Ilia Luchnikov, PhD

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EXPERIENCE

Postdoctoral Researcher

University of Geneva

09/2022 - 10/2023 | Geneva

Theoretical physics department

- Currently, I am working on tensor networks based machine learning methods for processing of quantum computing data
- Tech stack: Python 3, Jax, Rust, Cuda C, Bash, Linux, Apptainer, Docker, Slurm Workload Manager

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Leading research fellow

Russian Quantum Center

01/2021 - 09/2022 | Moscow, Russia

Laboratory of Quantum Information Technologies

- I was developing novel numerical and data-driven methods for quantum dynamics analysis and prediction, including: - a method for data-driven identification of non-Markovian quantum systems based on dynamic mode decomposition, - a tensor networks based compression method for models of non-Markovian quantum systems, - a method for approximate quantum circuits simulation based on multi-scale entanglement renormalization ansatz
- I was a co-advisor of several Bachelor, Master students and one PhD student
- Tech stack: Python 3, Jax, TensorFlow, Rust, C/C++, Bush, Linux

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Master student -> PhD student -> Research scientist

Moscow institute of physics and technology

01/2015 - 01/2022 | Moscow, Russia

Laboratory of Quantum Information Theory

- I have developed a TensorFlow-based framework for Riemannian optimization in quantum technologies (link)
- We have developed a novel data-driven method for non-Markovian quantum dynamics identification capable to predict a response on a control signal (link)
- We have developed a theoretical framework for open quantum dynamics complexity analysis (link)
- I have developed a novel method for many-body quantum states reconstruction based on variational autoencoders (link)
- We have studied a new type of quantum dynamics induced by repeated projective measurements (link)
- I was a teaching assistant of quantum information, tensor networks, and open quantum systems theory courses
- Tech stack: Python 3, TensorFlow, NumPy

PhD student

Skoltech

2017 - 2021 | Moscow, Russia

Energy Systems Center

- I was developing new approaches to demand response based on statistical mechanics
- I was teaching Master students to non-equilibrium processes in engineering for two terms at the role of a teaching assistant
- Tech stack: Python 3, TensorFlow, NumPy, Scipy
- Two papers were published as the result of my research activity in top physics/engineering journals

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Bachelor student -> Junior research scientist

Russian quantum center

01/2014 - 01/2017 | Moscow, Russia

Laboratory of Quantum Simulators and Integrated Photonics

- I was supporting an experimental setup by coding different modules for quantum experiment control, e.g., evaporative cooling scheduler, real-time data-processing modules, GUI for a team of experimentalists
- Tech stack: LabView, Wolfram Mathematica

EDUCATION

PhD in Theoretical physics

Moscow Institute of Physics and Technology

09/2017 - 09/2020

MSc in Applied mathematics and physics

Moscow Institute of Physics and Technology

09/2015 - 09/2017

BSc in Applied mathematics and physics

Moscow Institute of Physics and Technology

09/2011 - 09/2015

LANGUAGES

English Advanced **Russian** Native

SKILLS

Rust **Python** **C/C++** **Cuda C** **Bash** **Linux** **Jax** **TensorFlow 1.x/2.x** **PyTorch** **Slurm Workload Manager** **HPC** **Apptainer** **Docker** **Tensor networks** **Open quantum systems** **Machine Learning** **Deep Learning** **Bayesian methods** **Riemannian optimization** **Convex optimization**

STRENGTHS

Programming skills

I am capable of writing complex and maintainable software with use of most of the modern best practices

Full-stack research

I am used doing full-stack research, starting from generating ideas and prototyping and finishing with a publication in top research journals.

Technical writing skills

I am capable of writing coherent and easy-to-read technical text explaining complex ideas.

PUBLICATIONS

Machine learning non-Markovian quantum dynamics

Physical Review Letters

Luchnikov I. A., Vintskevich S. V., Grigoriev D. A., Filippov S. N.

2020 https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.124.140502

Simulation complexity of open quantum dynamics: Connection with tensor networks

Physical Review Letters

Luchnikov I. A., Vintskevich S. V., Ouerdane H., Filippov S. N.

2019 https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.122.160401

PUBLICATIONS

QGOpt: Riemannian optimization for quantum technologies

SciPost Phys

Luchnikov I. A., Krechetov M. E., Filippov S. N.

2021 https://scipost.org/SciPostPhys.10.3.079

Riemannian geometry and automatic differentiation for optimization problems of quantum physics and quantum technologies

New Journal of Physics

Ilia A Luchnikov, Mikhail E Krechetov and Sergey N Filippov

2021 https://iopscience.iop.org/article/10.1088/1367-2630/ac0b02

Probing non-Markovian quantum dynamics with data-driven analysis: Beyond" black-box" machine learning models

Physical Review Research

Luchnikov, I. A., Kiktenko, E. O., Gavreev, M. A., Ouerdane, H., Filippov, S. N. and Fedorov, A. K.

2022 https://journals.aps.org/prresearch/abstract/10.1103/PhysRevResearch.4.043002

Variational autoencoder reconstruction of complex many-body physics

Entropy

Luchnikov I. A., Ryzhov A., Stas P. J., Filippov S. N., Ouerdane H.

2019 https://www.mdpi.com/1099-4300/21/11/1091

Quantum evolution in the stroboscopic limit of repeated measurements

Physics Review A

I. A. Luchnikov and S. N. Filippov

2017 https://journals.aps.org/pra/abstract/10.1103/PhysRevA.95.022113

Super-relaxation of space–time-quantized ensemble of energy loads to curtail their synchronization after demand response perturbation

Applied Energy

Luchnikov I , Metivier D., Ouerdane H., Chertkov M.

2021
https://www.sciencedirect.com/science/article/pii/S0306261920317827?casa_token=BE6Bnq5jX-wAAAAA:xeP_sUpxfHsAvSYHSUsQwnXDEdE669C59xP-lfcuRkuPlc_6A5eFDZa6VLQGfJ3iKohC-j4JxRo

Collisional open quantum dynamics with a generally correlated environment: Exact solvability in tensor networks

Physical Review A

Sergey N. Filippov, Ilia A. Luchnikov

2022 https://journals.aps.org/pra/abstract/10.1103/PhysRevA.105.062410

Light-assisted collisions in ultracold Tm atoms

Physical Review A

Cojocaru I. S., Pyatchenkov S. V., Snigirev S. A., Luchnikov I. A., et al.

2017 https://journals.aps.org/pra/abstract/10.1103/PhysRevA.95.012706

Polarized cold cloud of thulium atom

Journal of Physics B: Atomic, Molecular and Optical Physics

Tsyganok V. V., Khlebnikov V. A., Kalganova E. S., Pershin D. A., Davletov E. T., Cojocaru I. S., Luchnikov I. A., et al.

2018
https://iopscience.iop.org/article/10.1088/1361-6455/aad445/pdf?casa_token=fEGQbz0tGSYAAAAA:_PIH49cXh43WUqtcZJXsdhsREqBTB0eKHyrqcstYOjIM6H3lPmbtN9mKCKB5eYdmGHMRVX6RCL2QYRc

PUBLICATIONS

Power of ensemble Diversity and Randomization for energy Aggregation

Scientific reports

Metivier D., Luchnikov I., Chertkov M.

2019 https://www.nature.com/articles/s41598-019-41515-4

Simulating quantum circuits using the multi-scale entanglement renormalization ansatz

arXiv preprint

Luchnikov, I. A., A. V. Berezutskii, and A. K. Fedorov.

2021 https://arxiv.org/abs/2112.14046

High-performance state-vector emulator of a gate-based quantum processor implemented in the Rust programming language

arXiv preprint

Luchnikov I. A., Oleg E. T., Fedorov A. K.

2022 https://arxiv.org/pdf/2209.11460.pdf

Continuous monitoring for noisy intermediate-scale quantum processors

Physical Review Applied 19.1 (2023): 014027.

Zolotarev Y. F., Luchnikov I. A., López-Saldívar J. A., Fedorov A. K., Kiktenko E. O.

2022 https://journals.aps.org/prapplied/abstract/10.1103/PhysRevApplied.19.014027

Efficient variational synthesis of quantum circuits with coherent multi-start optimization

Quantum 7, 993

Nemkov N. A., Kiktenko E. O., Luchnikov I. A., Fedorov A. K.

2022 https://quantum-journal.org/papers/q-2023-05-04-993

FIND ME ONLINE

LinkedIn
https://www.linkedin.com/in/ilia-luchnikov-56723b143/

Google scholar
https://scholar.google.com/citations?user=5wB0-tkAAAAJ&hl=en

GitHub
https://github.com/LuchnikovI

OPEN SOURCE PROJECT

QGOpt: the library for Riemannian optimization in quantum technologies

2020 Russia, Moscow

GitHub link: https://github.com/LuchnikovI/QGOpt.