

Oles Shtanko

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Research Scientist at IBM Quantum (IBM Thomas J. Watson Research Center, NY) with 12+ years of experience in quantum information and many-body theory, including 5+ years in quantum computing industry. Author of 26 publications (h-index 13, 746 citations) in leading journals including *Nature Physics*, *PRL*, *PRX Quantum*, and *PNAS* ([Google Scholar](#)).

Research Interests

Quantum algorithms for early fault-tolerance · Thermal state preparation · Quantum complexity of noisy systems · Measurement-based near-term quantum algorithms

Education

Ph.D. in Physics, Massachusetts Institute of Technology 2013–2019
Thesis: *Boundaries, Disorder and Noise in Quantum-Coherent Systems*
Advisors: Prof. Seth Lloyd, Prof. Leonid Levitov (co-advisor)

M.Sc. & B.Sc. in Physics, Taras Shevchenko National University, Ukraine 2011–2013
Thesis: *Theory Behind the Observation of Neutral Modes in QHE $\nu = 2/3$*
Advisor: Prof. Vadim Cheianov (jointly w/ Lancaster University, UK)

Professional Experience

Research Scientist, IBM Quantum 2021–Present
Quantum Algorithms for Near-Term and Early Fault-Tolerance team
Key contributions: designed and execution of quantum experiments on up to 156 qubits [1,2], efficient quantum thermal state preparation [19, 21], improved Hamiltonian simulation [5], quantum machine learning [20], proved computational universality of local noisy quantum circuits [3]

Postdoctoral Fellow, QuICS and JQI, University of Maryland College Park 2019–2021
Established theoretical bounds on autonomous quantum error correction [4]; developed complexity results for dissipative systems [10, 11]; explored power of machine learning for physics [22]

Research Intern, IBM Quantum 2018, 2019
Random matrix theory for quantum many-body systems [12, 14]

Honours & Awards

MIT-IBM Research Externship 2018, 2019
Funded winter research at IBM Quantum

ExxonMobil-MIT Energy Initiative Fellowship 2017
Support for outstanding PhD research

Bronze Medal, International Physics Olympiad, Iran 2007

Technical Skills

Quantum Computing: Qiskit, Cirq; algorithm design, error correction, circuit optimization

Scientific Computing: Python, Julia, C++; PyTorch, TensorFlow/JAX; CUDA/GPU; MPI/OpenMP

Many-Body Simulation: tensor networks (DMRG/MPS/PEPS), ITensor, TeNPy, Quimb

Theory: quantum information, quantum field theory, condensed matter, random matrix theory, free probability

Infrastructure: Linux, Git, Slurm/PBS, HPC cluster management

Professional Service

Co-organizer, QSim 2025 conference at IBM Quantum

Large-scale demonstration committee, IBM Quantum (2024–2025)

Mentored 6 research interns at IBM Quantum (2021–2025) resulting in 4 publications [2, 7, 19, 20]

Referee for *Nature Physics*, *Physical Review X*, *PRX Quantum*, *Phys. Rev. Lett.*, *Phys. Rev. B*, *Phys. Rev. E*, *Quantum*

Selected Talks

- Noise-robust quantum dynamics and quantum refrigerators, KITP, UCSB (2025)
- Criteria for stable quantum memories protected by engineered dissipation, QSim 2024, URI (2024) [\[Video\]](#)
- Uncovering local integrability in quantum many-body dynamics, Qiskit Seminar Series, IBM (2023) [\[Video\]](#)
- Gibbs state samplers with noiseless and noisy random quantum circuits, BIRS, Banff (2022) [\[Video\]](#)

Selected Publications

- [S1] **O. Shtanko**, D.S. Wang, H. Zhang, N. Harle, A. Seif, R. Movassagh, Z. Minev, “*Uncovering local integrability in quantum many-body dynamics*,” Nature Communications **16**(1), 2552 (2025).
- [S2] **O. Shtanko**, K. Sharma, “*Complexity of local quantum circuits under nonunital noise*,” PRX Quantum **6**(3), 030347 (2025).
- [S3] N. Harle, **O. Shtanko**, R. Movassagh, “*Observing and braiding topological Majorana modes on programmable quantum simulators*,” Nature Communications **14**(1), 2286 (2023).
- [S4] **O. Shtanko**, R. Movassagh, “*Unitary subharmonic response and Floquet Majorana modes*,” Physical Review Letters **125**, 086804 (2020).
- [S5] **O. Shtanko**, L. Levitov, “*Robustness and universality of surface states in Dirac materials*,” PNAS **115**(23), 5908–5913 (2018).
- [S6] M.T. Allen, **O. Shtanko** *et al.*, “*Spatially resolved edge currents and guided-wave electronic states in graphene*,” Nature Physics **12**(2), 128 (2016).

Peer-Reviewed Publications

- [1] E.D. Switzer, N.F. Robertson, N. Keenan, Á. Rodríguez-Alcaraz, A. D’Urbano, **O. Shtanko** *et al.*, “*Realization of two-dimensional discrete time crystals with anisotropic Heisenberg coupling*,” Nature Communications **17**(1), 605 (2026). [\[DOI\]](#)
- [2] **O. Shtanko**, D.S. Wang, H. Zhang, N. Harle, A. Seif, R. Movassagh, Z. Minev, “*Uncovering local integrability in quantum many-body dynamics*,” Nature Communications **16**(1), 2552 (2025). [\[arXiv\]](#)
- [3] **O. Shtanko**, K. Sharma, “*Complexity of local quantum circuits under nonunital noise*,” PRX Quantum **6**(3), 030347 (2025). [\[DOI\]](#)
- [4] **O. Shtanko**, Y.J. Liu, S. Lieu, A.V. Gorshkov, V.V. Albert, “*Bounds on autonomous quantum error correction*,” Quantum **9**, 1804 (2025). [\[arXiv\]](#)
- [5] N.F. Robertson, B. Pokharel, B. Fuller, E. Switzer, **O. Shtanko**, M. Amico *et al.*, “*Tensor network enhanced dynamic multiproduct formulas*,” PRX Quantum **6**(2), 020360 (2025). [\[DOI\]](#)
- [6] A. Kolchinsky, I. Marvian, C. Gokler, Z.W. Liu, P. Shor, **O. Shtanko** *et al.*, “*Maximizing free energy gain*,” Entropy **27**(1), 91 (2025). [\[arXiv\]](#)
- [7] N. Harle, **O. Shtanko**, R. Movassagh, “*Observing and braiding topological Majorana modes on programmable quantum simulators*,” Nature Communications **14**(1), 2286 (2023). [\[DOI\]](#)
- [8] M. Van Regemortel, **O. Shtanko**, L.P. García-Pintos, A. Deshpande, H. Dehghani, A.V. Gorshkov, M. Hafezi, “*Monitoring-induced entanglement entropy and sampling complexity*,” Physical Review Research **4**(3), L032021 (2022). [\[DOI\]](#)
- [9] S. Lieu, M. McGinley, **O. Shtanko**, N.R. Cooper, A.V. Gorshkov, “*Kramers’ degeneracy for open systems in thermal equilibrium*,” Physical Review B **105**(12), L121104 (2022). [\[DOI\]](#)
- [10] A. Deshpande, B. Fefferman, A.V. Gorshkov, M.J. Gullans, P. Niroula, **O. Shtanko**, “*Tight bounds on the convergence of noisy random circuits to the uniform distribution*,” PRX Quantum **3**(4), 040329 (2022). [\[DOI\]](#)
- [11] **O. Shtanko**, A. Deshpande, P.S. Julienne, A.V. Gorshkov, “*Complexity of fermionic dissipative interactions and applications to quantum computing*,” PRX Quantum **2**, 030350 (2021). [\[DOI\]](#)
- [12] **O. Shtanko**, R. Movassagh, “*Unitary subharmonic response and Floquet Majorana modes*,” Physical Review Letters **125**, 086804 (2020). [\[DOI\]](#)
- [13] K.X. Wei, P. Peng, **O. Shtanko**, I. Marvian, S. Lloyd, C. Ramanathan, P. Cappellaro, “*Emergent prethermalization signatures in out-of-time ordered correlations*,” Physical Review Letters **123**(9), 090605 (2019). [\[DOI\]](#)
- [14] **O. Shtanko**, R. Movassagh, “*Stability of disordered Floquet topological phases*,” Physical Review Letters **121**, 126803 (2018). [\[DOI\]](#)
- [15] **O. Shtanko**, L. Levitov, “*Robustness and universality of surface states in Dirac materials*,” PNAS **115**(23), 5908–5913 (2018). [\[DOI\]](#)
- [16] M.T. Allen, **O. Shtanko**, I.C. Fulga, J.I-J. Wang, D. Nurgaliev, K. Watanabe, T. Taniguchi, A. Akhmerov, P. Jarillo-Herrero, L. Levitov, A. Yacoby, “*Observation of electron coherence and Fabry–Pérot standing waves at a graphene edge*,” Nano Letters **17**(12), 7380–7386 (2017). [\[DOI\]](#)
- [17] M.T. Allen, **O. Shtanko**, I.C. Fulga, J.I-J. Wang, D. Nurgaliev, K. Watanabe, T. Taniguchi, A.R. Akhmerov, P. Jarillo-Herrero, L. Levitov, A. Yacoby, “*Spatially resolved edge currents and guided-wave electronic states*”

- in graphene,”* Nature Physics **12**(2), 128 (2016). [\[DOI\]](#)
- [18] **O. Shtanko**, K. Snizhko, V. Cheianov, “*Nonequilibrium noise in transport across a tunneling contact between $\nu = 2/3$ fractional quantum Hall edges,*” Physical Review B **89**(12), 125104 (2014). [\[DOI\]](#)

Preprints and working papers

- [19] D. Hahn, R. Sweke, A. Deshpande, **O. Shtanko**, “*Efficient quantum Gibbs sampling with local circuits,*” arXiv:2506.04321 (2025). [\[arXiv\]](#)
- [20] W. Zhong, **O. Shtanko**, R. Movassagh, “*Advantage of quantum neural networks as quantum information decoders,*” arXiv:2401.06300 (2024). [\[arXiv\]](#)
- [21] **O. Shtanko**, R. Movassagh, “*Preparing thermal states on noiseless and noisy programmable quantum processors,*” arXiv:2112.14688 (2021). [\[arXiv\]](#)
- [22] Y. Kharkov, **O. Shtanko**, A. Seif, P. Bienias, M. Van Regemortel, M. Hafezi, A.V. Gorshkov, “*Discovering hydrodynamic equations of many-body quantum systems,*” arXiv:2111.02385 (2021). [\[arXiv\]](#)
- [23] **O. Shtanko**, Y.A. Kharkov, L.P. García-Pintos, A.V. Gorshkov, “*Classical models of entanglement in monitored random circuits,*” arXiv:2004.06736 (2020). [\[arXiv\]](#)
- [24] **O. Shtanko**, S. Lloyd, “*Hydrodynamic behavior of non-interacting quantum particles in presence of dephasing,*” arXiv:1807.07087 (2018). [\[arXiv\]](#)
- [25] C. Gokler, A. Kolchinsky, Z.W. Liu, I. Marvian, P. Shor, **O. Shtanko**, K. Thompson, D. Wolpert, S. Lloyd, “*When is a bit worth much more than $kT \ln 2?$* ” arXiv:1705.09598 (2017). [\[arXiv\]](#)
- [26] K. Akkaravarawong, **O. Shtanko**, L. Levitov, “*Ballistic guided electron states in graphene,*” arXiv:1512.04185 (2015). [\[arXiv\]](#)