Alexander Cingoranelli

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github.com/minifold

Education

University of Central Florida August 2018 - August 2023

Bachelors of Science in Computer Science

College of Engineering and Computer Science (Honors)

Bachelors of Science in Physical Sciences, Computational

College of Science (Honors)

Total GPA: 3.646

Oregon State University September 2025 - Present

Doctorate of Philosophy in Physics

College of Science

Awards and Honors

UCF Burnett Honors Scholar

UCF Provost Scholar 2018-2023

Florida Bright Futures Scholar 2018-2022

Summer Undergraduate Research Fellowship 2020

Withlacoochee River Electric Company Scholarship 2018-2022

FGLSAMP Research Scholar 2021-2022 & 2022-2023

President's Honor Roll Fall 2020 | Spring 2021 | Fall 2022

UCF Dean's List Fall 2019 | Spring 2019 | Spring 2020 | Fall 2021

Projects

Deep Neural Emulation of the Supermassive Black-hole Binary Population

Using a normalizing flow (NF) emulator that is trained on the entirety of the GWB strain ensemble distribution, rather than only mean and standard deviation allows prediction of strain distributions that mirror underlying simulations very closely while also capturing frequency covariances in the strain distributions as well as statistical complexities such as tails, non-Gaussianities, and multimodalities that are otherwise not learnable by existing techniques.
https://arxiv.org/abs/2411.10519

Measuring Orbital Period and Eccentricity of Pulsar J0437-4715 Using GBO's 20-meter Telescope

As part of the Green Bank Observatory's Single Dish Summer School 2024. Observed Pulsar J0437-4715 with the 20-meter telescope at GBO, excised the RFI channels using PRESTO's rfifind tool, and measured the barycentric orbital period and eccentricity using archival data as a proof-of-concept data reduction pipeline.
https://github.com/minifold/SDSS24-Pulsars

A Spectral Kurtosis Algorithm to Reduce RFI with Arecibo's 12-meter Telescope

The application of the generalized Spectral Kurtosis estimator as a tool for identifying and excising RFI in radio astronomy data is explored via an object oriented methodology written in Python. The usefulness of this technique is demonstrated using S-band (3.3 GHz) observations from the recently upgraded 12-meter telescope at the Arecibo Observatory to take a survey of CH hyperfile transitions near 3.3 GHz.
https://ui.adsabs.harvard.edu/abs/2024AAS...24317407C/abstract
https://github.com/minifold/pytosis

CH Galactic Center Survey

A map of the 3.3 GHz transitions of the CH molecule toward the Galactic Center region is presented. One of the primary science projects of the upgraded 12-m radio telescope at the Arecibo Observatory was the observation of a 1.5 x 1.5 deg. single-pointing map of the region of all 3 CH hyperfine transitions at this frequency. The CH line was detected at 3.335 GHz in all nine positions in good agreement with previous observations. The first detections of the 3.264 and 3.349 GHz CH lines across the region are presented in several positions where the 3.264 GHz line amplitude exceeds the main line by a factor of two, versus expected LTE conditions.
https://ui.adsabs.harvard.edu/abs/2024AAS...24340223D/abstract

Holodeck Gravitational Wave Simulation

Worked on documentation and assisted module development of Holodeck, a comprehensive framework for SMBH binary population synthesis as a junior member of NANOGrav. Written in Python and Cython and published as a package on PyPI.
https://github.com/nanograv/holodeck/

Polyoculus Telescope Array
PolyOculus is a project utilising commercial off the shelf equipment (telescopes, CCD cameras, and control computers) combined with a novel optical architecture to produce telescope collecting areas equivalent to standard telescopes with large mirror diameters at a fraction of the cost. Written in Java and C++, using NVidia Jetson nanos to apply machine vision technology to mirror telescopes. The repository on Github is currently private.
https://astro.ufl.edu/wp-content/uploads/sites/58/2020/05/PolyOculus.pdf

Galactic H2 Survey using the 40-Foot Telescope at Green Bank Observatory
Conducted a survey of the galactic plane for H2 using the 40-foot radio telescope at Green Bank, and conducted data analysis on the redshift of H2 with respect to the orientation of the galaxy's angle of tilt.

Event HoryZen
Worked on a python library designed to simulate and visualize geodesic motion around different black holes. Project completed alongside building a computational methods computer for the Society of Physics Students / Sigma-Pi-Sigma.
https://github.com/UCFSPS/event-horyzen

EZ-RASSOR 2.0
Project Lead for capstone Senior Design project in conjunction with the Florida Space Institute and NASA, recreating the codebase for the EZ-RASSOR in ROS 2.0. The EZ-RASSOR is a regolith mining robot constructed to be inexpensively made through 3D printing and easy to source parts such as an Arduino, Raspberry Pi, etc.
https://fsi.ucf.edu/ez/

CUWiP Website
Webmaster for updating the Conference for Undergraduate Women in Physics hosted by the University of Central Florida in January 2023.
https://sciences.ucf.edu/cuwip

Fast Retrieval and Generation of Cloudy Exoplanet Data using Machine Learning
Planetary atmospheric retrieval, or the modelling of atmospheric processes based on observed spectra, provides a window into the chemical and temperature profiles and possible cloud structures present on exoplanets. A neural network can be used, in tandem with simulated spectra, to potentially generate any plausible simulated exoplanet posterior using observed data at reasonable speed. We generate these models using atmospheric data with clouds and generate 1D marginalised posteriors, 2D pairwise posteriors, and parameter history traces.

PyJOSE
PyJOSE is an implementation of the original JOSE written by John Dermody and Joe Harrington in 2004. The package extracts a spectrum from a reduced spectrograph dataframe using the optimal algorithm as described in “An Optimal Extraction Algorithm for CCD Spectroscopy” (K. Horne, 1986, PASP 98:609-617).
https://github.com/jwfraustro/pyJose

Predicting Atomization Energy using Machine Learning
A class Kaggle competition based on real molecular data: predicting the atomization energy of different molecules using machine learning.
https://www.kaggle.com/c/cap-4611-2021-fall-assignment-3

SVM Classification of the ESRB rating of Video Games
A class Kaggle competition using a library of video games; using a support vector machine, the goal was to assign an ESRB rating based on whether the game had strong language, violence, blood, etc.
https://www.kaggle.com/code/subatomic/assignment-2

Presentations

AAS 2024
January 2024: New Orleans, LA
Virtual iPoster on research of mathematical methods to reduce RFI from radio spectroscopy data from the Arecibo 12-meter telescope.
Cingoranelli, A., Morales Butler, E. J., Smith, A., Roshi, A. (2024, January). Exploring RFI Reduction Techniques on CH 3.3 GHz Observations using the Arecibo Observatory 12-Meter Telescope. In *American Astronomical Society Meeting Abstracts* (Vol. 57, No. , pp.).

SPIE 2023
Moraitis, C. et. al. (2023, October). OPA! The Original PolyOculus Array: a status update. In *UV/Optical/IR Space Telescopes and Instruments: Innovative Technologies and Concepts XI* (Vol. 12676, pp. 51-65). SPIE.

AAS 2023

January 2023: Seattle, WA
Virtual iPoster on research of Machine Learning for the retrieval and simulation of cloudy exoplanetary atmospheres.
Cingoranelli, A., & Himes, M. (2023, January). Fast Retrieval and Generation of Cloudy Exoplanet Data using Machine Learning. In *American Astronomical Society Meeting Abstracts* (Vol. 55, No. 2, pp. 204-07).

DPS 53

October 2021: Virtual
Virtual iPoster displaying PyJOSE.
Fraustro, J. W., Harrington, J., & Cingoranelli, A. (2021, October). JOSE: An Open-Source Python Optimal Spectrum Extraction Package. In *AAS/Division for Planetary Sciences Meeting Abstracts* (Vol. 53, No. 7, pp. 212-16).

Organizations

NANOGrav — Junior Member
Society of Physics Students — Member
Women in Physics — Local Organizing Committee Member

Quantum Computing Journal Club

Summer 2021
Lectured on Turing Machines from Quantum Computing textbook by Neilsen and Chuang to Journal Club group with members from Tulane, LSU, and UCF.

Machine Learning Journal Club

Summer 2022
Assisted in teaching about Tensorflow, neural networks, activation functions and hyperparameters to graduate students in the physics department.

Work Experience

Graduate Teaching Assistant
Oregon State University
September 2025 — Present

- Teaching introduction to physics laboratories exploring fundamentals of movement and introductory newtonian physics.
- Tutoring students one-on-one in the “wormhole” a department-led undergraduate tutoring effort

Bicycle Mechanic
High Desert Bicycles East
November 2024 — August 2025

- Built Specialized mountain, road, and e- bicycles for customer purchase.
- Repaired a variety of bicycles across different brands ranging from flat repair to fixing drivetrain issues and suspension maintenance.
- Assisted with sales of Specialized retail products and apparel in person and over the phone.
- Worked with a network of other Specialized retail stores to enhance customer bicycle purchase experience via logistics management
- Participates in group rides led by the shop to various local trails

Software Development Lead
University of Central Florida: College for Research of Optics and Photonics
March 2023 — January 2024

- Mentored and managed several undergraduates on a large scale research software project involving telescope instrumentation for optical astronomy.
- Used the Jetson Orin Nano for Computer Vision using CUDA.
- Employed usage and understanding of various commercial off the shelf electronics such as Arduinos as part of systems testing
- Worked with Java/Maven and Python for controlling the telescopes using an interface with the C++ INDI libraries.

Undergraduate Researcher
Arecibo Observatory
October 2022 – August 2023

- Worked with multiple researchers and engineers to observe using the 12-meter radio telescope at Arecibo,
- Observed radio telescope data and synthesized data using various analysis techniques
- Wrote scripts in IDL and Python for data analysis
- Wrote computational algorithms in Python to aid in the process of cleaning and excising noise from observations using the telescope.

Software Engineering Intern
National Aeronautics and Space Administration: Kennedy Space Center
OSTEM Intern June 2022 — August 2022

- Developed the telemetry retrieval software of the rocket launch control software suite to be used by various launch vehicles and ground support equipment as part of the Artemis mission.
- Wrote documentation for the full software stack, including for existing modules written by senior developers.

Programming languages used: C, C++. Programs used and developed: Wireshark.

ML Software Developer
USEncryption, Inc.
April 2022 - January 2023

- Developed machine learning algorithms and paradigms in python for use in encrypted data structures.
- Reverse-engineered popular python packages such as Pandas and Numpy to work with the novel encrypted data type.
- Contributed to development of novel methods of encryption “as a service”.

Programming languages used: C++, Python (Numpy, Pandas, Pytorch, Keras)

Software Application Developer
University of Central Florida: Physics Department
July 2021 — January 2022
A randomized exam and quiz question generator written using C, LaTeX, and Python. The Python GUI is a front-end for professors to create and edit test questions that can be populated with random numbers for their coursework.

- Refactored GUI template and added user functionality.
- Created an object-oriented Tkinter application framework.
- Combined LaTeX and Shell scripts with a Python GUI for removal of CLI input and improved end-user experience.

Systems Administrator
University of Central Florida: Physics Department
September 2019 — February 2023

- Managed several department Linux servers of different distributions, including Ubuntu, CentOS, Rocky Linux, Windows Enterprise.
- Serviced and analysed infected department computers to remove malicious software.
- Utilized network administration skills to interact with data remotely.
- Worked with research computing clusters Stokes and Newton writing SLURM scripts.
- Priced, built, and repaired enterprise-level ($10,000+) computers.

Programming Languages & Skills

Python: 5+ years experience

- ML (Keras, Tensorflow, Pytorch)
- Numerical Computation (Numpy, Cython, JAX, Pandas, astropy)
- Packaging (Poetry, PyPI)

Java: 4+ years experience

- Apache Maven projects
- JavaFX
- Multithreading

Other Languages

C/C++ | ELISP | *sh | Fortran | Julia | SQL | Rust | Web

Computer Skills

- Git and remote repository workflow (Github, Bitbucket, Gitlab, Gitea)
- Github CI/CD
- Docker/Singularity container management
- Agile development workflow
- Documentation & literate programming (docstrings, sphinx, mkdocs, org)
- High Performance Computing (HPC) Skills (SLURM scripting)
- Linux (Debian-based systems e.g. Ubuntu, Arch, NixOS)
- Unix (AIX, BSD)
- Jira ticket and issue management

Other Skills

- Flat tire repair
- Tubeless tire installation
- Drivetrain and derailleur adjustment and alignment
- Mechanical caliper and disk and hydraulic disk brake repair and maintenance
- Basic outdoor skills