Nazli Ugur Koyluoglu

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EDUCATION

Harvard University — Cambridge, MA
Ph.D. in Quantum Science and Engineering · Advisor: Prof. Mikhail D. Lukin — Sep 2022 – 2027 (expected)
A.M. in Quantum Science and Engineering · GPA 3.96 — May 2025

Stanford University — Stanford, CA
B.S. in Physics with Distinction and Honors · GPA 4.12/4.3 — Sep 2018 – Jun 2022
Minors in Mathematics, Computer Science, History
Honors thesis: Engineering Spin Squeezing with Finite-Range Interactions

RESEARCH & WORK EXPERIENCE

Harvard University — Cambridge, MA
Graduate Student Researcher, Lukin Group — Sep 2022 – Present

Control of interacting quantum systems for practical applications through co-design of applications, algorithms, and hardware.

- **Analog simulation:** devised Floquet engineering protocols that generate tunable multi-body interactions in neutral-atom arrays, expanding the condensed-matter and high-energy physics models they can simulate.
- **Digital simulation:** constructed hardware-efficient circuits for state preparation and dynamics of strongly correlated fermionic matter, exploiting the reconfigurable connectivity of neutral-atom processors.
- **Fault tolerance:** developed physics-aware primitives and qLDPC compilers for fault-tolerant quantum simulation and computation.
- **Experiment:** collaborated as a theorist on joint experiments with neutral-atom and solid-state spin-sensor teams.

Google Quantum AI — San Francisco, CA
Student Researcher, Quantum Algorithms Team — May 2026 – Aug 2026

- Developed a hybrid quantum-classical amplitude estimation algorithm for resource-efficient estimation of physical observables, suited to early fault-tolerant quantum computers.

IBM Quantum — Yorktown Heights, NY
Quantum Engineering Intern; external collaborator — Mar 2021 – Aug 2024

- Implemented variational state preparation of 1+1D conformal field theories and extracted their central charge on a superconducting quantum processor.

Stanford University — Stanford, CA
Research Assistant, Schleier-Smith Lab — Apr 2019 – Jun 2025

- Proposed gap-protected countertwisting, a spin-squeezing protocol for locally interacting spins that approaches the Heisenberg limit in phase sensitivity.

D. E. Shaw & Co. — New York, NY
Quantitative Developer Intern — Jun 2021 – Aug 2021

- Built statistical and LSTM models for time-series forecasting on alternative data to inform discretionary trading strategies.

Microsoft — Istanbul, Turkey
Software Engineering Intern, Azure Database for PostgreSQL (Citus Data) — Jun 2020 – Aug 2020

- Extended SQLancer, an automated database logic-bug finder, to support the Citus distributed PostgreSQL extension.

Stanford University — Stanford, CA
Research Assistant, LevLab — Nov 2018 – May 2019

- Built radio-frequency electronics for a quantum-optical spin-glass experiment.

PUBLICATIONS

1. **N. U. Koyluoglu** *et al.* "Arithmetic quantum circuits for physics-aware compilation of fault-tolerant quantum simulation." [Manuscript in preparation]
2. H. Gao, P. Put, N. T. Leitao, **N. U. Koyluoglu**, A. Maccabe, M. Mammen, S. Dandavate, L. B. H. Wyatt, L. S. Martin, A. C. B. Jayich, H. Park, M. D. Lukin. "Nanoscale magnetometry via collective many-body dynamics in diamond." *Nature* (2026). arXiv:2609.03039 [In press]
3. A. A. Geim, **N. U. Koyluoglu**, S. J. Evered, R. Sahay, S. H. Li, M. Xu, D. Bluvstein, N. O. Gjonbalaj, N. Maskara, M. Kalinowski, T. Manovitz, R. Verresen, S. F. Yelin, J. Feldmeier, M. Greiner, V. Vuletić, M. D. Lukin. "Engineering quantum criticality and dynamics on an analog-digital simulator." arXiv:2602.18555 (2026). [Preprint]
4. **N. U. Koyluoglu**, S. Majumder, M. Amico, S. Mostame, E. Berg, M. A. Rajabpour, Z. Minev, K. Najafi. "Measuring central charge on a universal quantum processor." *Nature Communications* **17**, 305 (2026). doi:10.1038/s41467-025-66775-9

5. H. Gao, L. S. Martin, L. B. Hughes, N. T. Leitao, P. Put, H. Zhou, **N. U. Koyluoglu**, S. A. Meynell, A. C. B. Jayich, H. Park, M. D. Lukin. "Signal amplification in a solid-state quantum sensor via asymmetric time-reversal of many-body dynamics." *Nature* **646**, 68–73 (2025). doi:10.1038/s41586-025-09452-7
6. **N. U. Koyluoglu**, N. Maskara, J. Feldmeier, M. D. Lukin. "Floquet engineering of interactions and entanglement in periodically driven Rydberg chains." *Phys. Rev. Lett.* **135**, 113603 (2025). doi:10.1103/5qhh-322q
7. **N. U. Koyluoglu**, S. V. Rajagopal, G. L. Moreau, J. A. Hines, O. Marković, M. Schleier-Smith. "Squeezing towards the Heisenberg limit with locally interacting spins." arXiv:2506.16973 (2025). [Preprint]
8. T. Manovitz, S. H. Li, S. Ebadi, R. Samajdar, A. A. Geim, S. J. Evered, D. Bluvstein, H. Zhou, **N. U. Koyluoglu**, J. Feldmeier, P. E. Dolgirev, N. Maskara, M. Kalinowski, S. Sachdev, D. A. Huse, M. Greiner, V. Vuletić, M. D. Lukin. "Quantum coarsening and collective dynamics on a programmable simulator." *Nature* **638**, 86–92 (2025). doi:10.1038/s41586-024-08353-5
9. J. Feldmeier, N. Maskara, **N. U. Koyluoglu**, M. D. Lukin. "Quantum simulation of dynamical gauge theories in periodically driven Rydberg atom arrays." arXiv:2408.02733 (2024). [Preprint]

TALKS & POSTERS

- *Engineering quantum criticality and dynamics on an analog-digital simulator*. Invited talk, Robust Quantum Simulation (RQS) Institute — Jun 2026
- *Hamiltonian engineering of multi-body interactions in periodically driven Rydberg atom arrays*. Poster, Quantum Simulation Conference (QSim) — Aug 2025
- *Interaction-enhanced many-body covariance magnetometry with strongly interacting quantum sensors*. Talk, APS Global Physics Summit — Mar 2025
- *Quantum simulation with tunable multi-body interactions in periodically driven Rydberg atom arrays*. Invited talk, ITAMP Luncheon, Harvard–Smithsonian CfA — Mar 2025
- *Hamiltonian engineering of multi-body interactions in periodically driven Rydberg atom arrays*. Poster, Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC) — Sep 2024
- *Hamiltonian engineering of multi-body interactions in periodically driven Rydberg atom arrays*. Poster, Gordon Research Conference on Quantum Science — Jul 2024
- *Interaction-enabled nanoscale correlation sensing from non-equilibrium quench dynamics*. Poster, Gordon Research Conference on Quantum Science — Jul 2024
- *Fast and robust entanglement of locally interacting spins for quantum sensing*. Talk, APS March Meeting — Mar 2023
- *Detecting the footprint of central charge using IBM quantum simulator*. Talk, APS March Meeting — Mar 2022

AWARDS

- Generation Q G2 Graduate Fellowship, Amazon Web Services (2023)
- Harvard Frontier Fellowship, Harvard University (2023)
- Selected for Knight-Hennessy Scholars, Stanford University (2022)
- J. E. Wallace Sterling Award for Scholastic Achievement, Stanford School of Humanities & Sciences (2022)
- Phi Beta Kappa, Stanford chapter (2021)
- David S. Levine Award, Stanford University Physics Department (2021)

TEACHING

- Teaching Fellow: Physics 160, Introduction to Quantum Information, Harvard University — Spring 2024
- Course Development Assistant: PHYSICS 14N, Quantum Information, Stanford University — Winter 2021
- Subject Teacher: Physics and Mathematics tutoring, Stanford University — Fall 2019

COMMUNITY ENGAGEMENT

Stanford Quantum Computing Association — *President; Vice President; Chief Financial Officer* — Jan 2019 – May 2022
Founding executive; helped build an 800+ member community through workshops and outreach with academic and industry partners.

QCHack 2021 — *Hackathon Director* — Dec 2020 – Apr 2021
Organized a week-long Stanford–Yale quantum computing bootcamp and hackathon with 2,200 participants and 200+ project submissions, sponsored by industry partners.

Physics Undergraduate Women and Gender Minorities at Stanford — *Financial Officer; Dir. of Professional Development* — Jun 2019 – May 2021

SKILLS

Programming	Python, C++, C, Java, SQL; Git/GitHub
AI tools	Claude, Claude Code, Codex
ML & scientific computing	PyTorch, TeNPy, QuSpin, Cirq, OpenFermion, Qiskit, PyQuil, PySCF
Languages	Turkish (native), English (fluent), French (proficient)