.00954*.
- [723] Lowe, A., and Nayak, A. (2022). Lower bounds for learning quantum states with single-copy measurements. *arXiv:2207.14438*.
- [724] Lu, H.-H., Klco, N., Lukens, J. M., et al. (2019). Simulations of subatomic many-body physics on a quantum frequency processor. *Phys. Rev. A*, **100**, 012320. doi:[10.1103/PhysRevA.100.012320](https://doi.org/10.1103/PhysRevA.100.012320). *arXiv:1810.03959*.
- [725] Lubasch, M., Joo, J., Moinier, P., et al. (2020). Variational quantum algorithms for nonlinear problems. *Phys. Rev. A*, **101**, 010301. doi:[10.1103/PhysRevA.101.010301](https://doi.org/10.1103/PhysRevA.101.010301). *arXiv:1907.09032*.
- [726] Lucas, A. (2014). Ising formulations of many NP problems. *Front. Phys.*, **2**. doi:[10.3389/fphy.2014.00005](https://doi.org/10.3389/fphy.2014.00005). *arXiv:1302.5843*.
- [727] Luo, J., and Li, L. (2024). Circuit complexity of sparse quantum state preparation. *arXiv:2406.16142*.

- [728] Luo, Z., You, Y.-Z., Li, J., et al. (2019). Quantum simulation of the non-Fermi-liquid state of Sachdev–Ye–Kitaev model. *npj Quant. Inf.*, **5**, 53. doi:[10.1038/s41534-019-0166-7](https://doi.org/10.1038/s41534-019-0166-7). arXiv:[1712.06458](https://arxiv.org/abs/1712.06458).
- [729] Luongo, A. (2020). *Quantum algorithms for data analysis*. <https://quantumalgorithms.org>, accessed: 2024-11-19.
- [730] Lusch, B., Kutz, J. N., and Brunton, S. L. (2018). Deep learning for universal linear embeddings of nonlinear dynamics. *Nat. Commun.*, **9**, 4950. doi:[10.1038/s41467-018-07210-0](https://doi.org/10.1038/s41467-018-07210-0). arXiv:[1712.09707](https://arxiv.org/abs/1712.09707).
- [731] Macridin, A., Spentzouris, P., Amundson, J., and Harnik, R. (2018). Digital quantum computation of fermion–boson interacting systems. *Phys. Rev. A*, **98**, 042312. doi:[10.1103/PhysRevA.98.042312](https://doi.org/10.1103/PhysRevA.98.042312). arXiv:[1805.09928](https://arxiv.org/abs/1805.09928).
- [732] Macridin, A., Spentzouris, P., Amundson, J., and Harnik, R. (2018). Electron-phonon systems on a universal quantum computer. *Phys. Rev. Lett.*, **121**, 110504. doi:[10.1103/PhysRevLett.121.110504](https://doi.org/10.1103/PhysRevLett.121.110504). arXiv:[1802.07347](https://arxiv.org/abs/1802.07347).
- [733] Magniez, F., Nayak, A., Roland, J., and Santha, M. (2011). Search via quantum walk. *SIAM J. Comp.*, **40**, 142–164. doi:[10.1137/090745854](https://doi.org/10.1137/090745854). Earlier version in *STOC'07*. arXiv:[quant-ph/0608026](https://arxiv.org/abs/quant-ph/0608026).
- [734] Magnifico, G., Felser, T., Silvi, P., and Montangero, S. (2021). Lattice quantum electrodynamics in (3+1)-dimensions at finite density with tensor networks. *Nat. Commun.*, **12**, 3600. doi:[10.1038/s41467-021-23646-3](https://doi.org/10.1038/s41467-021-23646-3). arXiv:[2011.10658](https://arxiv.org/abs/2011.10658).
- [735] Magnifico, G., Cataldi, G., Rigobello, M., et al. (2024). Tensor networks for lattice gauge theories beyond one dimension: A roadmap. arXiv:[2407.03058](https://arxiv.org/abs/2407.03058).
- [736] Mande, N. S., and de Wolf, R. (2023). Tight bounds for quantum phase estimation and related problems. Pages 81:1–81:16 of: *ESA*, vol. 274. doi:[10.4230/LIPICs.ESA.2023.81](https://doi.org/10.4230/LIPICs.ESA.2023.81). arXiv:[2305.04908](https://arxiv.org/abs/2305.04908).
- [737] Manin, Y. I. (2007). *Mathematics as metaphor: Selected essays of Yuri I. Manin*. Vol. 20. American Mathematical Society.
- [738] Manrique, D. Z., Khan, I. T., Yamamoto, K., et al. (2020). Momentum-space unitary coupled cluster and translational quantum subspace expansion for periodic systems on quantum computers. arXiv:[2008.08694](https://arxiv.org/abs/2008.08694).
- [739] Marino, R., Parisi, G., and Ricci-Tersenghi, F. (2016). The backtracking survey propagation algorithm for solving random k-SAT problems. *Nat. Commun.*, **7**, 12996. doi:[10.1038/ncomms12996](https://doi.org/10.1038/ncomms12996). arXiv:[1508.05117](https://arxiv.org/abs/1508.05117).
- [740] Maris, P., Vary, J. P., Navrátil, P., et al. (2011). Origin of the anomalous long lifetime of ^{14}C . *Phys. Rev. Lett.*, **106**, 202502. doi:[10.1103/PhysRevLett.106.202502](https://doi.org/10.1103/PhysRevLett.106.202502). arXiv:[1101.5124](https://arxiv.org/abs/1101.5124).
- [741] Markov, I. L., and Shi, Y. (2008). Simulating quantum computation by contracting tensor networks. *SIAM J. Comp.*, **38**, 963–981. doi:[10.1137/050644756](https://doi.org/10.1137/050644756). arXiv:[quant-ph/0511069](https://arxiv.org/abs/quant-ph/0511069).
- [742] Marrero, C. O., Kieferová, M., and Wiebe, N. (2021). Entanglement-induced barren plateaus. *PRX Quantum*, **2**, 040316. doi:[10.1103/PRXQuantum.2.040316](https://doi.org/10.1103/PRXQuantum.2.040316). arXiv:[2010.15968](https://arxiv.org/abs/2010.15968).
- [743] Martiel, S., and Remaud, M. (2020). Practical implementation of a quantum backtracking algorithm. Pages 597–606 of: *SOFSEM*. doi:[10.1007/978-3-030-38919-2_49](https://doi.org/10.1007/978-3-030-38919-2_49). arXiv:[1908.11291](https://arxiv.org/abs/1908.11291).

- [744] Martyn, J. M., Rossi, Z. M., Tan, A. K., and Chuang, I. L. (2021). Grand unification of quantum algorithms. *Phys. Rev. X*, **2**, 040203. doi:[10.1103/PRXQuantum.2.040203](https://doi.org/10.1103/PRXQuantum.2.040203). arXiv:[2105.02859](https://arxiv.org/abs/2105.02859).
- [745] Marx, D., and Hutter, J. (2009). *Ab initio molecular dynamics: Basic theory and advanced methods*. Cambridge University Press.
- [746] Maskara, N., Kubica, A., and Jochym-O'Connor, T. (2019). Advantages of versatile neural-network decoding for topological codes. *Phys. Rev. A*, **99**, 052351. doi:[10.1103/PhysRevA.99.052351](https://doi.org/10.1103/PhysRevA.99.052351). arXiv:[1802.08680](https://arxiv.org/abs/1802.08680).
- [747] Mathis, S. V., Mazzola, G., and Tavernelli, I. (2020). Toward scalable simulations of lattice gauge theories on quantum computers. *Phys. Rev. D*, **102**, 094501. doi:[10.1103/PhysRevD.102.094501](https://doi.org/10.1103/PhysRevD.102.094501). arXiv:[2005.10271](https://arxiv.org/abs/2005.10271).
- [748] Matsuzawa, Y., and Kurashige, Y. (2020). Jastrow-type decomposition in quantum chemistry for low-depth quantum circuits. *J. Chem. Theory Comput.*, **16**, 944–952. doi:[10.1021/acs.jctc.9b00963](https://doi.org/10.1021/acs.jctc.9b00963). arXiv:[1909.12410](https://arxiv.org/abs/1909.12410).
- [749] McArdle, S. (2021). Learning from physics experiments with quantum computers: Applications in muon spectroscopy. *PRX Quantum*, **2**, 020349. doi:[10.1103/PRXQuantum.2.020349](https://doi.org/10.1103/PRXQuantum.2.020349). arXiv:[2012.06602](https://arxiv.org/abs/2012.06602).
- [750] McArdle, S., Mayorov, A., Shan, X., et al. (2019). Digital quantum simulation of molecular vibrations. *Chem. Sci.*, **10**, 5725–5735. doi:[10.1039/C9SC01313J](https://doi.org/10.1039/C9SC01313J). arXiv:[1811.04069](https://arxiv.org/abs/1811.04069).
- [751] McArdle, S., Jones, T., Endo, S., et al. (2019). Variational ansatz-based quantum simulation of imaginary time evolution. *npj Quant. Inf.*, **5**, 75. doi:[10.1038/s41534-019-0187-2](https://doi.org/10.1038/s41534-019-0187-2). arXiv:[1804.03023](https://arxiv.org/abs/1804.03023).
- [752] McArdle, S., Endo, S., Aspuru-Guzik, A., et al. (2020). Quantum computational chemistry. *Rev. Mod. Phys.*, **92**, 015003. doi:[10.1103/RevModPhys.92.015003](https://doi.org/10.1103/RevModPhys.92.015003). arXiv:[1808.10402](https://arxiv.org/abs/1808.10402).
- [753] McArdle, S., Campbell, E., and Su, Y. (2022). Exploiting fermion number in factorized decompositions of the electronic structure Hamiltonian. *Phys. Rev. A*, **105**, 012403. doi:[10.1103/PhysRevA.105.012403](https://doi.org/10.1103/PhysRevA.105.012403). arXiv:[2107.07238](https://arxiv.org/abs/2107.07238).
- [754] McArdle, S., Gilyén, A., and Berta, M. (2022). Quantum state preparation without coherent arithmetic. arXiv:[2210.14892](https://arxiv.org/abs/2210.14892).
- [755] McArdle, S., Gilyén, A., and Berta, M. (2022). A streamlined quantum algorithm for topological data analysis with exponentially fewer qubits. arXiv:[2209.12887](https://arxiv.org/abs/2209.12887).
- [756] McClean, J. R., Boixo, S., Smelyanskiy, V. N., et al. (2018). Barren plateaus in quantum neural network training landscapes. *Nat. Commun.*, **9**, 1–6. doi:[10.1038/s41467-018-07090-4](https://doi.org/10.1038/s41467-018-07090-4). arXiv:[1803.11173](https://arxiv.org/abs/1803.11173).
- [757] McKee, C., and Lubasch, M. (2023). Classically optimized Hamiltonian simulation. *Phys. Rev. Res.*, **5**, 023146. doi:[10.1103/PhysRevResearch.5.023146](https://doi.org/10.1103/PhysRevResearch.5.023146). arXiv:[2205.11427](https://arxiv.org/abs/2205.11427).
- [758] McLachlan, A. D. (1964). A variational solution of the time-dependent Schrodinger equation. *Mol. Phys.*, **8**, 39–44. doi:[10.1080/00268976400100041](https://doi.org/10.1080/00268976400100041).
- [759] Meister, R., Benjamin, S. C., and Campbell, E. T. (2022). Tailoring term truncations for electronic structure calculations using a linear combination of unitaries. *Quantum*, **6**, 637. doi:[10.22331/q-2022-02-02-637](https://doi.org/10.22331/q-2022-02-02-637). arXiv:[2007.11624](https://arxiv.org/abs/2007.11624).

- [760] Merton, R. C. (1972). An analytic derivation of the efficient portfolio frontier. *J. Financial Quant. Anal.*, **7**, 1851–1872. doi:[10.2307/2329621](https://doi.org/10.2307/2329621).
- [761] Meurice, Y., Sakai, R., and Unmuth-Yockey, J. (2022). Tensor lattice field theory for renormalization and quantum computing. *Rev. Mod. Phys.*, **94**, 025005. doi:[10.1103/RevModPhys.94.025005](https://doi.org/10.1103/RevModPhys.94.025005). arXiv:[2010.06539](https://arxiv.org/abs/2010.06539).
- [762] Mi, X., Michailidis, A. A., Shabani, S., et al. (2024). Stable quantum-correlated many-body states through engineered dissipation. *Science*, **383**, 1332–1337. doi:[10.1126/science.adh9932](https://doi.org/10.1126/science.adh9932). arXiv:[2304.13878](https://arxiv.org/abs/2304.13878).
- [763] Miller, V. S. (1986). Use of elliptic curves in cryptography. Pages 417–426 of: *CRYPTO*. doi:[10.1007/3-540-39799-X_31](https://doi.org/10.1007/3-540-39799-X_31).
- [764] Milosavljević, N., Morozov, D., and Skraba, P. (2011). Zigzag persistent homology in matrix multiplication time. Pages 216–225 of: *SoCG*. doi:[10.1145/1998196.1998229](https://doi.org/10.1145/1998196.1998229).
- [765] Mischaikow, K., and Nanda, V. (2013). Morse theory for filtrations and efficient computation of persistent homology. *Discrete Comput. Geom.*, **50**, 330–353. doi:[10.1007/s00454-013-9529-6](https://doi.org/10.1007/s00454-013-9529-6).
- [766] Mitarai, K., Negoro, M., Kitagawa, M., and Fujii, K. (2018). Quantum circuit learning. *Phys. Rev. A*, **98**, 032309. doi:[10.1103/PhysRevA.98.032309](https://doi.org/10.1103/PhysRevA.98.032309). arXiv:[1803.00745](https://arxiv.org/abs/1803.00745).
- [767] Miyamoto, K., and Kubo, K. (2021). Pricing multi-asset derivatives by finite-difference method on a quantum computer. *IEEE Trans. Quantum Eng.*, **3**, 1–25. doi:[10.1109/TQE.2021.3128643](https://doi.org/10.1109/TQE.2021.3128643). arXiv:[2109.12896](https://arxiv.org/abs/2109.12896).
- [768] Miyamoto, K., and Shiohara, K. (2020). Reduction of qubits in a quantum algorithm for Monte Carlo simulation by a pseudo-random-number generator. *Phys. Rev. A*, **102**, 022424. doi:[10.1103/PhysRevA.102.022424](https://doi.org/10.1103/PhysRevA.102.022424). arXiv:[1911.12469](https://arxiv.org/abs/1911.12469).
- [769] Mizuta, K. (2023). Optimal/nearly-optimal simulation of multi-periodic time-dependent Hamiltonians. arXiv:[2301.06232](https://arxiv.org/abs/2301.06232).
- [770] Mizuta, K., and Fujii, K. (2023). Optimal Hamiltonian simulation for time-periodic systems. *Quantum*, **7**, 962. doi:[10.22331/q-2023-03-28-962](https://doi.org/10.22331/q-2023-03-28-962). arXiv:[2209.05048](https://arxiv.org/abs/2209.05048).
- [771] Mohammadisiahroudi, M., Fakhimi, R., and Terlaky, T. (2022). Efficient use of quantum linear system algorithms in interior point methods for linear optimization. arXiv:[2205.01220](https://arxiv.org/abs/2205.01220).
- [772] Mohammadisiahroudi, M., Wu, Z., Augustino, B., et al. (2022). Quantum-enhanced regression analysis using state-of-the-art QLSAs and QIPMs. Pages 375–380 of: *SEC*. doi:[10.1109/SEC54971.2022.00055](https://doi.org/10.1109/SEC54971.2022.00055).
- [773] Montanaro, A. (2015). Quantum speedup of Monte Carlo methods. *Proc. R. Soc. A*, **471**. doi:[10.1098/rspa.2015.0301](https://doi.org/10.1098/rspa.2015.0301). arXiv:[1504.06987](https://arxiv.org/abs/1504.06987).
- [774] Montanaro, A. (2016). Quantum algorithms: An overview. *npj Quant. Inf.*, **2**, 15023. doi:[10.1038/npjqi.2015.23](https://doi.org/10.1038/npjqi.2015.23). arXiv:[1511.04206](https://arxiv.org/abs/1511.04206).
- [775] Montanaro, A. (2018). Quantum-walk speedup of backtracking algorithms. *Theory Comput.*, **14**, 1–24. doi:[10.4086/toc.2018.v014a015](https://doi.org/10.4086/toc.2018.v014a015). arXiv:[1509.02374](https://arxiv.org/abs/1509.02374).
- [776] Montanaro, A. (2020). Quantum speedup of branch-and-bound algorithms. *Phys. Rev. Res.*, **2**, 013056. doi:[10.1103/PhysRevResearch.2.013056](https://doi.org/10.1103/PhysRevResearch.2.013056). arXiv:[1906.10375](https://arxiv.org/abs/1906.10375).

- [777] Montanaro, A., and Pallister, S. (2016). Quantum algorithms and the finite element method. *Phys. Rev. A*, **93**, 032324. doi:[10.1103/PhysRevA.93.032324](https://doi.org/10.1103/PhysRevA.93.032324). arXiv:[1512.05903](https://arxiv.org/abs/1512.05903).
- [778] Monteiro, R. D., and Tsuchiya, T. (2000). Polynomial convergence of primal-dual algorithms for the second-order cone program based on the MZ-family of directions. *Math. Program.*, **88**, 61–83. doi:[10.1007/PL00011378](https://doi.org/10.1007/PL00011378).
- [779] Moradi, S., Trad, D., and Innanen, K. A. (2018). Quantum computing in geophysics: Algorithms, computational costs, and future applications. In: *2018 SEG International Exposition and Annual Meeting*. doi:[10.1190/segam2018-2998507.1](https://doi.org/10.1190/segam2018-2998507.1).
- [780] Morales, M. E., Biamonte, J., and Zimborás, Z. (2020). On the universality of the quantum approximate optimization algorithm. *Quantum Inf. Process.*, **19**, 1–26. doi:[10.1007/s11128-020-02748-9](https://doi.org/10.1007/s11128-020-02748-9). arXiv:[1909.03123](https://arxiv.org/abs/1909.03123).
- [781] MOSEK ApS. (2023). *MOSEK portfolio optimization cookbook: Release 1.3.0*. <https://docs.mosek.com/MOSEKPortfolioCookbook-a4paper.pdf>, accessed: 2023-10-04.
- [782] Motlagh, D., and Wiebe, N. (2024). Generalized quantum signal processing. *PRX Quantum*, **5**, 020368. doi:[10.1103/PRXQuantum.5.020368](https://doi.org/10.1103/PRXQuantum.5.020368). arXiv:[2308.01501](https://arxiv.org/abs/2308.01501).
- [783] Motta, M., and Rice, J. E. (2022). Emerging quantum computing algorithms for quantum chemistry. *WIREs Comput. Mol. Sci.*, **12**, e1580. doi:[10.1002/wcms.1580](https://doi.org/10.1002/wcms.1580). arXiv:[2109.02873](https://arxiv.org/abs/2109.02873).
- [784] Motta, M., Ceperley, D. M., Chan, G. K.-L., et al. (2017). Towards the solution of the many-electron problem in real materials: Equation of state of the hydrogen chain with state-of-the-art many-body methods. *Phys. Rev. X*, **7**, 031059. doi:[10.1103/PhysRevX.7.031059](https://doi.org/10.1103/PhysRevX.7.031059). arXiv:[1705.01608](https://arxiv.org/abs/1705.01608).
- [785] Motta, M., Genovese, C., Ma, F., et al. (2020). Ground-state properties of the hydrogen chain: Dimerization, insulator-to-metal transition, and magnetic phases. *Phys. Rev. X*, **10**, 031058. doi:[10.1103/PhysRevX.10.031058](https://doi.org/10.1103/PhysRevX.10.031058). arXiv:[1911.01618](https://arxiv.org/abs/1911.01618).
- [786] Motta, M., Ye, E., McClean, J. R., et al. (2021). Low rank representations for quantum simulation of electronic structure. *npj Quant. Inf.*, **7**, 1–7. doi:[10.1038/s41534-021-00416-z](https://doi.org/10.1038/s41534-021-00416-z). arXiv:[1808.02625](https://arxiv.org/abs/1808.02625).
- [787] Mottonen, M., and Vartiainen, J. J. (2005). Decompositions of general quantum gates. arXiv:[quant-ph/0504100](https://arxiv.org/abs/quant-ph/0504100).
- [788] Moussa, J. E. (2016). Transversal Clifford gates on folded surface codes. *Phys. Rev. A*, **94**, 042316. doi:[10.1103/PhysRevA.94.042316](https://doi.org/10.1103/PhysRevA.94.042316). arXiv:[1603.02286](https://arxiv.org/abs/1603.02286).
- [789] Moylett, A. E., Linden, N., and Montanaro, A. (2017). Quantum speedup of the traveling-salesman problem for bounded-degree graphs. *Phys. Rev. A*, **95**, 032323. doi:[10.1103/PhysRevA.95.032323](https://doi.org/10.1103/PhysRevA.95.032323). arXiv:[1612.06203](https://arxiv.org/abs/1612.06203).
- [790] Mugel, S., Kuchkovsky, C., Sanchez, E., et al. (2022). Dynamic portfolio optimization with real datasets using quantum processors and quantum-inspired tensor networks. *Phys. Rev. Res.*, **4**, 013006. doi:[10.1103/PhysRevResearch.4.013006](https://doi.org/10.1103/PhysRevResearch.4.013006). arXiv:[2007.00017](https://arxiv.org/abs/2007.00017).
- [791] Muñoz-Coreas, E., and Thapliyal, H. (2018). T-count and qubit optimized quantum circuit design of the non-restoring square root algorithm.

- ACM *J. Emerg. Technol. Comput. Syst.*, **14**, 1–15. doi:[10.1145/3264816](https://doi.org/10.1145/3264816). arXiv:[1712.08254](https://arxiv.org/abs/1712.08254).
- [792] Nagaj, D., Wocjan, P., and Zhang, Y. (2009). Fast amplification of QMA. *Quantum Inf. Comput.*, **9**, 1053–1068. doi:[10.26421/QIC9.11-12](https://doi.org/10.26421/QIC9.11-12). arXiv:[0904.1549](https://arxiv.org/abs/0904.1549).
- [793] Nagata, K. (2022). Finite-density lattice QCD and sign problem: Current status and open problems. *Prog. Part. Nuc. Phys.*, **127**, 103991. doi:[10.1016/j.pnpnp.2022.103991](https://doi.org/10.1016/j.pnpnp.2022.103991). arXiv:[2108.12423](https://arxiv.org/abs/2108.12423).
- [794] Nakaji, K., Bagherimehrab, M., and Aspuru-Guzik, A. (2023). qSWIFT: High-order randomized compiler for Hamiltonian simulation. arXiv:[2302.14811](https://arxiv.org/abs/2302.14811).
- [795] Nam, Y., Su, Y., and Maslov, D. (2020). Approximate quantum Fourier transform with $o(n \log(n))$ T gates. *npj Quant. Inf.*, **6**, 26. doi:[10.1038/s41534-020-0257-5](https://doi.org/10.1038/s41534-020-0257-5). arXiv:[1803.04933](https://arxiv.org/abs/1803.04933).
- [796] Navrátil, P., and Quaglioni, S. (2022). Ab initio nuclear reaction theory with applications to astrophysics. Pages 1–46 of: *Handbook of nuclear physics*. doi:[10.1007/978-981-15-8818-1_7-1](https://doi.org/10.1007/978-981-15-8818-1_7-1). arXiv:[2204.01187](https://arxiv.org/abs/2204.01187).
- [797] Nemirovski, A. S., and Todd, M. J. (2008). Interior-point methods for optimization. *Acta Numer.*, **17**, 191–234. doi:[10.1017/S0962492906370018](https://doi.org/10.1017/S0962492906370018).
- [798] Nesterov, Y. (2018). *Lectures on convex optimization*. Springer. doi:[10.1007/978-3-319-91578-4](https://doi.org/10.1007/978-3-319-91578-4).
- [799] Nezami, S., Lin, H. W., Brown, A. R., et al. (2023). Quantum gravity in the lab. II. Teleportation by size and traversable wormholes. *PRX Quantum*, **4**, 010321. doi:[10.1103/PRXQuantum.4.010321](https://doi.org/10.1103/PRXQuantum.4.010321). arXiv:[2102.01064](https://arxiv.org/abs/2102.01064).
- [800] Nguyen, N., Watts, T. W., Link, B., et al. (2024). Quantum computing for corrosion-resistant materials and anti-corrosive coatings design. arXiv:[2406.18759](https://arxiv.org/abs/2406.18759).
- [801] Nielsen, M. A., and Chuang, I. L. (2000). *Quantum computation and quantum information*. Cambridge University Press. doi:[10.1017/CB09780511976667](https://doi.org/10.1017/CB09780511976667).
- [802] Niroula, P., Shaydulin, R., Yalovetzky, R., et al. (2022). Constrained quantum optimization for extractive summarization on a trapped-ion quantum computer. *Sci. Rep.*, **12**, 1–14. doi:[10.1038/s41598-022-20853-w](https://doi.org/10.1038/s41598-022-20853-w). arXiv:[2206.06290](https://arxiv.org/abs/2206.06290).
- [803] Novikau, I., Startsev, E. A., and Dodin, I. Y. (2022). Quantum signal processing for simulating cold plasma waves. *Phys. Rev. A*, **105**, 062444. doi:[10.1103/PhysRevA.105.062444](https://doi.org/10.1103/PhysRevA.105.062444). arXiv:[2112.06086](https://arxiv.org/abs/2112.06086).
- [804] Novo, L., and Berry, D. W. (2017). Improved Hamiltonian simulation via a truncated Taylor series and corrections. *Quantum Inf. Comput.*, **17**, 623–635. doi:[10.26421/QIC17.7-8-5](https://doi.org/10.26421/QIC17.7-8-5). arXiv:[1611.10033](https://arxiv.org/abs/1611.10033).
- [805] O’Brien, T. E., Streif, M., Rubin, N. C., et al. (2022). Efficient quantum computation of molecular forces and other energy gradients. *Phys. Rev. Res.*, **4**, 043210. doi:[10.1103/PhysRevResearch.4.043210](https://doi.org/10.1103/PhysRevResearch.4.043210). arXiv:[2111.12437](https://arxiv.org/abs/2111.12437).
- [806] O’Brien, T. E., Ioffe, L. B., Su, Y., et al. (2022). Quantum computation of molecular structure using data from challenging-to-classically-simulate nuclear magnetic resonance experiments. *PRX Quantum*, **3**, 030345. doi:[10.1103/PRXQuantum.3.030345](https://doi.org/10.1103/PRXQuantum.3.030345). arXiv:[2109.02163](https://arxiv.org/abs/2109.02163).
- [807] O’Donnell, R., and Wright, J. (2016). Efficient quantum tomography. Pages 899–912 of: *STOC*. doi:[10.1145/2897518.2897544](https://doi.org/10.1145/2897518.2897544). arXiv:[1508.01907](https://arxiv.org/abs/1508.01907).

- [808] O’Gorman, B., Irani, S., Whitfield, J., and Fefferman, B. (2022). Intractability of electronic structure in a fixed basis. *PRX Quantum*, **3**, 020322. doi:[10.1103/PRXQuantum.3.020322](https://doi.org/10.1103/PRXQuantum.3.020322). arXiv:[2103.08215](https://arxiv.org/abs/2103.08215).
- [809] O’Gorman, J., and Campbell, E. T. (2017). Quantum computation with realistic magic-state factories. *Phys. Rev. A*, **95**, 032338. doi:[10.1103/PhysRevA.95.032338](https://doi.org/10.1103/PhysRevA.95.032338). arXiv:[1605.07197](https://arxiv.org/abs/1605.07197).
- [810] Oh, C., Liu, M., Alexeev, Y., et al. (2024). Classical algorithm for simulating experimental Gaussian boson sampling. *Nat. Phys.*, **20**, 1461–1468. doi:[10.1038/s41567-024-02535-8](https://doi.org/10.1038/s41567-024-02535-8). arXiv:[2306.03709](https://arxiv.org/abs/2306.03709).
- [811] Oh, C., Lim, Y., Wong, Y., et al. (2024). Quantum-inspired classical algorithms for molecular vibronic spectra. *Nat. Phys.*, **20**, 225–231. doi:[10.1038/s41567-023-02308-9](https://doi.org/10.1038/s41567-023-02308-9). arXiv:[2202.01861](https://arxiv.org/abs/2202.01861).
- [812] Oka, T., and Kitamura, S. (2019). Floquet engineering of quantum materials. *Annu. Rev. Condens. Matter Phys.*, **10**, 387–408. doi:[10.1146/annurev-conmatphys-031218-013423](https://doi.org/10.1146/annurev-conmatphys-031218-013423). arXiv:[1804.03212](https://arxiv.org/abs/1804.03212).
- [813] Ollitrault, P. J., Baiardi, A., Reiher, M., and Tavernelli, I. (2020). Hardware efficient quantum algorithms for vibrational structure calculations. *Chem. Sci.*, **11**, 6842–6855. doi:[10.1039/D0SC01908A](https://doi.org/10.1039/D0SC01908A). arXiv:[2003.12578](https://arxiv.org/abs/2003.12578).
- [814] Orsucci, D., and Dunjko, V. (2021). On solving classes of positive-definite quantum linear systems with quadratically improved runtime in the condition number. *Quantum*, **5**, 573. doi:[10.22331/q-2021-11-08-573](https://doi.org/10.22331/q-2021-11-08-573). arXiv:[2101.11868](https://arxiv.org/abs/2101.11868).
- [815] Orús, R. (2019). Tensor networks for complex quantum systems. *Nat. Rev. Phys.*, **1**, 538–550. doi:[10.1038/s42254-019-0086-7](https://doi.org/10.1038/s42254-019-0086-7). arXiv:[1812.04011](https://arxiv.org/abs/1812.04011).
- [816] Orús, R., and Vidal, G. (2009). Simulation of two-dimensional quantum systems on an infinite lattice revisited: Corner transfer matrix for tensor contraction. *Phys. Rev. B*, **80**, 094403. doi:[10.1103/PhysRevB.80.094403](https://doi.org/10.1103/PhysRevB.80.094403). arXiv:[0905.3225](https://arxiv.org/abs/0905.3225).
- [817] Otgonbaatar, S., and Krantzlmüller, D. 2023 (7). Quantum-inspired tensor network for earth science. Pages 788–791 of: *IGARSS*. doi:[10.1109/IGARSS52108.2023.10282577](https://doi.org/10.1109/IGARSS52108.2023.10282577). arXiv:[2301.07528](https://arxiv.org/abs/2301.07528).
- [818] Otten, M., Watts, T. W., Johnson, S. D., et al. (2024). Quantum resources required for binding affinity calculations of amyloid beta. arXiv:[2406.18744](https://arxiv.org/abs/2406.18744).
- [819] Otter, N., Porter, M. A., Tillmann, U., et al. (2017). A roadmap for the computation of persistent homology. *EPJ Data Sci.*, **6**, 1–38. doi:[10.1140/epjds/s13688-017-0109-5](https://doi.org/10.1140/epjds/s13688-017-0109-5). arXiv:[1506.08903](https://arxiv.org/abs/1506.08903).
- [820] Ouyang, Y., White, D. R., and Campbell, E. T. (2020). Compilation by stochastic Hamiltonian sparsification. *Quantum*, **4**, 235. doi:[10.22331/q-2020-02-27-235](https://doi.org/10.22331/q-2020-02-27-235). arXiv:[1910.06255](https://arxiv.org/abs/1910.06255).
- [821] Oz, F., Vuppala, R. K., Kara, K., and Gaitan, F. (2022). Solving Burgers’ equation with quantum computing. *Quantum Inf. Process.*, **21**, 1–13. doi:[10.1007/s11128-021-03391-8](https://doi.org/10.1007/s11128-021-03391-8).
- [822] Ozols, M., Roetteler, M., and Roland, J. (2013). Quantum rejection sampling. *ACM Trans. Comput. Theory*, **5**. doi:[10.1145/2493252.2493256](https://doi.org/10.1145/2493252.2493256). arXiv:[1103.2774](https://arxiv.org/abs/1103.2774).
- [823] Paini, M., and Kalev, A. (2019). An approximate description of quantum states. arXiv:[1910.10543](https://arxiv.org/abs/1910.10543).

- [824] Palmer, S., Sahin, S., Hernandez, R., et al. (2021). Quantum portfolio optimization with investment bands and target volatility. arXiv:[2106.06735](#).
- [825] Palmer, S., Karagiannis, K., Florence, A., et al. (2022). Financial index tracking via quantum computing with cardinality constraints. arXiv:[2208.11380](#).
- [826] Pan, F., and Zhang, P. (2021). Simulating the sycamore quantum supremacy circuits. arXiv:[2103.03074](#).
- [827] Pantelev, P., and Kalachev, G. (2022). Asymptotically good quantum and locally testable classical LDPC codes. Pages 375–388 of: *STOC*. doi:[10.1145/3519935.3520017](#). arXiv:[2111.03654](#).
- [828] Park, J. W., Al-Saadon, R., MacLeod, M. K., et al. (2020). Multireference electron correlation methods: Journeys along potential energy surfaces. *Chem. Rev.*, **120**, 5878–5909. doi:[10.1021/acs.chemrev.9b00496](#). arXiv:[1911.06836](#).
- [829] Patel, D., Tan, S. J. S., Subaşı, Y., and Sornborger, A. T. (2024). Optimal coherent quantum phase estimation via tapering. arXiv:[2403.18927](#).
- [830] Patel, R., Hsing, C.-W., Sahin, S., et al. (2022). Quantum-inspired tensor neural networks for partial differential equations. arXiv:[2208.02235](#).
- [831] Peikert, C. (2020). He gives c-sieves on the CSIDH. Pages 463–492 of: *EUROCRYPT*. doi:[10.1007/978-3-030-45724-2_16](#). ePrint:[2019/725](#).
- [832] Penuel, J., Katabarwa, A., Johnson, P. D., et al. (2024). Feasibility of accelerating incompressible computational fluid dynamics simulations with fault-tolerant quantum computers. arXiv:[2406.06323](#).
- [833] Peruzzo, A., McClean, J., Shadbolt, P., et al. (2014). A variational eigenvalue solver on a photonic quantum processor. *Nat. Commun.*, **5**. doi:[10.1038/ncomms5213](#). arXiv:[1304.3061](#).
- [834] Pirandola, S., Andersen, U. L., Banchi, L., et al. (2020). Advances in quantum cryptography. *Adv. Opt. Photon.*, **12**, 1012–1236. doi:[10.1364/AOP.361502](#). arXiv:[1906.01645](#).
- [835] Plesch, M., and Brukner, i. c. v. (2011). Quantum-state preparation with universal gate decompositions. *Phys. Rev. A*, **83**, 032302. doi:[10.1103/PhysRevA.83.032302](#). arXiv:[1003.5760](#).
- [836] Poggi, P. M. (2020). Analysis of lower bounds for quantum control times and their relation to the quantum speed limit. arXiv:[2002.11147](#).
- [837] Polkovnikov, A., Sengupta, K., Silva, A., and Vengalattore, M. (2011). Colloquium: Nonequilibrium dynamics of closed interacting quantum systems. *Rev. Mod. Phys.*, **83**, 863–883. doi:[10.1103/RevModPhys.83.863](#). arXiv:[1007.5331](#).
- [838] Poulin, D., and Wocjan, P. (2009). Sampling from the thermal quantum Gibbs state and evaluating partition functions with a quantum computer. *Phys. Rev. Lett.*, **103**, 220502. doi:[10.1103/PhysRevLett.103.220502](#). arXiv:[0905.2199](#).
- [839] Poulin, D., Qarry, A., Somma, R., and Verstraete, F. (2011). Quantum simulation of time-dependent Hamiltonians and the convenient illusion of Hilbert space. *Phys. Rev. Lett.*, **106**, 170501. doi:[10.1103/PhysRevLett.106.170501](#). arXiv:[1102.1360](#).
- [840] Poulin, D., Hastings, M. B., Wecker, D., et al. (2015). The Trotter step size required for accurate quantum simulation of quantum chemistry. *Quantum Info. Comput.*, **15**, 361–384. doi:[10.26421/QIC15.5-6-1](#). arXiv:[1406.4920](#).

- [841] Poulin, D., Kitaev, A., Steiger, D. S., et al. (2018). Quantum algorithm for spectral measurement with a lower gate count. *Phys. Rev. Lett.*, **121**, 010501. doi:[10.1103/PhysRevLett.121.010501](https://doi.org/10.1103/PhysRevLett.121.010501). arXiv:[1711.11025](https://arxiv.org/abs/1711.11025).
- [842] Poulsen Nautrup, H., Friis, N., and Briegel, H. J. (2017). Fault-tolerant interface between quantum memories and quantum processors. *Nat. Commun.*, **8**. doi:[10.1038/s41467-017-01418-2](https://doi.org/10.1038/s41467-017-01418-2). arXiv:[1609.08062](https://arxiv.org/abs/1609.08062).
- [843] Preskill, J. (2018). Quantum computing in the NISQ era and beyond. *Quantum*, **2**, 79. doi:[10.22331/q-2018-08-06-79](https://doi.org/10.22331/q-2018-08-06-79). arXiv:[1801.00862](https://arxiv.org/abs/1801.00862).
- [844] Preskill, J. (2019). Simulating quantum field theory with a quantum computer. doi:[10.22323/1.334.0024](https://doi.org/10.22323/1.334.0024). arXiv:[1811.10085](https://arxiv.org/abs/1811.10085).
- [845] Preskill, J. (2022). *Course information for physics 219/computer science 219 quantum computation (formerly physics 229)*. <http://theory.caltech.edu/~preskill/ph229/>, accessed: 2024-11-19.
- [846] Proos, J., and Zalka, C. (2003). Shor's discrete logarithm quantum algorithm for elliptic curves. *Quantum Inf. Comput.*, **3**, 317–344. arXiv:[0301141](https://arxiv.org/abs/0301141).
- [847] Qin, M., Schafer, T., Andergassen, S., et al. (2022). The Hubbard model: A computational perspective. *Annu. Rev. Condens. Matter Phys.*, **13**, 275–302. doi:[10.1146/annurev-conmatphys-090921-033948](https://doi.org/10.1146/annurev-conmatphys-090921-033948). arXiv:[2104.00064](https://arxiv.org/abs/2104.00064).
- [848] Ragavan, S. (2024). Regev factoring beyond Fibonacci: Optimizing prefactors. ePrint:[2024/636](https://arxiv.org/abs/2024.0636).
- [849] Ragavan, S., and Vaikuntanathan, V. (2024). Space-efficient and noise-robust quantum factoring. arXiv:[2310.00899](https://arxiv.org/abs/2310.00899).
- [850] Ragone, M., Bakalov, B. N., Sauvage, F., et al. (2023). A unified theory of barren plateaus for deep parametrized quantum circuits. arXiv:[2309.09342](https://arxiv.org/abs/2309.09342).
- [851] Rahmani, A., and Franz, M. (2019). Interacting Majorana fermions. *Rep. Prog. Phys.*, **82**, 084501. doi:[10.1088/1361-6633/ab28ef](https://doi.org/10.1088/1361-6633/ab28ef). arXiv:[1811.02593](https://arxiv.org/abs/1811.02593).
- [852] Rajput, A., Roggero, A., and Wiebe, N. (2022). Hybridized methods for quantum simulation in the interaction picture. *Quantum*, **6**, 780. doi:[10.22331/q-2022-08-17-780](https://doi.org/10.22331/q-2022-08-17-780). arXiv:[2109.03308](https://arxiv.org/abs/2109.03308).
- [853] Rall, P. (2020). Quantum algorithms for estimating physical quantities using block encodings. *Phys. Rev. A*, **102**, 022408. doi:[10.1103/PhysRevA.102.022408](https://doi.org/10.1103/PhysRevA.102.022408). arXiv:[2004.06832](https://arxiv.org/abs/2004.06832).
- [854] Rall, P. (2021). Faster coherent quantum algorithms for phase, energy, and amplitude estimation. *Quantum*, **5**, 566. doi:[10.22331/q-2021-10-19-566](https://doi.org/10.22331/q-2021-10-19-566). arXiv:[2103.09717](https://arxiv.org/abs/2103.09717).
- [855] Rall, P., and Fuller, B. (2023). Amplitude estimation from quantum signal processing. *Quantum*, **7**, 937. doi:[10.22331/q-2023-03-02-937](https://doi.org/10.22331/q-2023-03-02-937). arXiv:[2207.08628](https://arxiv.org/abs/2207.08628).
- [856] Rall, P., Wang, C., and Wocjan, P. (2023). Thermal state preparation via rounding promises. *Quantum*, **7**, 1132. doi:[10.22331/q-2023-10-10-1132](https://doi.org/10.22331/q-2023-10-10-1132). arXiv:[2210.01670](https://arxiv.org/abs/2210.01670).
- [857] Ramos-Calderer, S., Pérez-Salinas, A., García-Martín, D., et al. (2021). Quantum unary approach to option pricing. *Phys. Rev. A*, **103**, 032414. doi:[10.1103/PhysRevA.103.032414](https://doi.org/10.1103/PhysRevA.103.032414). arXiv:[1912.01618](https://arxiv.org/abs/1912.01618).
- [858] Rasmussen, C. E., and Williams, C. K. I. (2005). *Gaussian processes for machine learning*. The MIT Press. doi:[10.7551/mitpress/3206.001.0001](https://doi.org/10.7551/mitpress/3206.001.0001).

- [859] Rattew, A. G., and Koczor, B. (2022). Preparing arbitrary continuous functions in quantum registers with logarithmic complexity. *arXiv:2205.00519*.
- [860] Rattew, A. G., Sun, Y., Minssen, P., and Pistoia, M. (2021). The efficient preparation of normal distributions in quantum registers. *Quantum*, **5**, 609. doi:[10.22331/q-2021-12-23-609](https://doi.org/10.22331/q-2021-12-23-609). *arXiv:2009.06601*.
- [861] Raussendorf, R. (2012). Key ideas in quantum error correction. *Philos. Trans. R. Soc. A*, **370**, 4541–4565. doi:[10.1098/rsta.2011.0494](https://doi.org/10.1098/rsta.2011.0494).
- [862] Raussendorf, R., and Harrington, J. (2007). Fault-tolerant quantum computation with high threshold in two dimensions. *Phys. Rev. Lett.*, **98**, 190504. doi:[10.1103/PhysRevLett.98.190504](https://doi.org/10.1103/PhysRevLett.98.190504). *arXiv:quant-ph/0610082*.
- [863] Raussendorf, R., Harrington, J., and Goyal, K. (2007). Topological fault-tolerance in cluster state quantum computation. *New J. Phys.*, **9**, 199. doi:[10.1088/1367-2630/9/6/199](https://doi.org/10.1088/1367-2630/9/6/199). *arXiv:quant-ph/0703143*.
- [864] Raychowdhury, I., and Stryker, J. R. (2020). Solving Gauss's law on digital quantum computers with loop-string-hadron digitization. *Phys. Rev. Res.*, **2**, 033039. doi:[10.1103/PhysRevResearch.2.033039](https://doi.org/10.1103/PhysRevResearch.2.033039). *arXiv:1812.07554*.
- [865] Reberndorf, P., and Lloyd, S. (2018). Quantum computational finance: Quantum algorithm for portfolio optimization. *arXiv:1811.03975*.
- [866] Reberndorf, P., Mohseni, M., and Lloyd, S. (2014). Quantum support vector machine for big data classification. *Phys. Rev. Lett.*, **113**, 130503. doi:[10.1103/PhysRevLett.113.130503](https://doi.org/10.1103/PhysRevLett.113.130503). *arXiv:1307.0471*.
- [867] Reberndorf, P., Gupta, B., and Bromley, T. R. (2018). Quantum computational finance: Monte Carlo pricing of financial derivatives. *Phys. Rev. A*, **98**, 022321. doi:[10.1103/PhysRevA.98.022321](https://doi.org/10.1103/PhysRevA.98.022321). *arXiv:1805.00109*.
- [868] Reberndorf, P., Luongo, A., Bosch, S., and Lloyd, S. (2022). Quantum computational finance: Martingale asset pricing for incomplete markets. *arXiv:2209.08867*.
- [869] Regev, O. (2023). An efficient quantum factoring algorithm. *arXiv:2308.06572*.
- [870] Reiher, M., Wiebe, N., Svore, K. M., et al. (2017). Elucidating reaction mechanisms on quantum computers. *Proc. Natl. Acad. Sci.*, **114**, 7555–7560. doi:[10.1073/pnas.1619152114](https://doi.org/10.1073/pnas.1619152114). *arXiv:1605.03590*.
- [871] Reiner, J. M., Zanker, S., Schwenk, I., et al. (2018). Effects of gate errors in digital quantum simulations of fermionic systems. *Quantum Sci. Technol.*, **3**. doi:[10.1088/2058-9565/aad5ba](https://doi.org/10.1088/2058-9565/aad5ba). *arXiv:1804.06668*.
- [872] Reiner, J. M., Wilhelm-Mauch, F., Schön, G., and Marthaler, M. (2019). Finding the ground state of the Hubbard model by variational methods on a quantum computer with gate errors. *Quantum Sci. Technol.*, **4**. doi:[10.1088/2058-9565/ab1e85](https://doi.org/10.1088/2058-9565/ab1e85). *arXiv:1811.04476*.
- [873] Rhodes, M., Kreshchuk, M., and Pathak, S. (2024). Exponential improvements in the simulation of lattice gauge theories using near-optimal techniques. *arXiv:2405.10416*.
- [874] Richard, E., and Montanari, A. (2014). A statistical model for tensor PCA. In: *NeurIPS*. *arXiv:1411.1076*.
- [875] Rivest, R. L., Shamir, A., and Adleman, L. (1978). A method for obtaining digital signatures and public-key cryptosystems. *Commun. ACM*, **21**, 120–126. doi:[10.1145/359340.359342](https://doi.org/10.1145/359340.359342).

- [876] Roetteler, M., Naehrig, M., Svore, K. M., and Lauter, K. (2017). Quantum resource estimates for computing elliptic curve discrete logarithms. Pages 241–270 of: *ASIACRYPT*. doi:[10.1007/978-3-319-70697-9_9](https://doi.org/10.1007/978-3-319-70697-9_9). arXiv:[1706.06752](https://arxiv.org/abs/1706.06752).
- [877] Roggero, A., Li, A. C. Y., Carlson, J., et al. (2020). Quantum computing for neutrino-nucleus scattering. *Phys. Rev. D*, **101**, 074038. doi:[10.1103/PhysRevD.101.074038](https://doi.org/10.1103/PhysRevD.101.074038). arXiv:[1911.06368](https://arxiv.org/abs/1911.06368).
- [878] Romero, J., and Aspuru-Guzik, A. (2021). Variational quantum generators: Generative adversarial quantum machine learning for continuous distributions. *Adv. Quantum Technol.*, **4**, 2000003. doi:[10.1002/qute.202000003](https://doi.org/10.1002/qute.202000003). arXiv:[1901.00848](https://arxiv.org/abs/1901.00848).
- [879] Romero, J., Olson, J. P., and Aspuru-Guzik, A. (2017). Quantum autoencoders for efficient compression of quantum data. *Quantum Sci. Technol.*, **2**, 045001. doi:[10.1088/2058-9565/aa8072](https://doi.org/10.1088/2058-9565/aa8072). arXiv:[1612.02806](https://arxiv.org/abs/1612.02806).
- [880] Rosenberg, E., Andersen, T. I., Samajdar, R., et al. (2024). Dynamics of magnetization at infinite temperature in a Heisenberg spin chain. *Science*, **384**, 48–53. doi:[10.1126/science.adi7877](https://doi.org/10.1126/science.adi7877). arXiv:[2306.09333](https://arxiv.org/abs/2306.09333).
- [881] Rosenberg, G., Haghnegahdar, P., Goddard, P., et al. (2016). Solving the optimal trading trajectory problem using a quantum annealer. *IEEE Journal of Selected Topics in Signal Processing*, **10**, 1053–1060. doi:[10.1109/JSTSP.2016.2574703](https://doi.org/10.1109/JSTSP.2016.2574703). Earlier version in *WHPCF'15*. arXiv:[1508.06182](https://arxiv.org/abs/1508.06182).
- [882] Rosenhaus, V. (2019). An introduction to the SYK model. *J. Phys. A*, **52**, 323001. doi:[10.1088/1751-8121/ab2ce1](https://doi.org/10.1088/1751-8121/ab2ce1). arXiv:[1807.03334](https://arxiv.org/abs/1807.03334).
- [883] Rosenthal, G. (2021). Query and depth upper bounds for quantum unitaries via Grover search. arXiv:[2111.07992](https://arxiv.org/abs/2111.07992).
- [884] Ross, N. J., and Selinger, P. (2016). Optimal ancilla-free Clifford+T approximation of z-rotations. *Quantum Inf. Comput.*, **16**, 901–953. doi:[10.26421/QIC16.11-12-1](https://doi.org/10.26421/QIC16.11-12-1). arXiv:[1403.2975](https://arxiv.org/abs/1403.2975).
- [885] Rossi, M., Asproni, L., Caputo, D., et al. (2022). Using Shor's algorithm on near term quantum computers: A reduced version. *Quantum Mach. Intell.*, **4**, 18. doi:[10.1007/s42484-022-00072-2](https://doi.org/10.1007/s42484-022-00072-2). arXiv:[2112.12647](https://arxiv.org/abs/2112.12647).
- [886] Rubin, N. C., Berry, D. W., Malone, F. D., et al. (2023). Fault-tolerant quantum simulation of materials using Bloch orbitals. *PRX Quantum*, **4**, 040303. doi:[10.1103/PRXQuantum.4.040303](https://doi.org/10.1103/PRXQuantum.4.040303). arXiv:[2302.05531](https://arxiv.org/abs/2302.05531).
- [887] Rubin, N. C., Berry, D. W., Kononov, A., et al. (2024). Quantum computation of stopping power for inertial fusion target design. *Proc. Natl. Acad. Sci.*, **121**, e2317772121. doi:[10.1073/pnas.2317772121](https://doi.org/10.1073/pnas.2317772121). arXiv:[2308.12352](https://arxiv.org/abs/2308.12352).
- [888] Saad, Y. (2003). *Iterative methods for sparse linear systems*. 2nd edn. Society for Industrial and Applied Mathematics. doi:[10.1137/1.9780898718003](https://doi.org/10.1137/1.9780898718003).
- [889] Sachdev, S., and Ye, J. (1993). Gapless spin-fluid ground state in a random quantum Heisenberg magnet. *Phys. Rev. Lett.*, **70**, 3339–3342. doi:[10.1103/PhysRevLett.70.3339](https://doi.org/10.1103/PhysRevLett.70.3339). arXiv:[cond-mat/9212030](https://arxiv.org/abs/cond-mat/9212030).
- [890] Saffman, M., Walker, T. G., and Mølmer, K. (2010). Quantum information with Rydberg atoms. *Rev. Mod. Phys.*, **82**, 2313–2363. doi:[10.1103/RevModPhys.82.2313](https://doi.org/10.1103/RevModPhys.82.2313). arXiv:[0909.4777](https://arxiv.org/abs/0909.4777).

- [891] Şahinoğlu, B., and Somma, R. D. (2021). Hamiltonian simulation in the low-energy subspace. *npj Quant. Inf.*, **7**. doi:[10.1038/s41534-021-00451-w](https://doi.org/10.1038/s41534-021-00451-w). arXiv:[2006.02660](https://arxiv.org/abs/2006.02660).
- [892] Sakamoto, K., Morisaki, H., Haruna, J., et al. (2024). End-to-end complexity for simulating the Schwinger model on quantum computers. *Quantum*, **8**, 1474. doi:[10.22331/q-2024-09-17-1474](https://doi.org/10.22331/q-2024-09-17-1474). arXiv:[2311.17388](https://arxiv.org/abs/2311.17388).
- [893] Salakhutdinov, R., and Larochelle, H. (2010). Efficient learning of deep Boltzmann machines. Pages 693–700 of: *AISTATS*.
- [894] Sanders, Y. R., Low, G. H., Scherer, A., and Berry, D. W. (2019). Black-box quantum state preparation without arithmetic. *Phys. Rev. Lett.*, **122**, 020502. doi:[10.1103/PhysRevLett.122.020502](https://doi.org/10.1103/PhysRevLett.122.020502). arXiv:[1807.03206](https://arxiv.org/abs/1807.03206).
- [895] Sanders, Y. R., Berry, D. W., Costa, P. C., et al. (2020). Compilation of fault-tolerant quantum heuristics for combinatorial optimization. *PRX Quantum*, **1**, 020312. doi:[10.1103/PRXQuantum.1.020312](https://doi.org/10.1103/PRXQuantum.1.020312). arXiv:[2007.07391](https://arxiv.org/abs/2007.07391).
- [896] Santagati, R., Aspuru-Guzik, A., Babbush, R., et al. (2024). Drug design on quantum computers. *Nat. Phys.*, **20**, 549–557. doi:[10.1038/s41567-024-02411-5](https://doi.org/10.1038/s41567-024-02411-5). arXiv:[2301.04114](https://arxiv.org/abs/2301.04114).
- [897] Sawaya, N. P., Menke, T., Kyaw, T. H., et al. (2020). Resource-efficient digital quantum simulation of d-level systems for photonic, vibrational, and spin-s Hamiltonians. *npj Quant. Inf.*, **6**, 1–13. doi:[10.1038/s41534-020-0278-0](https://doi.org/10.1038/s41534-020-0278-0). arXiv:[1909.12847](https://arxiv.org/abs/1909.12847).
- [898] Sawaya, N. P. D., and Huh, J. (2019). Quantum algorithm for calculating molecular vibronic spectra. *J. Phys. Chem. Lett.*, **10**, 3586–3591. doi:[10.1021/acs.jpclett.9b01117](https://doi.org/10.1021/acs.jpclett.9b01117). arXiv:[1812.10495](https://arxiv.org/abs/1812.10495).
- [899] Sawaya, N. P. D., Paesani, F., and Tabor, D. P. (2021). Near- and long-term quantum algorithmic approaches for vibrational spectroscopy. *Phys. Rev. A*, **104**, 062419. doi:[10.1103/PhysRevA.104.062419](https://doi.org/10.1103/PhysRevA.104.062419). arXiv:[2009.05066](https://arxiv.org/abs/2009.05066).
- [900] Schäfer, T., Wentzell, N., Šimkovic, F., et al. (2021). Tracking the footprints of spin fluctuations: A multimethod, multimessenger study of the two-dimensional Hubbard model. *Phys. Rev. X*, **11**, 011058. doi:[10.1103/PhysRevX.11.011058](https://doi.org/10.1103/PhysRevX.11.011058). arXiv:[2006.10769](https://arxiv.org/abs/2006.10769).
- [901] Schatzki, L., Larocca, M., Nguyen, Q. T., et al. (2024). Theoretical guarantees for permutation-equivariant quantum neural networks. *npj Quant. Inf.*, **10**, 12. doi:[10.1038/s41534-024-00804-1](https://doi.org/10.1038/s41534-024-00804-1). arXiv:[2210.09974](https://arxiv.org/abs/2210.09974).
- [902] Scherer, A., Valiron, B., Mau, S.-C., et al. (2017). Concrete resource analysis of the quantum linear-system algorithm used to compute the electromagnetic scattering cross section of a 2D target. *Quantum Inf. Process.*, **16**, 1–65. doi:[10.1007/s11128-016-1495-5](https://doi.org/10.1007/s11128-016-1495-5). arXiv:[1505.06552](https://arxiv.org/abs/1505.06552).
- [903] Schmidhuber, A., and Lloyd, S. (2023). Complexity-theoretic limitations on quantum algorithms for topological data analysis. *PRX Quantum*, **4**, 040349. doi:[10.1103/PRXQuantum.4.040349](https://doi.org/10.1103/PRXQuantum.4.040349). arXiv:[2209.14286](https://arxiv.org/abs/2209.14286).
- [904] Schmidhuber, A., O'Donnell, R., Kothari, R., and Babbush, R. (2024). Quartic quantum speedups for planted inference. arXiv:[2406.19378](https://arxiv.org/abs/2406.19378).
- [905] Schölkopf, B., Herbrich, R., and Smola, A. J. (2001). A generalized representer theorem. Pages 416–426 of: *COLT*. doi:[10.1007/3-540-44581-1_27](https://doi.org/10.1007/3-540-44581-1_27).

- [906] Scholl, P., Schuler, M., Williams, H. J., et al. (2021). Quantum simulation of 2D antiferromagnets with hundreds of Rydberg atoms. *Nature*, **595**, 233–238. doi:[10.1038/s41586-021-03585-1](https://doi.org/10.1038/s41586-021-03585-1). arXiv:[2012.12268](https://arxiv.org/abs/2012.12268).
- [907] Schollwöck, U. (2011). The density-matrix renormalization group in the age of matrix product states. *Ann. Phys.*, **326**, 96–192. doi:[10.1016/j.aop.2010.09.012](https://doi.org/10.1016/j.aop.2010.09.012). arXiv:[1008.3477](https://arxiv.org/abs/1008.3477).
- [908] Schöning, U. (1999). A probabilistic algorithm for k-SAT and constraint satisfaction problems. Pages 410–414 of: *FOCS*. doi:[10.1109/SFPCS.1999.814612](https://doi.org/10.1109/SFPCS.1999.814612).
- [909] Schubert, A., and Mendl, C. B. (2023). Trotter error with commutator scaling for the Fermi–Hubbard model. *Phys. Rev. B*, **108**, 195105. doi:[10.1103/PhysRevB.108.195105](https://doi.org/10.1103/PhysRevB.108.195105). arXiv:[2306.10603](https://arxiv.org/abs/2306.10603).
- [910] Schuch, N., and Verstraete, F. (2009). Computational complexity of interacting electrons and fundamental limitations of density functional theory. *Nat. Phys.*, **5**, 732–735. doi:[10.1038/nphys1370](https://doi.org/10.1038/nphys1370). arXiv:[0712.0483](https://arxiv.org/abs/0712.0483).
- [911] Schuch, N., Wolf, M. M., Verstraete, F., and Cirac, J. I. (2007). Computational complexity of projected entangled pair states. *Phys. Rev. Lett.*, **98**, 140506. doi:[10.1103/PhysRevLett.98.140506](https://doi.org/10.1103/PhysRevLett.98.140506). arXiv:[quant-ph/0611050](https://arxiv.org/abs/quant-ph/0611050).
- [912] Schuch, N., Wolf, M. M., Verstraete, F., and Cirac, J. I. (2008). Entropy scaling and simulability by matrix product states. *Phys. Rev. Lett.*, **100**, 030504. doi:[10.1103/PhysRevLett.100.030504](https://doi.org/10.1103/PhysRevLett.100.030504). arXiv:[0705.0292](https://arxiv.org/abs/0705.0292).
- [913] Schuld, M. (2021). Supervised quantum machine learning models are kernel methods. arXiv:[2101.11020](https://arxiv.org/abs/2101.11020).
- [914] Schuld, M., and Killoran, N. (2019). Quantum machine learning in feature Hilbert spaces. *Phys. Rev. Lett.*, **122**, 040504. doi:[10.1103/PhysRevLett.122.040504](https://doi.org/10.1103/PhysRevLett.122.040504). arXiv:[1803.07128](https://arxiv.org/abs/1803.07128).
- [915] Schuld, M., and Killoran, N. (2022). Is quantum advantage the right goal for quantum machine learning? *PRX Quantum*, **3**, 030101. doi:[10.1103/PRXQuantum.3.030101](https://doi.org/10.1103/PRXQuantum.3.030101). arXiv:[2203.01340](https://arxiv.org/abs/2203.01340).
- [916] Schuld, M., and Petruccione, F. (2021). *Machine learning with quantum computers*. Springer. doi:[10.1007/978-3-030-83098-4](https://doi.org/10.1007/978-3-030-83098-4).
- [917] Schuld, M., Sinayskiy, I., and Petruccione, F. (2016). Prediction by linear regression on a quantum computer. *Phys. Rev. A*, **94**, 022342. doi:[10.1103/PhysRevA.94.022342](https://doi.org/10.1103/PhysRevA.94.022342). arXiv:[1601.07823](https://arxiv.org/abs/1601.07823).
- [918] Schuld, M., Bergholm, V., Gogolin, C., et al. (2019). Evaluating analytic gradients on quantum hardware. *Phys. Rev. A*, **99**, 032331. doi:[10.1103/PhysRevA.99.032331](https://doi.org/10.1103/PhysRevA.99.032331). arXiv:[1811.11184](https://arxiv.org/abs/1811.11184).
- [919] Schuld, M., Bocharov, A., Svore, K. M., and Wiebe, N. (2020). Circuit-centric quantum classifiers. *Phys. Rev. A*, **101**, 032308. doi:[10.1103/PhysRevA.101.032308](https://doi.org/10.1103/PhysRevA.101.032308). arXiv:[1804.00633](https://arxiv.org/abs/1804.00633).
- [920] Sels, D., Dashti, H., Mora, S., et al. (2020). Quantum approximate Bayesian computation for NMR model inference. *Nat. Mach. Intell.*, **2**, 396–402. doi:[10.1038/s42256-020-0198-x](https://doi.org/10.1038/s42256-020-0198-x). arXiv:[1910.14221](https://arxiv.org/abs/1910.14221).
- [921] Serbyn, M., Papić, Z., and Abanin, D. A. (2013). Universal slow growth of entanglement in interacting strongly disordered systems. *Phys. Rev. Lett.*, **110**, 260601. doi:[10.1103/PhysRevLett.110.260601](https://doi.org/10.1103/PhysRevLett.110.260601). arXiv:[1304.4605](https://arxiv.org/abs/1304.4605).

- [922] Setia, K., Bravyi, S., Mezzacapo, A., and Whitfield, J. D. (2019). Super-fast encodings for fermionic quantum simulation. *Phys. Rev. Res.*, **1**, 033033. doi:[10.1103/PhysRevResearch.1.033033](https://doi.org/10.1103/PhysRevResearch.1.033033). arXiv:[1810.05274](https://arxiv.org/abs/1810.05274).
- [923] Shang, H., Fan, Y., Shen, L., et al. (2023). Towards practical and massively parallel quantum computing emulation for quantum chemistry. *npj Quant. Inf.*, **9**, 33. doi:[10.1038/s41534-023-00696-7](https://doi.org/10.1038/s41534-023-00696-7). arXiv:[2303.03681](https://arxiv.org/abs/2303.03681).
- [924] Shao, C., and Montanaro, A. (2022). Faster quantum-inspired algorithms for solving linear systems. *ACM Trans. Quantum Comput.*, **3**. doi:[10.1145/3520141](https://doi.org/10.1145/3520141). arXiv:[2103.10309](https://arxiv.org/abs/2103.10309).
- [925] Shao, C., and Xiang, H. (2018). Quantum circulant preconditioner for a linear system of equations. *Phys. Rev. A*, **98**, 062321. doi:[10.1103/PhysRevA.98.062321](https://doi.org/10.1103/PhysRevA.98.062321). arXiv:[1807.04563](https://arxiv.org/abs/1807.04563).
- [926] Sharma, K., Cerezo, M., Cincio, L., and Coles, P. J. (2022). Trainability of dissipative perceptron-based quantum neural networks. *Phys. Rev. Lett.*, **128**, 180505. doi:[10.1103/PhysRevLett.128.180505](https://doi.org/10.1103/PhysRevLett.128.180505). arXiv:[2005.12458](https://arxiv.org/abs/2005.12458).
- [927] Shaw, A. F., Lougovski, P., Stryker, J. R., and Wiebe, N. (2020). Quantum algorithms for simulating the lattice Schwinger model. *Quantum*, **4**, 306. doi:[10.22331/q-2020-08-10-306](https://doi.org/10.22331/q-2020-08-10-306). arXiv:[2002.11146](https://arxiv.org/abs/2002.11146).
- [928] Shaydulin, R., Li, C., Chakrabarti, S., et al. (2023). Evidence of scaling advantage for the quantum approximate optimization algorithm on a classically intractable problem. arXiv:[2308.02342](https://arxiv.org/abs/2308.02342).
- [929] Shehab, O., Landsman, K., Nam, Y., et al. (2019). Toward convergence of effective-field-theory simulations on digital quantum computers. *Phys. Rev. A*, **100**, 062319. doi:[10.1103/PhysRevA.100.062319](https://doi.org/10.1103/PhysRevA.100.062319).
- [930] Shen, J., Tang, T., and Wang, L.-L. (2011). *Spectral methods: Algorithms, analysis and applications*. Vol. 41. Springer Science & Business Media. doi:[10.1007/978-3-540-71041-7](https://doi.org/10.1007/978-3-540-71041-7).
- [931] Shende, V. V., Markov, I. L., and Bullock, S. S. (2004). Minimal universal two-qubit controlled-not-based circuits. *Phys. Rev. A*, **69**, 062321. doi:[10.1103/PhysRevA.69.062321](https://doi.org/10.1103/PhysRevA.69.062321). arXiv:[quant-ph/0308033](https://arxiv.org/abs/quant-ph/0308033).
- [932] Shepherd, J. J., Grüneis, A., Booth, G. H., et al. (2012). Convergence of many-body wave-function expansions using a plane-wave basis: From homogeneous electron gas to solid state systems. *Phys. Rev. B*, **86**, 035111. doi:[10.1103/PhysRevB.86.035111](https://doi.org/10.1103/PhysRevB.86.035111). arXiv:[1202.4990](https://arxiv.org/abs/1202.4990).
- [933] Sherrington, D., and Kirkpatrick, S. (1975). Solvable model of a spin-glass. *Phys. Rev. Lett.*, **35**, 1792. doi:[10.1103/PhysRevLett.35.1792](https://doi.org/10.1103/PhysRevLett.35.1792).
- [934] Shokrian Zini, M., Delgado, A., dos Reis, R., et al. (2023). Quantum simulation of battery materials using ionic pseudopotentials. *Quantum*, **7**, 1049. doi:[10.22331/q-2023-07-10-1049](https://doi.org/10.22331/q-2023-07-10-1049). arXiv:[2302.07981](https://arxiv.org/abs/2302.07981).
- [935] Shor, P. W. (1995). Scheme for reducing decoherence in quantum computer memory. *Phys. Rev. A*, **52**, R2493–R2496. doi:[10.1103/PhysRevA.52.R2493](https://doi.org/10.1103/PhysRevA.52.R2493).
- [936] Shor, P. W. (1996). Fault-tolerant quantum computation. Pages 56–65 of: *FQCS*. doi:[10.1109/SFCS.1996.548464](https://doi.org/10.1109/SFCS.1996.548464). arXiv:[quant-ph/9605011](https://arxiv.org/abs/quant-ph/9605011).

- [937] Shor, P. W. (1997). Polynomial-time algorithms for prime factorization and discrete logarithms on a quantum computer. *SIAM J. Comp.*, **26**, 1484–1509. doi:[10.1137/S0097539795293172](https://doi.org/10.1137/S0097539795293172). Earlier version in *FOCS'94*. arXiv:[quant-ph/9508027](https://arxiv.org/abs/quant-ph/9508027).
- [938] Shor, P. W. (2022). The early days of quantum computation. arXiv:[2208.09964](https://arxiv.org/abs/2208.09964).
- [939] Shtanko, O., and Movassagh, R. (2021). Preparing thermal states on noiseless and noisy programmable quantum processors. arXiv:[2112.14688](https://arxiv.org/abs/2112.14688).
- [940] Simon, D. R. (1997). On the power of quantum computation. *SIAM J. Comp.*, **26**, 1474–1483. doi:[10.1137/S0097539796298637](https://doi.org/10.1137/S0097539796298637). Earlier version in *FOCS'94*.
- [941] Simon, S., Santagati, R., Degroote, M., et al. (2023). Improved precision scaling for simulating coupled quantum-classical dynamics. arXiv:[2307.13033](https://arxiv.org/abs/2307.13033).
- [942] Skoric, L., Browne, D. E., Barnes, K. M., et al. (2023). Parallel window decoding enables scalable fault tolerant quantum computation. *Nat. Commun.*, **14**. doi:[10.1038/s41467-023-42482-1](https://doi.org/10.1038/s41467-023-42482-1).
- [943] Smolin, J. A., Smith, G., and Vargo, A. (2013). Oversimplifying quantum factoring. *Nature*, **499**, 163–165. doi:[10.1038/nature12290](https://doi.org/10.1038/nature12290).
- [944] Somma, R., Boixo, S., and Barnum, H. (2007). Quantum simulated annealing. arXiv:[0712.1008](https://arxiv.org/abs/0712.1008).
- [945] Song, X.-Y., Jian, C.-M., and Balents, L. (2017). Strongly correlated metal built from Sachdev–Ye–Kitaev models. *Phys. Rev. Lett.*, **119**, 216601. doi:[10.1103/PhysRevLett.119.216601](https://doi.org/10.1103/PhysRevLett.119.216601). arXiv:[1705.00117](https://arxiv.org/abs/1705.00117).
- [946] Sparrow, C., Martín-López, E., Maraviglia, N., et al. (2018). Simulating the vibrational quantum dynamics of molecules using photonics. *Nature*, **557**, 660–667. doi:[10.1038/s41586-018-0152-9](https://doi.org/10.1038/s41586-018-0152-9).
- [947] Stace, T. M., Barrett, S. D., and Doherty, A. C. (2009). Thresholds for topological codes in the presence of loss. *Phys. Rev. Lett.*, **102**, 200501. doi:[10.1103/PhysRevLett.102.200501](https://doi.org/10.1103/PhysRevLett.102.200501). arXiv:[0904.3556](https://arxiv.org/abs/0904.3556).
- [948] Stamatoopoulos, N., and Zeng, W. J. (2023). Derivative pricing using quantum signal processing. arXiv:[2307.14310](https://arxiv.org/abs/2307.14310).
- [949] Stamatoopoulos, N., Egger, D. J., Sun, Y., et al. (2020). Option pricing using quantum computers. *Quantum*, **4**, 291. doi:[10.22331/q-2020-07-06-291](https://doi.org/10.22331/q-2020-07-06-291). arXiv:[1905.02666](https://arxiv.org/abs/1905.02666).
- [950] Stamatoopoulos, N., Mazzola, G., Woerner, S., and Zeng, W. J. (2022). Towards quantum advantage in financial market risk using quantum gradient algorithms. *Quantum*, **6**, 770. doi:[10.22331/q-2022-07-20-770](https://doi.org/10.22331/q-2022-07-20-770). arXiv:[2111.12509](https://arxiv.org/abs/2111.12509).
- [951] Stanisic, S., Bosse, J. L., Gambetta, F. M., et al. (2022). Observing ground-state properties of the Fermi–Hubbard model using a scalable algorithm on a quantum computer. *Nat. Commun.*, **13**, 5743. doi:[10.1038/s41467-022-33335-4](https://doi.org/10.1038/s41467-022-33335-4). arXiv:[2112.02025](https://arxiv.org/abs/2112.02025).
- [952] Steane, A. M. (1996). Error correcting codes in quantum theory. *Phys. Rev. Lett.*, **77**, 793–797. doi:[10.1103/PhysRevLett.77.793](https://doi.org/10.1103/PhysRevLett.77.793).
- [953] Steane, A. M. (1997). Active stabilization, quantum computation, and quantum state synthesis. *Phys. Rev. Lett.*, **78**, 2252–2255. doi:[10.1103/physrevlett.78.2252](https://doi.org/10.1103/physrevlett.78.2252). arXiv:[quant-ph/9611027](https://arxiv.org/abs/quant-ph/9611027).

- [954] Steiger, D. S., and Troyer, M. (2016). Racing in parallel: Quantum versus classical. Pages H44–010 of: *APS March Meeting Abstracts*, vol. 2016. doi:[10.48660/16080019](https://doi.org/10.48660/16080019).
- [955] Stetcu, I., Baroni, A., and Carlson, J. (2022). Variational approaches to constructing the many-body nuclear ground state for quantum computing. *Phys. Rev. C*, **105**, 064308. doi:[10.1103/PhysRevC.105.064308](https://doi.org/10.1103/PhysRevC.105.064308). arXiv:[2110.06098](https://arxiv.org/abs/2110.06098).
- [956] Steudtner, M., Morley-Short, S., Pol, W., et al. (2023). Fault-tolerant quantum computation of molecular observables. arXiv:[2303.14118](https://arxiv.org/abs/2303.14118).
- [957] Stevenson, P. D. (2023). Comments on quantum computing in nuclear physics. *Int. J. Unconv. Comput.*, **18**, 10.
- [958] Stroberg, S. R., Bogner, S. K., Hergert, H., and Holt, J. D. (2019). Nonempirical interactions for the nuclear shell model: An update. *Ann. Rev. Nucl. Part. Sci.*, **69**, 307–362. doi:[10.1146/annurev-nucl-101917-021120](https://doi.org/10.1146/annurev-nucl-101917-021120).
- [959] Strohmer, T., and Vershynin, R. (2009). A randomized Kaczmarz algorithm with exponential convergence. *J. Fourier Anal. Appl.*, **15**, 262–278. doi:[10.1007/s00041-008-9030-4](https://doi.org/10.1007/s00041-008-9030-4). arXiv:[math/0702226](https://arxiv.org/abs/math/0702226).
- [960] Stryker, J. R. (2019). Oracles for Gauss’s law on digital quantum computers. *Phys. Rev. A*, **99**, 042301. doi:[10.1103/PhysRevA.99.042301](https://doi.org/10.1103/PhysRevA.99.042301). arXiv:[1812.01617](https://arxiv.org/abs/1812.01617).
- [961] Su, Y. (2024). Private communication.
- [962] Su, Y., Berry, D. W., Wiebe, N., et al. (2021). Fault-tolerant quantum simulations of chemistry in first quantization. *PRX Quantum*, **2**, 040332. doi:[10.1103/PRXQuantum.2.040332](https://doi.org/10.1103/PRXQuantum.2.040332). arXiv:[2105.12767](https://arxiv.org/abs/2105.12767).
- [963] Su, Y., Huang, H. Y., and Campbell, E. T. (2021). Nearly tight Trotterization of interacting electrons. *Quantum*, **5**, 1–58. doi:[10.22331/q-2021-07-05-495](https://doi.org/10.22331/q-2021-07-05-495). arXiv:[2012.09194](https://arxiv.org/abs/2012.09194).
- [964] Subaşı, Y., Somma, R. D., and Orsucci, D. (2019). Quantum algorithms for systems of linear equations inspired by adiabatic quantum computing. *Phys. Rev. Lett.*, **122**, 060504. doi:[10.1103/PhysRevLett.122.060504](https://doi.org/10.1103/PhysRevLett.122.060504). arXiv:[1805.10549](https://arxiv.org/abs/1805.10549).
- [965] Succi, S., Itani, W., Sreenivasan, K. R., and Steijl, R. (2023). Ensemble fluid simulations on quantum computers. arXiv:[2304.05410](https://arxiv.org/abs/2304.05410).
- [966] Sugisaki, K., Toyota, K., Sato, K., et al. (2022). Adiabatic state preparation of correlated wave functions with nonlinear scheduling functions and broken-symmetry wave functions. *Commun. Chem.*, **5**, 84. doi:[10.1038/s42004-022-00701-8](https://doi.org/10.1038/s42004-022-00701-8).
- [967] Sun, S.-N., Motta, M., Tazhigulov, R. N., et al. (2021). Quantum computation of finite-temperature static and dynamical properties of spin systems using quantum imaginary time evolution. *PRX Quantum*, **2**, 010317. doi:[10.1103/PRXQuantum.2.010317](https://doi.org/10.1103/PRXQuantum.2.010317). arXiv:[2009.03542](https://arxiv.org/abs/2009.03542).
- [968] Sun, X., Tian, G., Yang, S., et al. (2023). Asymptotically optimal circuit depth for quantum state preparation and general unitary synthesis. *IEEE Trans. Comput.-Aided Des. Integr. Circuits Syst.*, 1–1. doi:[10.1109/TCAD.2023.3244885](https://doi.org/10.1109/TCAD.2023.3244885). arXiv:[2108.06150](https://arxiv.org/abs/2108.06150).
- [969] Sünderhauf, C., Campbell, E., and Camps, J. (2023). Block-encoding structured matrices for data input in quantum computing. arXiv:[2302.10949](https://arxiv.org/abs/2302.10949).

- [970] Susskind, L. (1977). Lattice fermions. *Phys. Rev. D*, **16**, 3031–3039. doi:[10.1103/PhysRevD.16.3031](https://doi.org/10.1103/PhysRevD.16.3031).
- [971] Suykens, J., De Brabanter, J., Lukas, L., and Vandewalle, J. (2002). Weighted least squares support vector machines: Robustness and sparse approximation. *Neurocomputing*, **48**, 85–105. doi:[10.1016/S0925-2312\(01\)00644-0](https://doi.org/10.1016/S0925-2312(01)00644-0).
- [972] Suykens, J. A. K., and Vandewalle, J. (1999). Least squares support vector machine classifiers. *Neural Process. Lett.*, **9**, 293–300. doi:[10.1023/A:1018628609742](https://doi.org/10.1023/A:1018628609742).
- [973] Sweke, R., Kesselring, M. S., van Nieuwenburg, E. P. L., and Eisert, J. (2020). Reinforcement learning decoders for fault-tolerant quantum computation. *Mach. Learn.: Sci. Technol.*, **2**, 025005. doi:[10.1088/2632-2153/abc609](https://doi.org/10.1088/2632-2153/abc609). arXiv:[1810.07207](https://arxiv.org/abs/1810.07207).
- [974] Szegedy, M. (2004). Quantum speed-up of Markov chain based algorithms. Pages 32–41 of: *FOCS*. doi:[10.1109/FOCS.2004.53](https://doi.org/10.1109/FOCS.2004.53). arXiv:[quant-ph/0401053](https://arxiv.org/abs/quant-ph/0401053).
- [975] Ta-Shma, A. (2013). Inverting well conditioned matrices in quantum logspace. Pages 881–890 of: *STOC*. doi:[10.1145/2488608.2488720](https://doi.org/10.1145/2488608.2488720).
- [976] Tang, E. (2019). A quantum-inspired classical algorithm for recommendation systems. Pages 217–228 of: *STOC*. doi:[10.1145/3313276.3316310](https://doi.org/10.1145/3313276.3316310). arXiv:[1807.04271](https://arxiv.org/abs/1807.04271).
- [977] Tang, E. (2021). Quantum principal component analysis only achieves an exponential speedup because of its state preparation assumptions. *Phys. Rev. Lett.*, **127**, 060503. doi:[10.1103/PhysRevLett.127.060503](https://doi.org/10.1103/PhysRevLett.127.060503). arXiv:[1811.00414](https://arxiv.org/abs/1811.00414).
- [978] Tang, E. (2022). Dequantizing algorithms to understand quantum advantage in machine learning. *Nat. Rev. Phys.*, **4**, 692–693. doi:[10.1038/s42254-022-00511-w](https://doi.org/10.1038/s42254-022-00511-w).
- [979] Tang, E. (2023). *Quantum machine learning without any quantum*. PhD thesis, University of Washington.
- [980] Tang, E., and Tian, K. (2023). A CS guide to the quantum singular value transformation. arXiv:[2302.14324](https://arxiv.org/abs/2302.14324).
- [981] Tang, H., Pal, A., Wang, T.-Y., et al. (2021). Quantum computation for pricing the collateralized debt obligations. *Quantum Eng.*, **3**, e84. doi:[10.1002/que2.84](https://doi.org/10.1002/que2.84). arXiv:[2008.04110](https://arxiv.org/abs/2008.04110).
- [982] Taube, A. G., and Bartlett, R. J. (2006). New perspectives on unitary coupled-cluster theory. *Int. J. Quantum Chem.*, **106**, 3393–3401. doi:[10.1002/qua.21198](https://doi.org/10.1002/qua.21198).
- [983] Tazhigulov, R. N., Sun, S.-N., Haghshenas, R., et al. (2022). Simulating models of challenging correlated molecules and materials on the sycamore quantum processor. *PRX Quantum*, **3**, 040318. doi:[10.1103/PRXQuantum.3.040318](https://doi.org/10.1103/PRXQuantum.3.040318). arXiv:[2203.15291](https://arxiv.org/abs/2203.15291).
- [984] Temme, K., Osborne, T. J., Vollbrecht, K. G., et al. (2011). Quantum Metropolis sampling. *Nature*, **471**, 87–90. doi:[10.1038/nature09770](https://doi.org/10.1038/nature09770). arXiv:[0911.3635](https://arxiv.org/abs/0911.3635).
- [985] Terhal, B. M. (2015). Quantum error correction for quantum memories. *Rev. Mod. Phys.*, **87**, 307–346. doi:[10.1103/revmodphys.87.307](https://doi.org/10.1103/revmodphys.87.307). arXiv:[1302.3428](https://arxiv.org/abs/1302.3428).

- [986] Terhal, B. M., and Burkard, G. (2005). Fault-tolerant quantum computation for local non-Markovian noise. *Phys. Rev. A*, **71**, 012336. doi:[10.1103/physreva.71.012336](https://doi.org/10.1103/physreva.71.012336). arXiv:[quant-ph/0402104](https://arxiv.org/abs/quant-ph/0402104).
- [987] Tews, I., Davoudi, Z., Ekström, A., et al. (2020). New ideas in constraining nuclear forces. *J. Phys. G*, **47**, 103001. doi:[10.1088/1361-6471/ab9079](https://doi.org/10.1088/1361-6471/ab9079). arXiv:[2001.03334](https://arxiv.org/abs/2001.03334).
- [988] Thanasilp, S., Wang, S., Cerezo, M., and Holmes, Z. (2022). Exponential concentration and untrainability in quantum kernel methods. arXiv:[2208.11060](https://arxiv.org/abs/2208.11060).
- [989] Thomas, P. S., Carrington Jr., T., Agarwal, J., and Schaefer III, H. F. (2018). Using an iterative eigensolver and intertwined rank reduction to compute vibrational spectra of molecules with more than a dozen atoms: Uracil and naphthalene. *J. Chem. Phys.*, **149**, 064108. doi:[10.1063/1.5039147](https://doi.org/10.1063/1.5039147).
- [990] Tong, Y., An, D., Wiebe, N., and Lin, L. (2021). Fast inversion, preconditioned quantum linear system solvers, fast Green's-function computation, and fast evaluation of matrix functions. *Phys. Rev. A*, **104**, 032422. doi:[10.1103/PhysRevA.104.032422](https://doi.org/10.1103/PhysRevA.104.032422). arXiv:[2008.13295](https://arxiv.org/abs/2008.13295).
- [991] Tong, Y., Albert, V. V., McClean, J. R., et al. (2022). Provably accurate simulation of gauge theories and bosonic systems. *Quantum*, **6**, 816. doi:[10.22331/q-2022-09-22-816](https://doi.org/10.22331/q-2022-09-22-816). arXiv:[2110.06942](https://arxiv.org/abs/2110.06942).
- [992] Torlai, G., and Melko, R. G. (2017). Neural decoder for topological codes. *Phys. Rev. Lett.*, **119**, 030501. doi:[10.1103/PhysRevLett.119.030501](https://doi.org/10.1103/PhysRevLett.119.030501). arXiv:[1610.04238](https://arxiv.org/abs/1610.04238).
- [993] Tran, M. C., Guo, A. Y., Su, Y., et al. (2019). Locality and digital quantum simulation of power-law interactions. *Phys. Rev. X*, **9**, 031006. doi:[10.1103/PhysRevX.9.031006](https://doi.org/10.1103/PhysRevX.9.031006). arXiv:[1808.05225](https://arxiv.org/abs/1808.05225).
- [994] Tran, M. C., Su, Y., Carney, D., and Taylor, J. M. (2021). Faster digital quantum simulation by symmetry protection. *PRX Quantum*, **2**, 010323. doi:[10.1103/PRXQuantum.2.010323](https://doi.org/10.1103/PRXQuantum.2.010323). arXiv:[2006.16248](https://arxiv.org/abs/2006.16248).
- [995] Trenev, D., Ollitrault, P. J., Harwood, S. M., et al. (2023). Refining resource estimation for the quantum computation of vibrational molecular spectra through Trotter error analysis. arXiv:[2311.03719](https://arxiv.org/abs/2311.03719).
- [996] Trottenberg, U., Oosterlee, C. W., and Schuller, A. (2000). *Multigrid*. Elsevier.
- [997] Troyer, M., and Wiese, U.-J. (2005). Computational complexity and fundamental limitations to fermionic quantum Monte Carlo simulations. *Phys. Rev. Lett.*, **94**, 170201. doi:[10.1103/PhysRevLett.94.170201](https://doi.org/10.1103/PhysRevLett.94.170201). arXiv:[cond-mat/0408370](https://arxiv.org/abs/cond-mat/0408370).
- [998] Tubman, N. M., Mejuto-Zaera, C., Epstein, J. M., et al. (2018). Postponing the orthogonality catastrophe: Efficient state preparation for electronic structure simulations on quantum devices. arXiv:[1809.05523](https://arxiv.org/abs/1809.05523).
- [999] Tuckett, D. K., Bartlett, S. D., and Flammia, S. T. (2018). Ultrahigh error threshold for surface codes with biased noise. *Phys. Rev. Lett.*, **120**, 050505. doi:[10.1103/PhysRevLett.120.050505](https://doi.org/10.1103/PhysRevLett.120.050505). arXiv:[1708.08474](https://arxiv.org/abs/1708.08474).
- [1000] Turro, F., Chistolini, T., Hashim, A., et al. (2023). Demonstration of a quantum-classical coprocessing protocol for simulating nuclear reactions. *Phys. Rev. A*, **108**, 032417. doi:[10.1103/PhysRevA.108.032417](https://doi.org/10.1103/PhysRevA.108.032417).

- [1001] Valahu, C. H., Olaya-Agudelo, V. C., MacDonell, R. J., et al. (2023). Direct observation of geometric-phase interference in dynamics around a conical intersection. *Nat. Chem.*, **15**, 1503–1508. doi:[10.1038/s41557-023-01300-3](https://doi.org/10.1038/s41557-023-01300-3). arXiv:[2211.07320](https://arxiv.org/abs/2211.07320).
- [1002] van Vreumingen, D., Neukart, F., Von Dollen, D., et al. (2019). Quantum-assisted finite-element design optimization. arXiv:[1908.03947](https://arxiv.org/abs/1908.03947).
- [1003] Varbanov, B. M., Serra-Peralta, M., Byfield, D., and Terhal, B. M. (2023). Neural network decoder for near-term surface-code experiments. arXiv:[2307.03280](https://arxiv.org/abs/2307.03280).
- [1004] Vasmer, M., and Kubica, A. (2022). Morphing quantum codes. *PRX Quantum*, **3**, 030319. doi:[10.1103/PRXQuantum.3.030319](https://doi.org/10.1103/PRXQuantum.3.030319). arXiv:[2112.01446](https://arxiv.org/abs/2112.01446).
- [1005] Vasmer, M., Browne, D. E., and Kubica, A. (2021). Cellular automaton decoders for topological quantum codes with noisy measurements and beyond. *Sci. Rep.*, **11**, 2027. doi:[10.1038/s41598-021-81138-2](https://doi.org/10.1038/s41598-021-81138-2). arXiv:[2004.07247](https://arxiv.org/abs/2004.07247).
- [1006] Veis, L., and Pittner, J. (2014). Adiabatic state preparation study of methylene. *J. Chem. Phys.*, **140**, 214111. doi:[10.1063/1.4880755](https://doi.org/10.1063/1.4880755). arXiv:[1401.3186](https://arxiv.org/abs/1401.3186).
- [1007] Venkateswaran, R., and O'Donnell, R. (2020). Quantum approximate counting with nonadaptive Grover iterations. arXiv:[2010.04370](https://arxiv.org/abs/2010.04370).
- [1008] Verdon, G., Broughton, M., and Biamonte, J. (2017). A quantum algorithm to train neural networks using low-depth circuits. arXiv:[1712.05304](https://arxiv.org/abs/1712.05304).
- [1009] Verdon, G., Pye, J., and Broughton, M. (2018). A universal training algorithm for quantum deep learning. arXiv:[1806.09729](https://arxiv.org/abs/1806.09729).
- [1010] Verstraete, F., and Cirac, J. I. (2005). Mapping local Hamiltonians of fermions to local Hamiltonians of spins. *J. Stat. Mech. Theory Exp.*, **2005**, P09012. doi:[10.1088/1742-5468/2005/09/P09012](https://doi.org/10.1088/1742-5468/2005/09/P09012). arXiv:[cond-mat/0508353](https://arxiv.org/abs/cond-mat/0508353).
- [1011] Wan, K. (2021). Exponentially faster implementations of Select(H) for fermionic Hamiltonians. *Quantum*, **5**. doi:[10.22331/q-2021-01-12-380](https://doi.org/10.22331/q-2021-01-12-380). arXiv:[2004.04170](https://arxiv.org/abs/2004.04170).
- [1012] Wan, K., and Kim, I. (2020). Fast digital methods for adiabatic state preparation. arXiv:[2004.04164](https://arxiv.org/abs/2004.04164).
- [1013] Wan, K., Berta, M., and Campbell, E. T. (2022). Randomized quantum algorithm for statistical phase estimation. *Phys. Rev. Lett.*, **129**, 030503. doi:[10.1103/PhysRevLett.129.030503](https://doi.org/10.1103/PhysRevLett.129.030503). arXiv:[2110.12071](https://arxiv.org/abs/2110.12071).
- [1014] Wan, K. H., Dahlsten, O., Kristjánsson, H., et al. (2017). Quantum generalisation of feedforward neural networks. *npj Quant. Inf.*, **3**, 36. doi:[10.1038/s41534-017-0032-4](https://doi.org/10.1038/s41534-017-0032-4). arXiv:[1612.01045](https://arxiv.org/abs/1612.01045).
- [1015] Wang, C. S., Curtis, J. C., Lester, B. J., et al. (2020). Efficient multiphoton sampling of molecular vibronic spectra on a superconducting bosonic processor. *Phys. Rev. X*, **10**, 021060. doi:[10.1103/PhysRevX.10.021060](https://doi.org/10.1103/PhysRevX.10.021060). arXiv:[1908.03598](https://arxiv.org/abs/1908.03598).
- [1016] Wang, C. S., Frattini, N. E., Chapman, B. J., et al. (2023). Observation of wavepacket branching through an engineered conical intersection. *Phys. Rev. X*, **13**, 011008. doi:[10.1103/PhysRevX.13.011008](https://doi.org/10.1103/PhysRevX.13.011008). arXiv:[2202.02364](https://arxiv.org/abs/2202.02364).
- [1017] Wang, D. S., Fowler, A. G., and Hollenberg, L. C. L. (2011). Surface code quantum computing with error rates over 1%. *Phys. Rev. A*, **83**, 020302. doi:[10.1103/PhysRevA.83.020302](https://doi.org/10.1103/PhysRevA.83.020302).

- [1018] Wang, J., Dong, Y., and Lin, L. (2022). On the energy landscape of symmetric quantum signal processing. *Quantum*, **6**, 850. doi:[10.22331/q-2022-11-03-850](https://doi.org/10.22331/q-2022-11-03-850). arXiv:[2110.04993](https://arxiv.org/abs/2110.04993).
- [1019] Wang, R., Kashinath, K., Mustafa, M., et al. (2020). Towards physics-informed deep learning for turbulent flow prediction. Pages 1457–1466 of: *KDD*. doi:[10.1145/3394486.3403198](https://doi.org/10.1145/3394486.3403198). arXiv:[1911.08655](https://arxiv.org/abs/1911.08655).
- [1020] Wang, S., Wang, Z., Cui, G., et al. (2021). Fast black-box quantum state preparation based on linear combination of unitaries. *Quantum Inf. Process.*, **20**, 1–14. doi:[10.1007/s11128-021-03203-z](https://doi.org/10.1007/s11128-021-03203-z). arXiv:[2105.06230](https://arxiv.org/abs/2105.06230).
- [1021] Wang, S., Fontana, E., Cerezo, M., et al. (2021). Noise-induced barren plateaus in variational quantum algorithms. *Nat. Commun.*, **12**, 1–11. doi:[10.1038/s41467-021-27045-6](https://doi.org/10.1038/s41467-021-27045-6). arXiv:[2007.14384](https://arxiv.org/abs/2007.14384).
- [1022] Wang, S., McArdle, S., and Berta, M. (2024). Qubit-efficient randomized quantum algorithms for linear algebra. *PRX Quantum*, **5**, 020324. doi:[10.1103/PRXQuantum.5.020324](https://doi.org/10.1103/PRXQuantum.5.020324). arXiv:[2302.01873](https://arxiv.org/abs/2302.01873).
- [1023] Wang, Z., Wei, S., Long, G.-L., and Hanzo, L. (2022). Variational quantum attacks threaten advanced encryption standard based symmetric cryptography. *Sci. China Inf. Sci.*, **65**, 200503. doi:[10.1007/s11432-022-3511-5](https://doi.org/10.1007/s11432-022-3511-5). arXiv:[2205.03529](https://arxiv.org/abs/2205.03529).
- [1024] Wanner, G., and Hairer, E. (1993). *Solving ordinary differential equations I*. Vol. 375. Springer Berlin, Heidelberg. doi:[10.1007/978-3-540-78862-1](https://doi.org/10.1007/978-3-540-78862-1).
- [1025] Wanner, G., and Hairer, E. (1996). *Solving ordinary differential equations II*. Vol. 375. Springer Berlin, Heidelberg. doi:[10.1007/978-3-642-05221-7](https://doi.org/10.1007/978-3-642-05221-7).
- [1026] Washington, L. C. (2008). *Elliptic curves: Number theory and cryptography, second edition*. Chapman and Hall/CRC.
- [1027] Watkins, J., Wiebe, N., Roggero, A., and Lee, D. (2022). Time-dependent Hamiltonian simulation using discrete clock constructions. arXiv:[2203.11353](https://arxiv.org/abs/2203.11353).
- [1028] Watson, J. D., Bringewatt, J., Shaw, A. F., et al. (2023). Quantum algorithms for simulating nuclear effective field theories. arXiv:[2312.05344](https://arxiv.org/abs/2312.05344).
- [1029] Watts, T. W., Otten, M., Necaie, J. T., et al. (2024). Fullerene-encapsulated cyclic ozone for the next generation of nano-sized propellants via quantum computation. arXiv:[2408.13244](https://arxiv.org/abs/2408.13244).
- [1030] Webber, M., Elfving, V., Weidt, S., and Hensinger, W. K. (2022). The impact of hardware specifications on reaching quantum advantage in the fault tolerant regime. *AVS Quantum Sci.*, **4**, 013801. doi:[10.1116/5.0073075](https://doi.org/10.1116/5.0073075). arXiv:[2108.12371](https://arxiv.org/abs/2108.12371).
- [1031] Wecker, D., Hastings, M. B., Wiebe, N., et al. (2015). Solving strongly correlated electron models on a quantum computer. *Phys. Rev. A*, **92**, 062318. doi:[10.1103/PhysRevA.92.062318](https://doi.org/10.1103/PhysRevA.92.062318). arXiv:[1506.05135](https://arxiv.org/abs/1506.05135).
- [1032] Wecker, D., Hastings, M. B., and Troyer, M. (2016). Training a quantum optimizer. *Phys. Rev. A*, **94**, 022309. doi:[10.1103/PhysRevA.94.022309](https://doi.org/10.1103/PhysRevA.94.022309). arXiv:[1605.05370](https://arxiv.org/abs/1605.05370).
- [1033] Wein, A. S., El Alaoui, A., and Moore, C. (2019). The Kikuchi hierarchy and tensor PCA. Pages 1446–1468 of: *FOCS*. doi:[10.1109/FOCS.2019.000-2](https://doi.org/10.1109/FOCS.2019.000-2). arXiv:[1904.03858](https://arxiv.org/abs/1904.03858).

- [1034] Whitfield, J. D., Biamonte, J., and Aspuru-Guzik, A. (2011). Simulation of electronic structure Hamiltonians using quantum computers. *Mol. Phys.*, **109**, 735–750. doi:[10.1080/00268976.2011.552441](https://doi.org/10.1080/00268976.2011.552441). arXiv:[1001.3855](https://arxiv.org/abs/1001.3855).
- [1035] Whitfield, J. D., Love, P. J., and Aspuru-Guzik, A. (2013). Computational complexity in electronic structure. *Phys. Chem. Chem. Phys.*, **15**, 397–411. doi:[10.1039/C2CP42695A](https://doi.org/10.1039/C2CP42695A). arXiv:[1208.3334](https://arxiv.org/abs/1208.3334).
- [1036] Whitlow, J., Jia, Z., Wang, Y., et al. (2023). Quantum simulation of conical intersections using trapped ions. *Nat. Chem.*, **15**, 1509–1514. doi:[10.1038/s41557-023-01303-0](https://doi.org/10.1038/s41557-023-01303-0). arXiv:[2211.07319](https://arxiv.org/abs/2211.07319).
- [1037] Wiebe, N., and Wossnig, L. (2019). Generative training of quantum Boltzmann machines with hidden units. arXiv:[1905.09902](https://arxiv.org/abs/1905.09902).
- [1038] Wiebe, N., Berry, D., Høyer, P., and Sanders, B. C. (2010). Higher order decompositions of ordered operator exponentials. *J. Phys. A*, **43**, 065203. doi:[10.1088/1751-8113/43/6/065203](https://doi.org/10.1088/1751-8113/43/6/065203). arXiv:[0812.0562](https://arxiv.org/abs/0812.0562).
- [1039] Wiebe, N., Braun, D., and Lloyd, S. (2012). Quantum algorithm for data fitting. *Phys. Rev. Lett.*, **109**, 050505. doi:[10.1103/PhysRevLett.109.050505](https://doi.org/10.1103/PhysRevLett.109.050505). arXiv:[1204.5242](https://arxiv.org/abs/1204.5242).
- [1040] Wiebe, N., Kapoor, A., and Svore, K. M. (2015). Quantum nearest-neighbor algorithms for machine learning. *Quantum Inf. Comput.*, **15**, 318–358. doi:[10.26421/QIC15.3-4](https://doi.org/10.26421/QIC15.3-4). arXiv:[1401.2142](https://arxiv.org/abs/1401.2142).
- [1041] Wiebe, N., Kapoor, A., and Svore, K. M. (2016). Quantum deep learning. *Quantum Inf. Comput.*, **16**, 541–587. doi:[10.26421/QIC16.7-8-1](https://doi.org/10.26421/QIC16.7-8-1). arXiv:[1412.3489](https://arxiv.org/abs/1412.3489).
- [1042] Wiebe, N., Bocharov, A., Smolensky, P., et al. (2019). Quantum language processing. arXiv:[1902.05162](https://arxiv.org/abs/1902.05162).
- [1043] Wierichs, D., Izaac, J., Wang, C., and Lin, C. Y.-Y. (2022). General parameter-shift rules for quantum gradients. *Quantum*. doi:[10.22331/q-2022-03-30-677](https://doi.org/10.22331/q-2022-03-30-677). arXiv:[2107.12390](https://arxiv.org/abs/2107.12390).
- [1044] Wilde, M. M. (2017). *Quantum information theory*. 2nd edn. Cambridge University Press. doi:[10.1017/9781316809976](https://doi.org/10.1017/9781316809976). arXiv:[1106.1445](https://arxiv.org/abs/1106.1445).
- [1045] Wilkinson, J. M., and Blundell, S. J. (2020). Information and decoherence in a muon-fluorine coupled system. *Phys. Rev. Lett.*, **125**, 087201. doi:[10.1103/PhysRevLett.125.087201](https://doi.org/10.1103/PhysRevLett.125.087201). arXiv:[2003.02762](https://arxiv.org/abs/2003.02762).
- [1046] Williams, K. T., Yao, Y., Li, J., et al. (2020). Direct comparison of many-body methods for realistic electronic Hamiltonians. *Phys. Rev. X*, **10**, 011041. doi:[10.1103/PhysRevX.10.011041](https://doi.org/10.1103/PhysRevX.10.011041). arXiv:[1910.00045](https://arxiv.org/abs/1910.00045).
- [1047] Williams, R. (2005). A new algorithm for optimal 2-constraint satisfaction and its implications. *Theor. Comput. Sci.*, **348**, 357–365. doi:[10.1016/j.tcs.2005.09.023](https://doi.org/10.1016/j.tcs.2005.09.023). Earlier version in *ICALP'04*.
- [1048] Wocjan, P., and Temme, K. (2023). Szegedy walk unitaries for quantum maps. *Commun. Math. Phys.*, **402**, 3201–3231. doi:[10.1007/s00220-023-04797-4](https://doi.org/10.1007/s00220-023-04797-4). arXiv:[2107.07365](https://arxiv.org/abs/2107.07365).
- [1049] Woerner, S., and Egger, D. J. (2019). Quantum risk analysis. *npj Quant. Inf.*, **5**, 15. doi:[10.1038/s41534-019-0130-6](https://doi.org/10.1038/s41534-019-0130-6). arXiv:[1806.06893](https://arxiv.org/abs/1806.06893).
- [1050] Wolf, M. M. (2012). *Quantum channels & operations: Guided tour*. <https://mediatum.ub.tum.de/download/1701036/1701036.pdf>, accessed: 2023-09-30.

- [1051] de Wolf, R. (2019). Quantum computing: Lecture notes. arXiv:1907.09415.
- [1052] Wright, M. (2005). The interior-point revolution in optimization: History, recent developments, and lasting consequences. *Bull. AMS*, **42**, 39–56. doi:10.1090/S0273-0979-04-01040-7.
- [1053] Wright, S. J. (1997). *Primal-dual interior-point methods*. Society for Industrial and Applied Mathematics. doi:10.1137/1.9781611971453.
- [1054] Wu, D., Rossi, R., Vicentini, F., et al. (2023). Variational benchmarks for quantum many-body problems. arXiv:2302.04919.
- [1055] Wu, H.-C., Wang, J., and Li, X. (2024). Quantum algorithms for nonlinear dynamics: Revisiting Carleman linearization with no dissipative conditions. arXiv:2405.12714.
- [1056] Wu, L.-A., Byrd, M. S., and Lidar, D. A. (2002). Polynomial-time simulation of pairing models on a quantum computer. *Phys. Rev. Lett.*, **89**, 057904. doi:10.1103/PhysRevLett.89.057904. arXiv:quant-ph/0108110.
- [1057] Wu, Y., Kolkowitz, S., Puri, S., and Thompson, J. D. (2022). Erasure conversion for fault-tolerant quantum computing in alkaline earth Rydberg atom arrays. *Nat. Commun.*, **13**, 4657. doi:10.1038/s41467-022-32094-6. arXiv:2201.03540.
- [1058] Xu, F., Ma, X., Zhang, Q., et al. (2020). Secure quantum key distribution with realistic devices. *Rev. Mod. Phys.*, **92**, 025002. doi:10.1103/RevModPhys.92.025002. arXiv:1903.09051.
- [1059] Xu, S., Susskind, L., Su, Y., and Swingle, B. (2020). A sparse model of quantum holography. arXiv:2008.02303.
- [1060] Xu, X., Sun, J., Endo, S., et al. (2021). Variational algorithms for linear algebra. *Sci. Bull.*, **66**, 2181–2188. doi:10.1016/j.scib.2021.06.023. arXiv:1909.03898.
- [1061] Xue, C., Xu, X.-F., Wu, Y.-C., and Guo, G.-P. (2022). Quantum algorithm for solving a quadratic nonlinear system of equations. *Phys. Rev. A*, **106**, 032427. doi:10.1103/PhysRevA.106.032427.
- [1062] Yalovetzky, R., Minssen, P., Herman, D., and Pistoia, M. (2021). NISQ-HHL: Portfolio optimization for near-term quantum hardware. arXiv:2110.15958.
- [1063] Yamada, S., Imamura, T., and Machida, M. (2005). 16.447 TFlops and 159-billion-dimensional exact-diagonalization for trapped Fermion–Hubbard model on the Earth simulator. Pages 44–44 of: *SC*. doi:10.1109/SC.2005.1.
- [1064] Yamasaki, H., Subramanian, S., Sonoda, S., and Koashi, M. (2020). Learning with optimized random features: Exponential speedup by quantum machine learning without sparsity and low-rank assumptions. Pages 13674–13687 of: *NeurIPS*, vol. 33. arXiv:2004.10756.
- [1065] Ying, L. (2022). Stable factorization for phase factors of quantum signal processing. *Quantum*, **6**, 842. doi:10.22331/q-2022-10-20-842. arXiv:2202.02671.
- [1066] Yoder, T. J., and Kim, I. H. (2017). The surface code with a twist. *Quantum*, **1**, 2. doi:10.22331/q-2017-04-25-2. arXiv:1612.04795.
- [1067] Yoder, T. J., Low, G. H., and Chuang, I. L. (2014). Fixed-point quantum search with an optimal number of queries. *Phys. Rev. Lett.*, **113**, 210501. doi:10.1103/PhysRevLett.113.210501. arXiv:1409.3305.

- [1068] Yoshioka, N., Sato, T., Nakagawa, Y. O., et al. (2022). Variational quantum simulation for periodic materials. *Phys. Rev. Res.*, **4**, 013052. doi:[10.1103/PhysRevResearch.4.013052](https://doi.org/10.1103/PhysRevResearch.4.013052). arXiv:[2008.09492](https://arxiv.org/abs/2008.09492).
- [1069] Yoshioka, N., Okubo, T., Suzuki, Y., et al. (2024). Hunting for quantum-classical crossover in condensed matter problems. *npj Quant. Inf.*, **10**, 45. doi:[10.1038/s41534-024-00839-4](https://doi.org/10.1038/s41534-024-00839-4). arXiv:[2210.14109](https://arxiv.org/abs/2210.14109).
- [1070] You, X., Chakrabarti, S., Chen, B., and Wu, X. (2023). Analyzing convergence in quantum neural networks: Deviations from neural tangent kernels. Pages 40199–40224 of: *ICML*, vol. 202. arXiv:[2303.14844](https://arxiv.org/abs/2303.14844).
- [1071] Young, A. P., Knysh, S., and Smelyanskiy, V. N. (2010). First-order phase transition in the quantum adiabatic algorithm. *Phys. Rev. Lett.*, **104**, 020502. doi:[10.1103/PhysRevLett.104.020502](https://doi.org/10.1103/PhysRevLett.104.020502). arXiv:[0910.1378](https://arxiv.org/abs/0910.1378).
- [1072] Yu, H., Lu, D., Wu, Q., and Wei, T.-C. (2022). Geometric quantum adiabatic methods for quantum chemistry. *Phys. Rev. Res.*, **4**, 033045. doi:[10.1103/PhysRevResearch.4.033045](https://doi.org/10.1103/PhysRevResearch.4.033045). arXiv:[2112.15186](https://arxiv.org/abs/2112.15186).
- [1073] Yuan, P., and Zhang, S. (2023). Optimal (controlled) quantum state preparation and improved unitary synthesis by quantum circuits with any number of ancillary qubits. *Quantum*, **7**, 956. doi:[10.22331/q-2023-03-20-956](https://doi.org/10.22331/q-2023-03-20-956). arXiv:[2202.11302](https://arxiv.org/abs/2202.11302).
- [1074] Yuan, X., Endo, S., Zhao, Q., et al. (2019). Theory of variational quantum simulation. *Quantum*, **3**, 191. doi:[10.22331/q-2019-10-07-191](https://doi.org/10.22331/q-2019-10-07-191). arXiv:[1812.08767](https://arxiv.org/abs/1812.08767).
- [1075] Yuen, H. (2023). An improved sample complexity lower bound for (fidelity) quantum state tomography. *Quantum*, **7**, 890. doi:[10.22331/q-2023-01-03-890](https://doi.org/10.22331/q-2023-01-03-890). arXiv:[2206.11185](https://arxiv.org/abs/2206.11185).
- [1076] Yung, M.-H., and Aspuru-Guzik, A. (2012). A quantum-quantum Metropolis algorithm. *Proc. Natl. Acad. Sci.*, **109**, 754–759. doi:[10.1073/pnas.1111758109](https://doi.org/10.1073/pnas.1111758109). arXiv:[1011.1468](https://arxiv.org/abs/1011.1468).
- [1077] Zaletel, M. P., and Pollmann, F. (2020). Isometric tensor network states in two dimensions. *Phys. Rev. Lett.*, **124**, 037201. doi:[10.1103/PhysRevLett.124.037201](https://doi.org/10.1103/PhysRevLett.124.037201). arXiv:[1902.05100](https://arxiv.org/abs/1902.05100).
- [1078] Zeng, B., Cross, A., and Chuang, I. L. (2011). Transversality versus universality for additive quantum codes. *IEEE Trans. Inf. Theory*, **57**, 6272–6284. doi:[10.1109/tit.2011.2161917](https://doi.org/10.1109/tit.2011.2161917). arXiv:[0706.1382](https://arxiv.org/abs/0706.1382).
- [1079] Zhang, C., and Li, T. (2021). Escape saddle points by a simple gradient-descent based algorithm. Pages 8545–8556 of: *NeurIPS*. arXiv:[2111.14069](https://arxiv.org/abs/2111.14069).
- [1080] Zhang, C., and Li, T. (2023). Quantum lower bounds for finding stationary points of nonconvex functions. Pages 41268–41299 of: *ICML*, vol. 202. arXiv:[2212.03906](https://arxiv.org/abs/2212.03906).
- [1081] Zhang, C., Leng, J., and Li, T. (2021). Quantum algorithms for escaping from saddle points. *Quantum*, **5**, 529. doi:[10.22331/q-2021-08-20-529](https://doi.org/10.22331/q-2021-08-20-529). arXiv:[2007.10253](https://arxiv.org/abs/2007.10253).
- [1082] Zhang, J., Feng, F., and Zhang, Q. (2021). Quantum method for finite element simulation of electromagnetic problems. Pages 120–123 of: *IMS*. doi:[10.1109/IMS19712.2021.9574852](https://doi.org/10.1109/IMS19712.2021.9574852).

- [1083] Zhang, K., Yu, K., and Korepin, V. (2022). Quantum search on noisy intermediate-scale quantum devices. *Europhys. Lett.*, **140**, 18002. doi:[10.1209/0295-5075/ac90e6](https://doi.org/10.1209/0295-5075/ac90e6). arXiv:[2202.00122](https://arxiv.org/abs/2202.00122).
- [1084] Zhang, X.-M., and Yuan, X. (2024). Circuit complexity of quantum access models for encoding classical data. *npj Quant. Inf.*, **10**, 42. doi:[10.1038/s41534-024-00835-8](https://doi.org/10.1038/s41534-024-00835-8). arXiv:[2311.11365](https://arxiv.org/abs/2311.11365).
- [1085] Zhang, X.-M., Li, T., and Yuan, X. (2022). Quantum state preparation with optimal circuit depth: Implementations and applications. *Phys. Rev. Lett.*, **129**, 230504. doi:[10.1103/PhysRevLett.129.230504](https://doi.org/10.1103/PhysRevLett.129.230504). arXiv:[2201.11495](https://arxiv.org/abs/2201.11495).
- [1086] Zhao, Q., and Yuan, X. (2021). Exploiting anticommutation in Hamiltonian simulation. *Quantum*, **5**, 534. doi:[10.22331/q-2021-08-31-534](https://doi.org/10.22331/q-2021-08-31-534). arXiv:[2103.07988](https://arxiv.org/abs/2103.07988).
- [1087] Zhao, Q., Zhou, Y., Shaw, A. F., et al. (2022). Hamiltonian simulation with random inputs. *Phys. Rev. Lett.*, **129**, 270502. doi:[10.1103/PhysRevLett.129.270502](https://doi.org/10.1103/PhysRevLett.129.270502). arXiv:[2111.04773](https://arxiv.org/abs/2111.04773).
- [1088] Zhao, Z., Fitzsimons, J. K., Osborne, M. A., et al. (2019). Quantum algorithms for training Gaussian processes. *Phys. Rev. A*, **100**, 012304. doi:[10.1103/PhysRevA.100.012304](https://doi.org/10.1103/PhysRevA.100.012304). arXiv:[1803.10520](https://arxiv.org/abs/1803.10520).
- [1089] Zhao, Z., Fitzsimons, J. K., and Fitzsimons, J. F. (2019). Quantum-assisted Gaussian process regression. *Phys. Rev. A*, **99**, 052331. doi:[10.1103/PhysRevA.99.052331](https://doi.org/10.1103/PhysRevA.99.052331). arXiv:[1512.03929](https://arxiv.org/abs/1512.03929).
- [1090] Zhou, H., Zhao, C., Cain, M., et al. (2024). Algorithmic fault tolerance for fast quantum computing. arXiv:[2406.17653](https://arxiv.org/abs/2406.17653).
- [1091] Zhou, L., Basso, J., and Mei, S. (2024). Statistical estimation in the spiked tensor model via the quantum approximate optimization algorithm. arXiv:[2402.19456](https://arxiv.org/abs/2402.19456).
- [1092] Zobel, J. P., and González, L. (2021). The quest to simulate excited-state dynamics of transition metal complexes. *JACS Au*, **1**, 1116–1140. doi:[10.1021/jacsau.1c00252](https://doi.org/10.1021/jacsau.1c00252). arXiv:[2106.11912](https://arxiv.org/abs/2106.11912).
- [1093] Zoufal, C., Lucchi, A., and Woerner, S. (2021). Variational quantum Boltzmann machines. *Quantum Mach. Intell.*, **3**, 7. doi:[10.1007/s42484-020-00033-7](https://doi.org/10.1007/s42484-020-00033-7). arXiv:[2006.06004](https://arxiv.org/abs/2006.06004).
- [1094] Žutić, I., Fabian, J., and Das Sarma, S. (2004). Spintronics: Fundamentals and applications. *Rev. Mod. Phys.*, **76**, 323–410. doi:[10.1103/RevModPhys.76.323](https://doi.org/10.1103/RevModPhys.76.323). arXiv:[cond-mat/0405528](https://arxiv.org/abs/cond-mat/0405528).

