Alexander Atanasov

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Experience

D. E. Shaw & Co. – Quantitative Researcher — Nov 2024 – Present
Strategy 1 – Systematic Equities — *New York, NY*

Jane Street – Quantitative Research Intern — May – Aug 2023
Machine Learning in Financial Markets — *New York, NY*
- Research in financial markets leveraging modern machine learning and statistical methodologies. Given return offer.

Quantum Si & Protein Evolution – Senior Scientist, AI — Dec 2021 – May 2023
Machine Learning for Protein Discovery under 4catalyzer — *Remote*
- (Quantum Si) Achieved **high accuracy in extracting sparse signal** from noisy time series using randomized kernels and Kalman filters.
- (Protein Evolution) Applied **transformer language models to discover novel structure** in protein sequences for industrial application.

Google – Software Engineering Intern — May – Aug 2017
Deep Learning and Computer Vision – Supervised by Dr. Nhat Vu — *Mountain View, CA*
- Achieved a **6x speedup** in face detection and recognition for TensorFlow model on embedded devices **without drop in accuracy**.

Perimeter Institute for Theoretical Physics – Visiting Researcher — May 2016 – Jul 2018
Sparse Grid Finite Element Methods for Relativistic Astrophysics – Supervised by Dr. Erik Schnetter — *Waterloo, ON*
- Wrote Julia package reducing finite-element solver runtime from $O(N^D)$ **to** $O(N \log^{D-1} N)$ in dimension D.

Education

Harvard University — Aug 2018 – Aug 2024
Ph.D., M.S. Theoretical Physics, advised by Prof. Cengiz Pehlevan — GPA: 4.00
- **Thesis:** *Scaling and Renormalization in Statistical Learning*. Committee: Pehlevan, Sompolinsky, Brenner.
- Studied deep learning and neural scaling laws, leveraging high dimensional statistics, random matrix theory, and extensive empirics.
- Extensive prior work in string theory and quantum field theory (4+ papers in top physics journals).

Yale University — Graduated: May 2018
M.S. and B.S. Mathematics, B.S. Physics—*magna cum laude, Phi Beta Kappa* — GPAs: Math 4.00; Physics 3.97; Total 3.92
- **Undergrad Coursework in:** Systems Programming, Algorithm Design, Modern Combinatorics, Game Theory
- **Graduate Coursework in:** Statistical Physics, Algebraic Geometry, Representation Theory, Quantum & Conformal Field Theory

Selected Publications

For a full up-to-date list of all 20+ papers, see my Google Scholar. *(* denotes equal contribution.)*

There Will Be a Scientific Theory of Deep Learning — Apr 2026
J. Simon, D. Kunin, **A. Atanasov**, et al. Perspective paper on emerging theory of deep learning. arXiv | learningmechanics.pub.

How Feature Learning Can Improve Neural Scaling Laws — Sept 2024
B. Bordelon*, **A. Atanasov***, and C. Pehlevan. ICLR 2025 **(Spotlight)**. Proposed hypothesis for when feature learning improves scaling.

Scaling and Renormalization in High-Dimensional Regression — May 2024
A. Atanasov, J. Zavatone-Veth, and C. Pehlevan. JSTAT 2024. Identified simple reformulation of scaling laws & double descent grounded in free probability, recovering & extending hundreds of papers. TechXplore press.

μP Networks Are Consistent Across Widths At Realistic Scales — May 2023
N. Vyas*, **A. Atanasov***, B. Bordelon*, et al. NeurIPS 2023. Early empirical work on μP showing not just loss curves, but learned functions and representations converge across widths in vision & language models. Kempner Institute Blog.

Neural Networks as Kernel Learners: The Silent Alignment Effect — Nov 2021
A. Atanasov, B. Bordelon, and C. Pehlevan. ICLR 2022. Identified the *silent alignment* effect, a dual to grokking.

Conformal Block Expansion in Celestial Conformal Field Theory — Apr 2021
A. Atanasov, W. Melton, A. Raclariu, and A. Strominger. Physical Review D.

Complex Analysis: In Dialogue — Oct 2013
In high school, independently published a 500-page textbook on complex analysis. Made for-sale on Amazon.

Honors and Awards

- **Citadel Securities' Inaugural PhD Summit** – Top 3 presentation award for the *Silent Alignment Effect* — 2022
- **Fannie & John Hertz Fellowship** – One of 11 students chosen from 850 to receive full graduate support ($250k) over 5 years — 2019
- **DoD Graduate Fellowship (NDSEG)** – One of 200 students chosen from 3,000 to receive full graduate support for 3 years — 2019
- **NSF Graduate Fellowship** (declined) – One of 2k students chosen from 12k to receive full graduate support for 3 years — 2019
- **Howard L. Schultz Prize in Physics** – To an outstanding senior in physics at Yale — 2018
- **William L. Putnam Mathematics Competition** – Taken twice; top 300 nationally both times — 2016, 2018

Skills

Programming: *(most to least experience)* Python, Julia, Mathematica, Java, C, C++, MATLAB
Tools: PyTorch, JAX, NumPy, Pandas, scikit-learn, LightGBM. Strong background in distributed computing & HPC.
Mentoring: Mentored 2 graduate students and 1 undergraduate across a breadth of deep learning projects, yielding 3 publications. Mentor and Lecturer for Perimeter Institute's ISSYP, SRS Bulgaria, and MIT's RSI Program (3×, 1 Best Paper Award).
Languages: English (native), Bulgarian (native), Latin (read and write, graduate coursework)
Other: Classically trained guitarist with a passion for Bach. Last but not least, LaTeX.