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

B.S. Biology Georgia Institute of Technology — December 2016

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 27, 2020