# MARGARET ANDERSON

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## EDUCATION

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|---|---|---|---|
| California Institute of Technology | B.S. Physics and History | GPA: 4.0 | June 2020 |
| **Harvard University** | **PhD Physics** | | **Est. 2026** |

## RESEARCH EXPERIENCE

**Condensed Matter Physics Senior Thesis Project| Partial Academic Year 2019-20**
**Mentor: Nai-Chang Yeh**
- Planned to investigate the energy levels and quantum confinement in nanoparticle quantum dots using Scanning Tunneling Microscopy and Spectroscopy (STM and STS)

**Medieval History Senior Thesis Project| Academic Year 2019-20**
**Mentor: Warren Brown**
- Considered why Charlemagne's grandson was called Charles the Bald given that he might not have been physically bald
- Explored medieval symbolism surrounding hair, the origin of epithets, and the image of Carolingian kings

**Imaging in the Physical Sciences REU at the Rochester Institute of Technology | Summer 2019**
**Mentors: David Messinger and Roger Easton, Jr**
- Investigated radiation exposure and heating conservation concerns of parchment documents
- Dated and characterized medieval documents with reflectance spectroscopy
- Conducted advanced image processing of multi- and hyperspectral images to reveal erased, damaged, and hidden text using ENVI Image Processing Software and MATLAB

**Summer Undergraduate Research Fellowship at Caltech | Summer 2018**
**Mentors: Nai-Chang Yeh and Matthew Hunt**
- Outlined and electrically isolated Graphene devices using a He-Ne-Ga Ion Beam Milling System
- Optimized milling quality with unique tilting method to reduce substrate swelling
- Characterized cut profiles with Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM)
- Patterned electrodes with E-beam Lithography
- Performed work in the Kavli Nanoscience Institute cleanroom

**California Institute of Technology Condensed Matter Physics Research Intern | Fall 2017-Spring 2018**
**Mentor: Nai-Chang Yeh**
- Investigated the induction of magnetism in 2-dimensional Transition Metal Dichalcogenides with self-assembled nanoparticle films
- Deposited magnetic nanoparticle solutions in a strong magnetic field to form oriented self-assembled arrays with net magnetism and characterized samples with SEM

**Independent Study History Project| Winter 2018**
**Mentor: Maura Dykstra**
- Discussed the introduction of female undergraduates to Caltech based on archival evidence

**Summer Undergraduate Research Fellowship at Cornell University | Summer 2017**
**Mentor: Darrell Schlom**
- Characterized multiferroic thin films with AFM, X-ray Diffraction (XRD), and Vibrating Sample Magnetometry (VSM) to improve future growth, crystal quality, and ferroelectric and ferromagnetic properties

- Observed film growth with Molecular Beam Epitaxy (MBE) and in situ characterization with Reflection High-Energy Electron Diffraction (RHEED)

**California Institute of Technology Geology Research Intern | Spring 2017**
**Mentor: Joann Stock**

- Used Python to analyze emission spectra and characterize composition of rock samples from alluvial fans

**Southern Illinois University of Edwardsville Research Intern | Summer 2016**
**Mentor: Abdullatif Hamad**

- Observed optics research in thermal lensing where weak lenses were formed via the laser heating and resulting expansion of a thin layer of liquid

**Missouri University of Science and Technology Summer Research Academy | Summer 2015**
**Mentor: Edward Kinzel**

- Studied the scalability and throughput of the process of Nanosphere Photolithography which produced microhole arrays beyond the diffraction limit by using a self-assembled monolayer array of silicon nanoparticles as a microlens array
- Analyzed and measured samples with light microscopy, SEM, and ImageJ

## EXTRACURRICULAR ACTIVITIES AND WORK EXPERIENCE

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| Caltech Association of Makers (President) | September 2017 – June 2018 |
| Caltech Academics and Research Committee | January 2017 – June 2018 |
| Teaching Assistant in Physics Electronics Lab | September 2018 – December 2018 |
| Work Study in 3D Printing Lab | January 2017 – June 2017 |
| Caltech-Occidental Wind Orchestra | September 2016 – March 2020 |
| Caltech Science Olympiad Volunteer | September 2016 – March 2020 |
| Work Study/ Employment with the Einstein Papers Project | January 2019 – present |

## AWARDS

- Arthur Noyes Scholarship 2016 – merit scholarship
- Margie Lauritsen Leighton Prize 2018 – awarded to a sophomore female physics major based on nomination from a faculty member
- Hugh F. and Audy Lou Colvin Named SURF Fellowship 2018 – awarded based on project proposal
- Carnation Foundation Scholarship 2018 and 2019 – merit scholarship
- Rodman W. Paul History Prize 2020
- 2020 Senior Undergraduate Thesis Prize

## SPECIAL SKILLS

- Python
- LaTeX
- MATLAB
- Mathematica
- ImageJ
- ENVI image processing
- CSS
- HTML
- SEM
- AFM
- VSM
- He-Ne-Ga Ion Milling/Microscopy
- Photolithography
- E-beam Lithography
- STM and STS
- Additive Manufacturing (3D Printing)
- Multispectral Imaging
- Hyperspectral Imaging
- Reflectance spectroscopy
- Transmission Electron Microscopy (TEM)

## ADVANCED COURSEWORK

- Atoms and Photons – A graduate-level class on the interaction of atoms with electromagnetic fields, atomic trapping and cooling, and other manipulation and control methods
- Analog Electronics for Physicists – a laboratory course covering analog electronics with an emphasis on Op-Amps which culminated in a two-week student designed project
- Mathematical Methods for Physics, Group Theory – a graduate-level course on group theory methods applied to physics
- Introductory Methods of Applied Mathematics for the Physical Sciences – a graduate-level course on complex analysis, ordinary differential equations, partial differential equations, transform methods, and green's functions
- Graduate-level quantum mechanics including quantum field theory and scattering