# James C. McCord

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## Research Interests

Quantum information and quantum computing; quantum many-body systems; numerical methods for strongly correlated systems; tensor network methods and algorithms; entanglement renormalization; quantum chemistry and quantum simulations; trapped-ion quantum computing; data analysis.

## Education

**B.A. Physics** Georgia Institute of Technology — Expected May 2021
- Selected Courses: Applied Particle Optics, Quantum Information & Computation, Physics of Small Systems.

**B.A. Biology** Georgia Institute of Technology — December 2016
Minor: Physics

## Research Experience

### *Current*

**Tensor Networks and Wavelets** — August 2019 - Present
Advisor: Dr. Glen Evenbly
- Use tensor network methods to develop more efficient data compression schemes, particularly for images.
- Develop unitary circuit algorithms in MATLAB to perform wavelet transforms on data of any dimension.
- Design novel discrete wavelet transforms using unitary gates derived from the tensor network formalism.
- Benchmark quantum-inspired wavelets against state-of-the-art wavelets for different tasks.

**Nitrogen Reactivity of p-Block Dopants** — January 2020 - Present
Advisor: Dr. Andrew Medford
- Investigate photocatalytic nitrogen fixation using density functional theory (DFT) calculations.
- Find doped surfaces that are preferentially reactive toward $N_2$ instead of $O_2$.
- Compute adsorption energies of $N_2$ and $O_2$ molecules on $TiO_2$ surfaces doped with p-block elements.
- Routinely run large-scale DFT simulations on remote computing clusters.

### *Previous*

**Dynamics of Exoplanet Magnetospheres** — September 2017 - June 2018
Advisor: Dr. Carol Paty
- Investigated magnetosphere interaction of possible exoplanet in the habitable zone of M-dwarf host star.
- Determined most probable radius, mass, and atmosphere of rocky exoplanet through literature review.
- Calculated equilibrium temperature, scale height, neutral and ionospheric density profiles of atmosphere.

**Single Top Quark Production** — March 2017 - August 2018
Advisor: Dr. Nikolaos Kidonakis
- Determined cross-sections of top quarks produced through multiple pathways using Monte Carlo methods.
- Calculated fully differential cross-sections from integrated cross-section data.
- Created transverse momenta and rapidity distributions from output data.

## Honors & Awards

**Presidents Undergraduate Research Award** $1,500 — Summer 2020

**Faculty Honors** — Spring 2020

## Professional Activities

**Quantum Ideas Summer School** Duke University (STAQ) — Summer 2020

## Teaching Experience

**Teaching Assistant** Introduction to Electromagnetism (Modern) — Summer 2020

**Lab Instructor** Introduction to Mechanics (Traditional) — Fall 2019, Spring 2020

**Grader** Stellar Astrophysics — Fall 2017, Fall 2019

**Lead Instructor** Mathnasium of Dunwoody — January 2018 - January 2020

**Private Tutor** Physics, Math, SAT, ACT — May 2018 - December 2019

**Astronomy Instructor** Boy Scout Merit Badge Clinic — February 2013 - February 2017

**Life Sciences Intern** Fernbank Museum of Natural History — Fall 2013

## Employment

**Building Supervisor** Campus Recreation Center (Georgia Tech) — August 2019 - Present

**Facilities Assistant** Campus Recreation Center (Georgia Tech) — May 2019 - August 2019

**Amphibian Specialist** Atlanta Botanical Garden — August 2018 - May 2018

**Research Technician** Int. Cooperative Biodiversity Group (Georgia Tech) — May 2017 - December 2017

**Research Technician** Marine Chemical Ecology Lab (Georgia Tech) — April 2014 - August 2014

## Leadership

**President** Georgia Tech Astronomy Club — August 2015 - August 2016

**Treasurer** Georgia Tech Astronomy Club — August 2014 - August 2015

Last updated: May 26, 2020