NICHOLAS FLOOD COTHARD, Ph.D.

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Education

Ph.D., Applied and Engineering Physics, Cornell University — August 2021
M.S., Applied and Engineering Physics, Cornell University — July 2018
NASA Space Technology Research Fellow — 2017 – 2021
Watt W Webb Graduate Research Fellow, Kavli Institute at Cornell for Nanoscale Science — 2016 – 2017
B.S., Physics (Minor Math), University of Rochester — May 2015

Technical Skills

Measurement: Low-noise superconducting microwave resonator characterization and data acquisition techniques
Cryogenics: Dilution, adiabatic demagnetization, He3/He4 sorption, and liquid helium refrigerators, vacuum systems
Fabrication: Lithography, thin film deposition, etching, metrology, SEM, package design, wirebonding, and inspection
Programming: Python – numpy, pandas, matplotlib, scipy, astropy, lmfit (proficient), Matlab (basic), C++ (basic)
Tools: Git, Jupyter, Bokeh, LabView, Solidworks, Zemax, CST Microwave Studios, Ansys HFSS, VS Code, KLayout
Communication: Technical proposal writing, peer-reviewed journal publishing, public speaking and presentations

Research Experience

NASA Postdoctoral Fellow, Goddard Space Flight Center, Greenbelt MD — Aug 2021 – Present

- Characterized sensitivity and response of multiple prototype superconducting kinetic inductance detector designs
- Developed cryogenic sensor characterization testbeds including warm and cold readout electronics
- Operated dilution, He3/He4 sorption, and adiabatic demagnetization refrigerators, and optimized control software
- Interfaced multiple fabrication teams to produce optically coupled superconducting detector focal-plane arrays
- Developed testbed for FPGA development for multiplexed readout of superconducting microwave resonators
- Designed and built mid-to-far-infrared Fourier Transform Spectrometer and associated control and analysis software
- Developed data reduction pipeline for JWST NIRCAM imaging of Galaxy NGC 4258
- Successfully led the proposal development and submission for multiple competitive NASA internal R&D grants

Graduate Student Researcher, Cornell University, Ithaca NY — Aug 2015 – Aug 2021

Developed superconducting sensors and cryogenic optics for three microwave astronomical observatories in Chile:

- *CCAT Observatory* – Designed metamaterial-based Fabry-Perot spectrometer and developed silicon anti-reflection coatings microfabrication process. Operated and characterized dilution refrigerator microwave sensor testbed.
- *Simons Observatory* – Measured prototype superconducting transition edge sensor heat capacity, time constants, and complex impedance. Designed and implemented cryogenic testbed for microwave cold readout components.
- *Advanced ACTPol* – Remotely operated Atacama Cosmology Telescope during observations, performed in-situ optical systematic measurements, characterized superconducting detector arrays and readout components.

Undergraduate Researcher, Fermi National Accelerator Laboratory, Batavia IL — Jun 2011 – Aug 2015

- Developed diagnostic, simulation, and analysis codes to search for magnetic monopoles in Fermilab collider data

DOE Undergraduate Research Fellow, General Atomics, San Diego CA — Summer 2014

- Improved data analysis fidelity and time-resolution of ion-loss measurements in DIII-D Tokamak Fusion reactor

NSF REU Student Researcher, SRI International, Menlo Park CA — Summer 2013

- Assembled, calibrated, and developed control software for UV-nearIR Echelle spectrometer for aernomical research

Publications & Other Related Experience

- 8 lead-author (+2 in prep), 40+ co-authored publications. Full list available: ncothard.github.io/publications
- Presented research at over a dozen conferences, workshops, and scientific collaboration meetings
- Subject matter expert in NASA peer reviews and peer-reviewer for two superconducting device journals
- Mentored 10+ undergraduate and graduate students in conducting scientific research
- Teaching assistant for six college courses ranging from honors and engineering physics to electronics lab
- Founder of Cornell Applied Physics Grad Society and former president of Rochester Society of Physics Students