Yaman Evkaya

M.Sc. Physics Candidate • Theoretical & Computational Quantum Physics

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Research Profile

Theoretical physicist and M.Sc. candidate at LMU Munich, working at the interface of **quantum field theory, lattice gauge dynamics and quantum many-body physics**. Combines analytical model building with large-scale numerical simulation in **Python/Julia**: tensor networks, Krylov methods and exact diagonalisation on Hilbert-space sectors of several million basis states, run reproducibly on Linux/HPC clusters and validated against independent reference calculations. Theoretical interests span **lattice QCD, AdS/CFT and gauge–gravity duality**. Integrates **AI coding agents and local LLM systems** into daily research and aims to translate **quantum simulation and quantum machine learning** into scalable, industry-relevant technologies.

Education

Ludwig-Maximilians-Universität München (LMU) M.Sc. Physics Oct. 2024–present

Graduate programme in Quantum Field Theory, Quantum Computation, Many-Body, Condensed-Matter and Few-Body Physics, complemented by thesis research in non-Abelian lattice gauge dynamics and tensor-network methods under Prof. Fabian Grusdt (MCQST). Expected completion: April 2027.

Istanbul University, Türkiye B.Sc. Physics Sep. 2020–Sep. 2024

GPA 3.76/4.00. YÖK-TEBİP High Performers Program Fellowship.

Research Experience

Non-Abelian Gauge Dynamics in a (2+1)D SU(2) Quantum Link Model on the Honeycomb Lattice

M.Sc. Thesis • Supervisor: Prof. Fabian Grusdt (MCQST) Oct. 2025–present, LMU Munich

- **Model Construction:** Formulated SU(2) lattice gauge theories in the rishon-based quantum-link formalism on a (1+1)D chain and a (2+1)D honeycomb lattice, as minimal models for the real-time non-Abelian gauge dynamics underlying quark–gluon plasma physics; derived the Gauss-law constraints, built the gauge-invariant Hilbert-space sectors via projected-sector analysis and representation theory, and verified the operator algebra.
- **Effective Theory and Many-Body Simulation:** Derived Schrieffer–Wolff effective Hamiltonians for the constrained dynamics and computed ground states, real-time evolution and many-body correlations with DMRG, tDMRG/TDVP and Krylov methods (ITensors.jl, ITensorMPS.jl, KrylovKit.jl), complemented by sparse exact diagonalisation on gauge-invariant sectors of up to 6.7 million basis states.
- **Independent Verification:** Cross-checked tensor-network results against independently constructed reference calculations from exact diagonalisation via state overlaps, residuals, convergence analysis and explicit gauge/symmetry checks, separating physical behaviour from truncation and implementation artefacts.
- **Reproducible Scientific Computing:** Engineered Python/Julia pipelines for parameter sweeps, observables and diagnostics; executed them as reproducible Linux/SLURM workloads under Git version control, with analysis and visualisation in NumPy, SciPy and Matplotlib.
- **Quantum Simulation Perspective:** Mapped the model onto cold-atom and Rydberg quantum simulators.

B.Sc. Thesis: Quantum Entanglement in Frustrated Triangular Lattice Nov. 2023–Oct. 2024

Supervisor: Prof. Ekrem Aydıner Istanbul University

Theoretical and numerical investigation of a frustrated, non-Hermitian PT-symmetric Kitaev chain: characterised the spectral structure and symmetry properties of the model and mapped its quantum dynamics across the parameter space.

Peer-Reviewed Publication (First Author) 2022–2023, Istanbul University

Evkaya, Y., Ökcü, Ö., Aydıner, E. Quantum Heat Engine with Level Degeneracy for Oscillator-Shaped Potential Well. *International Journal of Theoretical Physics* **62**, 237 (2023). DOI: 10.1007/s10773-023-05498-3.

Formulated a quantum heat engine with degenerate energy levels in an oscillator-shaped potential well and established how the spectral structure governs thermodynamic work output and efficiency.

Experimental Physics Project: Cosmic-Muon Scintillation Detector 2020–2022, Istanbul University

Contributed to the assembly and experimental testing of a scintillation-based cosmic-muon detector; supported the measurement campaign and critically evaluated the acquired data against physical expectations.

AI-Augmented Scientific Computing

- **Agentic Development Workflows:** Integrated Claude Code and OpenAI Codex into daily research practice for one year, delegating the implementation, debugging and refactoring of Python/Julia many-body models while retaining full ownership of model design, numerical-method selection and physical interpretation.
- **Local LLM Deployment and RAG:** Deployed quantised Ministral 3B Instruct on commodity Linux/CPU hardware with llama.cpp and Jan; characterised CPU inference constraints and built a source-grounded retrieval-augmented generation prototype spanning document ingestion, embedding and retrieval.

Scientific Presentations

Istanbul QG Workshop 2026 Sep. 2026
Poster presentation of master's thesis research, Boğaziçi University, Istanbul

Quantum Error Correction Seminar LMU Munich
Seminar talk: stabiliser formalism and fault-tolerant quantum gates

Technical Skills

AREA	TOOLS / TOPICS	APPLICATION
Python	NumPy, SciPy, Matplotlib	Scientific computing, numerical modelling, data analysis and visualisation.
Julia	ITensors.jl, ITensorMPS.jl, KrylovKit.jl	Tensor-network simulation, quantum many-body dynamics and Krylov-based solvers.
C++	Core language and standard library (foundational level)	Reading and adapting existing numerical code.
Computing	Linux, Bash, SLURM/HPC, Git, LaTeX	Reproducible cluster workflows, scripting, version control and scientific documentation.
AI Tooling	Claude Code, OpenAI Codex, llama.cpp, Jan	AI-assisted scientific coding, local LLM inference and source-grounded RAG.
Quantum	SU(2) lattice gauge theory, tensor networks, QEC foundations	Many-body model formulation, cold-atom/Rydberg quantum simulation, quantum information.

Selected Scientific Schools and Conferences

QMATH16 – Mathematical Results in Quantum Theory Sep. 2025
Technical University of Munich, Germany

Current Topics in Mathematical Physics Summer School Jul. 2024
University of Zurich, Switzerland

International Congress on Mathematical Physics Jul. 2024
University of Strasbourg, France

Current Topics in Mathematical Physics Summer School Aug. 2023
University of Warsaw, Poland

Physics in Ljubljana 2023 Summer School Jul. 2023
University of Ljubljana, Slovenia

Scholarship

YÖK-TEBİP High Performers Program Fellowship 2020–2024
Turkish Council of Higher Education

Languages

Turkish (Native) • English (C1) • German (B2) • Russian (A1)