

Nathan Che Drucker

ndrucker@g.harvard.edu

- EDUCATION** *PhD Student, Applied Physics*
Harvard University, Cambridge MA, August 2018-Present
- S.M. Applied Physics*
Harvard University, Cambridge MA, May 2020
- B.S. Materials Science and Engineering, Additional Major in Physics*
University Honors, Mellon College of Science Honors
Carnegie Mellon University, Pittsburgh PA, May 2018
- RESEARCH** *Graduate Research Assistant* June 2020-present
Quantum Matter Group, Massachusetts Institute of Technology, Cambridge MA
- Graduate Research Assistant* June 2018-March 2020
Professor Jennifer E. Hoffman Lab, Harvard University, Cambridge MA
- Investigating correlated electronic materials with scanning tunneling microscopy.
 - Mentoring undergraduates to engineer acoustic metamaterials.
- Visiting Student Researcher* June-August 2017
Center for Quantum Devices, Niels Bohr Institute, Copenhagen, Denmark
- Designed, fabricated and measured microwave circuits for integration into quantum computing systems.
- Undergraduate Research Assistant* January 2016-May 2018
Quantum Nanoelectronics Lab, Carnegie Mellon Physics Dept., Pittsburgh, PA
- Developed nanofabrication and measurement techniques for materials heterostructures in search of new 2D phases of matter.
- Undergraduate Research Assistant* June-October 2015
Professor Robert Davis' Lab, CMU Dept. of Material Science, Pittsburgh PA
- Researched different substrates for semiconductor growth.
- Undergraduate Research Assistant* October 2014-April 2015
Manipulation Lab, Robotics Institute, Pittsburgh, PA
- Designed and tested 3D printed fingers for rotor hands on robotic arms.
- PUBLICATIONS** • *van der Waals metamaterials*, W. Dorrell, H. Pirie, S. Minhal Gardezi, N.C. Drucker, J.E. Hoffman, Phys. Rev. B **101**, 121103(R) (2020)
- PROJECTS** *Strongly Correlated Topological Materials*
Hoffman Lab, Harvard Dept. of Physics
- Discovered new atomic scale magnetic structure on the surface of magnetic Weyl semimetal candidate CeBi with spin-polarized scanning tunneling microscopy (SP-STM).

- Mapping the band structure of CeBi in high magnetic field with quasiparticle interference (QPI).

Quantum Analogs in Acoustic Metamaterials

Hoffman Lab, Harvard Dept. of Physics

Graduate student mentor advising the following projects:

- Engineering van der Waals metamaterials, macroscopic mechanical analogs of atomically thin 2D materials, using COMSOL multiphysics.
- Design and measurement of Kagome flat band metamaterials with COMSOL multiphysics and scanning microphone.

Magnetism in 2D materials

Quantum Nanoelectronics Lab, Carnegie Mellon Physics Dept.

- Studied magnetic behavior of atomically thin materials with optical techniques and low temperature magneto-electric transport.

Design and Measurement of Hybrid Quantum Systems

Center for Quantum Devices, Niels Bohr Institute

- Engineered high-fidelity superconducting microwave resonators for long distance entanglement of spin qubits in SiGe.

Band Structure Calculation of Chiral Topological materials

Computational Design of Materials, Spring 2019

- Computed the band structure of PdGa and CoSi in Density Functional Theory package Quantum Espresso to search for topologically non-trivial crossings.

Fabrication and Processing of High Temperature Superconductor

Phase Transformations and Diagrams Lab, Spring 2016

- Produced various samples of high temperature superconductor YBCO to study the effects of processing on structure and performance of complex materials.

Thermal and Mechanical Characterization of High Strength, Dual Phase Steels

Materials Capstone Project, Fall 2017

- Partnered with Brazilian steel company Companhia Siderurgica Nacional to find the continuous cooling transformation diagrams of dual phase 600 and dual phase 1000 steels to be manufactured on their industrial lines.

Optimization of 4140 Steel Strength and Toughness

Microstructures and Properties of Materials Lab, Fall 2016

- Developed different heat treatments for 4140 steel samples to maximize mechanical performance. Achieved 145% higher ultimate yield strength and 800% higher toughness in tempered samples than in original, untreated samples.

Chaos in Driven Mechanical Systems

Modern Physics Lab, Spring 2018

- Wrote simulation of driven double well duffing oscillator to investigate its phase diagram and fractal dimension to compare with experiments.

Divine Comedy Math Education Game and Numerical Analysis Package

Fundamentals of Programming Final Project, Spring 2015

- Designed and implemented a game to help teach factorization and basic graph reading skills. Wrote programs to solve important problems in linear algebra and numerical analysis including Euler's Method and Newton's method.

- TEACHING** *Teaching Fellow, Electricity and Magnetism Lab*
Harvard University, Fall 2019
- Assisted design and teaching of Physics 15b experimental E+M labs for Harvard undergraduates.
- HONORS AND AWARDS** *Certificate of Distinction in Teaching*
Derek Bok center for Teaching and Learning, Harvard University, Fall 2019
- Recognized for outstanding teaching based on student course evaluations.
- Semiconductor Research Corporation Undergraduate Research Fellowship*
Carnegie Mellon University, January 2016- May 2018
- Competitive scholarship which funds research from Sophomore Spring through Senior Spring.
- International Summer Research Grant*
Carnegie Mellon University, Summer 2017
- Provided with funds to conduct research abroad at the Niels Bohr Institute in Copenhagen, Denmark.
- Carnegie Institute of Technology Grant*
Carnegie Mellon University, Summer 2017
- Provided with additional funds to conduct research abroad at the Niels Bohr Institute in Copenhagen, Denmark.
- Grobstein Memorial Fund Scholar*
Carnegie Mellon University, January 2016-May 2018
- Merit based scholarship at Carnegie Mellon.
- Carnegie Institute of Technology Dean's List*
Carnegie Mellon University, Fall 2016, Spring 2016, Spring 2017
- Achieved above 3.75 GPA.
- POSTERS AND TALKS** *APS March Meeting*
Boston, MA 2019
- *Magnetic Domains in the strongly correlated Weyl semimetal candidate CeBi*
- Austin, Texas, September 2016
- Selected from competitive applicant pool to present undergraduate research at the annual Semiconductor Research Conference in Austin.
- Meeting of the Minds*
Carnegie Mellon University, May 2016, May 2017, May 2018
- Presented posters at the annual undergraduate research poster presentation at Carnegie Mellon University.
 - Won 2nd place in the SRC poster competition May 2016, Won 1st place in SRC poster competition May 2018
 - Participated in Sigma Xi poster competition May 2017, May 2018. Won 3rd place May 2018
- OTHER EMPLOYMENT** *Peer Tutor*
Carnegie Mellon University Academic Development, January 2016-May 2018
- Trained tutor in a College Reading and Learning Association accredited program.

- Tutor science, engineering, and math classes in private appointments and lead large tutoring sessions.

SKILLS

Languages

- English; native proficiency

Programming

- Python, MATLAB, Mathematica

Equipment

- Scanning Tunneling Microscopy, Scanning Electron Microscope, X-Ray Diffraction, Atomic Force Microscope, UV Lithography, Soldering and Wirebonding

CAD

- AutoCAD, SolidWorks, Revit, Rhinoceros, CrystalMaker

ACTIVITIES

Carnegie Mellon University Grand Putnam Team

- Scored 10 points on question A1 on each of the 2016 and 2017 William Lowell Putnam Mathematics Competitions.

RELEVANT COURSEWORK

Physics

- Special Topics in Condensed Matter Physics (G), Quantum Theory of Solids (G), Statistical Mechanics (G), Mathematical Methods of Physics (G), Electronics (G), Computational Design of Materials (G), Solid State Physics(UG), Nanoscience and Nanotechnology(UG), Solid State Electronic Devices(UG), Advanced Quantum Mechanics(UG), Electricity and Magnetism(UG).

Materials Science

- Crsytallography (UG), Thermodynamics of Materials(UG), Phase Relations and Diagrams(UG), Defects in Materials(UG), Transport in Materials(UG), Materials Characterization(UG), Microstructure and Properties of Materials(UG), Selection and Performance of Materials(UG).

Other

- Machine Learning (G)