

Alexander Atanasov

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Github: github.com/ABAtanasov

Education

Yale University

B.S. Physics (intensive), M.S./B.S. Mathematics, 2018.

GPA: Physics 3.97; Math 4.00; Total 3.92

Thomas Jefferson High School for Science and Technology

Concentration in Optics and Modern Physics, 2014.

GPA: 3.92 unweighted

Research

Undergraduate Researcher: 3D Conformal Bootstrap and the Ising Model

Yale Dept. of Physics – Supervised by Prof. David Poland

August 2016 - Present

- Developed a [module](#) to perform numerical investigations on 3D conformal field theories (CFTs) sharing similar operator structures to the 3D Ising model.
- Excluded a large portion of previously unexplored potential CFTs using a technique called θ -scan. Found new numerical bounds for the $\mathcal{N} = 1$ supersymmetric Ising CFT.
- Supplemented by directed reading on topics in three-dimensional CFT and relationship to 3D quantum field theories towards senior thesis in the spring.

Software Engineering Intern: Machine Learning and Computer Vision

Google Inc. – Supervised by Dr. Nhat Vu

Summer 2017

- Worked to port TensorFlow models onto embedded devices for real-time face detection and recognition, achieving a 6x speedup in run-through time for inference from the start of the project without loss in accuracy.
- Presented results to [Hiroshi Lockheimer](#) and the mobile machine vision teams.

Visiting Researcher: Sparse Grid Discretization for Relativistic Astrophysics

Perimeter Institute for Theoretical Physics – Supervised by Dr. Erik Schnetter

Summer of 2016, Winter of 2016-2017

- One of seven students selected internationally to participate in Perimeter's [undergraduate program](#).
- Studied numerical solutions to Einstein's equations and Galerkin Methods in hyperbolic differential equations.
- Designed and implemented a sparse-grid based solver for hyperbolic equations, decreasing cost resolution N in d -dimensions from $O(N^d)$ to $O(N \log^{d-1} N)$. Successfully evolved a wave equation in $6 + 1$ dimensions with high accuracy and low memory requirements. Paper submitted for publication.
- Organized 10 meetings of weekly undergraduate lecture seminar. Presented two lectures on complex and algebraic geometry in physics.
- Engaged high schoolers in the [ISSYP program](#) as a lecturer and guest mentor.

Undergraduate Researcher: Dynamical Models of Recurrent Neural Networks
Yale School of Medicine, Dept. of Psychiatry N3 Division – Under Dr. John Murray
January 2016 - Present

- Built TensorFlow-based [package](#) for modeling neural dynamics in various cognitive tasks.
- Used CUDA, the Yale computing cluster, and tools in high-dimensional data science to generate results for upcoming publication.

Multi-scale Modelling of Carbon Nanomaterials

MITRE Corporation Student Program – Supervised by Dr. James Ellenbogen
Summer of 2014 & 2015. Winter of 2014-2015 & 2015-2016

- Studied techniques in quantum chemistry and density functional theory.
- Developed electrostatic model with quantum modification from symmetry breaking to account for the scaling regularity of the capacitance trends of certain carbon nanostructures. Published results.

SEAP Program: Plasma Cloud Generation using Cavity Resonators

Naval Research Laboratory – Supervised by Dr. Paul Bernhardt
Summer of 2013

- Studied electromagnetic wave equations and impedance in transmission lines, cavity resonators, and waveguides. Built voltage amplifier and tuned impedance to generate plasma clouds in confined region.

Publications

5. Alexander B. Atanasov and Erik Schnetter. *Sparse Grid Discretizations based on a Discontinuous Galerkin Method*. Preprint: [arXiv:1710.09356](#). October 2017. Submitted to *Journal of Classical and Quantum Gravity*.
4. Alexander B. Atanasov and James C. Ellenbogen. *Simple, accurate electrostatics based formulas for calculating ionization potentials, electron affinities, and capacitances of fullerenes*. [Phys. Rev A95](#). March 2017.
3. Alexander B. Atanasov and Erik Schnetter. *GalerkinSparseGrids.jl: A Module for Sparse Grid Discretization using Discontinuous Galerkin Bases*. [github.com/ABAtanasov/GalerkinSparseGrids.jl](#). August 2016.
2. Alexander B. Atanasov. *Complex Analysis: Appendix of Color Plots*. CreateSpace Publishing, 2013.
1. Alexander B. Atanasov. *Complex Analysis: In Dialogue*. CreateSpace Publishing, 2013.

Works in Progress:

- * Alexander B. Atanasov. *Representations of the Physical Universe*. Expected Publication April 2018. 200/550 Pages written. [[link](#)].

Talks

Conformal Field Theories beyond Two Dimensions

Yale Graduate Representation Theory Seminar, Nov. 2017 ([notes](#))

2D Conformal Field Theory and Lattice Models of BPZ

Seminar: Topics in Conformal Field Theory for Prof. David Poland, Dec. 2016 ([notes](#))

Instantons on \mathbb{R}^4 , Nakajima Quiver Varieties, and the Heisenberg Algebra

Seminar: Topics in Representation Theory for Prof. Igor Frenkel, Nov. 2016 (notes: [[0](#)][[1](#)][[2](#)])

Teaching	6j-symbols and the Tetrahedron <i>Seminar in Modern Algebra for Prof. You Qi, Apr. 2016</i> (notes)
	Phase Transitions in Graphs and the Margulis-Russo Theorem <i>Seminar in Modern Combinatorics under Prof. Van Vu, Dec. 2015</i>
	Grader and TA <i>Yale University</i> <ul style="list-style-type: none"> • Intro. to Complex Analysis, Fall 2016 & Fall 2017 • Vector Analysis on Manifolds, Spring 2017 & Spring 2017 • Intro. to Abstract Algebra, Fall 2015
	Guest Mentor and Lecturer <i>Perimeter International Summer School for Young Physicists</i> <ul style="list-style-type: none"> • Presented Lecture on Covariance, Contravariance, Manifolds, and their Flows for high school audience (lecture video here).
Awards and Fellowships	Yale Morse College Richter Fellowship 2016
	Yale Dean's Research Fellowship 2016
	William L. Putnam Mathematics Competition Top 300 2016
	U.S.A. Physics Olympiad Semifinalist 2013
Languages and Skills	English, Bulgarian (native), Latin (advanced) <i>Programming Languages (most to least proficient):</i> Mathematica, Julia, Python, C, C++, Java, Matlab/Octave, HTML, Excel, R <i>Parallel and HPC Tools:</i> OpenMP, MPI, CUDA, TensorFlow, Julia Toolkit Strong background in tutoring, public speaking, and academic lecturing. Last but not least, \LaTeX .

References

[James Ellenbogen](#)

Nanosystems Group

MITRE Corporation

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[David Poland](#)

Department of Physics

Yale University

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[Erik Schnetter](#)

Strong Gravity Group

Perimeter Institute

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[John Murray](#)

Department of Psychiatry N3 Division

Yale School of Medicine

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