ARTEM KOTOV

PhD Student @ St. Petersburg State University | ML Engineer

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EXPERIENCE

Engineer Researcher

Quantum Mechanics Lab @ St. Petersburg State University

Aug 2018 – Present · St. Petersburg, Russia

- Research and development of numerical algorithms for a relativistic spectrum calculation of the diatomic quasimolecules
- Performing chemical property calculation of the super-heavy elements and molecules

Teaching

St. Petersburg State University

Feb 2018 – Dec 2021 · St. Petersburg, Russia

- Theoretical and practical course on the introduction to the quantum mechanics for college students
- Practical course on the quantum mechanics for BSc. students

EDUCATION / COURSES

PhD student in Physics

St. Petersburg State University

Sep 2020 – Present · St. Petersburg, Russia

MSc. in Physics

St. Petersburg State University

Sep 2018 – June 2020

BSc. in Physics

St. Petersburg State University

Sep 2014 – June 2018

MSc. in Machine Learning and Data Analysis

Higher School of Economics

Sep 2020 – July 2022 · St. Petersburg, Russia

SKILLS

Natural Languages: Russian (native), English (upper-intermediate)
Programming Languages: Fortran, Python
Tools: Git, DIRAC, Intel OneAPI, MPI, OMP, ssh, LaTeX
Data Science Stack: PyTorch, PyTorch Lightning, cv2, scikit-learn, pandas, numpy, scipy, wandb
Operating systems: Unix, MacOS, Windows

HONOURS & AWARDS

- Master degree with honours in 2020
- Received stipend for excellent study and research results during master studying
- 2nd place in «Start-Up SPbU 2018»

PROJECTS IN PHYSICS

Field of interest: super-heavy elements, quasi-molecules, QED

Electronic structure of heavy few-electron diatomic quasimolecules, G-RISC

- Research on the configuration interaction method in the diatomic quasimolecules
- Development of the package to perform the electronic correlation calculation on the highest accuracy up-to-date.

Energy Spectra of Diatomic Quasimolecules

- Development of the numerical program for the electronic spectra calculation of the diatomic quasimolecules based on A-DKB B-Splines.
- Research and development of the package for the interelectronic interaction energy calculation.
- Optimization of the resource consumption by program up to 40% in RAM.

Super-heavy nuclei and atoms: mass limit of nuclei and boundary of the periodic table

- Property calculation of the super-heavy molecules and atoms such as dipole moment, polarizability, optimal geometry, etc.
- Calculation via coupled-cluster approach implemented in DIRAC.

PROJECTS IN ML

Field of interest: generative models in CV, multimodal models, image/video editing via neural networks, DL applications to physics problems

Generative Makeup

- Research and development of generative-adversarial network (GAN) application to makeup generation
- Controllable generation of makeup images using latent-search approaches (GANSpace, StyleCLIP, etc.)
- Makeup transfer using neural-network-based methods

What? Where? When?

- Development of Telegram-bot for ”What? Where? When?” game with generative questions similar to real one with GPT-based model
- Theme modelling of the questions from ”What? Where? When?” game with RuBert embeddings

RL in Quantum Computing

- Research and development of RL algorithms (Maskable PPO) for optimization of quantum circuits within ZX-calculus framework

Photonic crystal optimization

- Development of the photonic crystal optimization algorithm via 1) VAE approach to images of photonic crystal structures and 2) learnable representation within k-space approach

PUBLICATIONS

Journal articles

- A. A. Kotov *et al.* Atoms **9**, 44 (2021)
- A. A. Kotov *et al.* X-Ray Spectrometry **49**, 110 (2020)

Conferences

- (2021). *18th SPARC workshop, poster, video conference*.
- (2020). *17th SPARC workshop, poster, video conference*.
- (2019). *16th SPARC workshop, poster, Jena, Germany*.
- (2019). *PNPI 53th Annual Winter School 2019, talk, St. Petersburg, Russia*.
- (2019). *10 Years of G-RISC and Beyond, talk & poster, Berlin, Germany*.
- (2018). *19th International Conference on Physics of Highly Charged Ions, poster, Lisbon, Portugal*.
- (2018). *9th International Student Conference «Science and Progress-2018», talk, St. Petersburg, Russia*.
- (2017). *8th International Student Conference «Science and Progress-2017», poster, St. Petersburg, Russia*.