WALTER W. GOLAY

CONTACT INFORMATION

☎ +1 (515) 202-2651
✉ wgolay@cfa.harvard.edu
GitHub
0000-0001-7946-1034

Office A-103
Center for Astrophysics | Harvard & Smithsonian
60 Garden St., MS10
Cambridge, MA 02138, USA

RESEARCH INTERESTS

· Constraining models of extra-galactic transients by observing their radio emission
· Modeling and observing stellar radio emission, magnetism, and star-exoplanet interactions
· Instrumentation and robotic operation of small optical telescopes for educational use

EDUCATION

Harvard University, Cambridge, MA, USA
Ph.D. in Astronomy & Astrophysics — *In progress*
M.S. in Astronomy & Astrophysics
Advisor: Prof. Edo Berger

University of Iowa, Iowa City, IA, USA
B.S. in Astronomy, B.S. in Physics
University Honors & Honors in the Major (astronomy)
Thesis: A search for thermal gyro-synchrotron emission from hot stellar coronae
Advisor: Prof. Robert L. Mutel
Selected Courses: ASTR:4850 Astronomical Laboratory, PHYS:4905 Astrophysical Machine Learning, PHYS:4740 Elementary Particles and Nuclear Physics, PHYS:3712 Astrophysics II
GPA: 3.88/4.0

RESEARCH EXPERIENCE

BICEP/*Keck* Cosmic Microwave Background Detector Systematics — Jun–Aug '22
NSF REU Intern – Center for Astrophysics | Harvard & Smithsonian
· Member of a collaboration searching for evidence of inflation by observing polarization in the CMB, requiring a precise understanding of the detectors' optical transfer function (beam)
· Characterized systematic noise injected by the existing algorithm used in beam-mapping
· Developed the `SCOTTY` algorithm (Systematic Cleaning of Timestreams Yielding Beams)
· Designed three new metrics for comparing the performance of demodulators
· View detailed report here

Mutel Radio Group — Mar '21–May '23
Undergraduate Research Assistant – University of Iowa
· Implemented Bayesian inference to uncover a thermal electron energy distribution in the coronae of two pre-main-sequence weak-lined T Tauri stars V410 Tau and HD 283572
· Applied Bayesian inference directly to the observed radio visibilities of six epochs of observations of HR 1099 to elicit evidence of a coronal mass ejection in this RS CVn binary system
· Planning follow-up observations of new stars as the PI of a 2024A JVLA observing proposal
· Finalizing publication of a `Python` package called `pyTrace` for ray-tracing of radio emission from non-homogenous magneto-active plasma, to be published Jan '23
· Modeling electron cyclotron masers in the magnetosphere of ultracool dwarf 2M J0746+20 using `pyTrace` to uncover highly circularly-polarized pulsed radio emission

Macalester-Augustana-Coe Robotic Observatory
Junior Instrument Specialist – University of Iowa — Sept '20–present
Technical Advisor – MACRO Consortium — Sept '22–present
· Led the effort to integrate a new CMOS camera by planning installation and modifying software, including the development of a new automated image calibration pipeline in `Python`
· Built the latest iteration of the miniature grism (grating-prism) spectrometer (Patent No. US20170357038A1) with a high-efficiency volume-phase-holographic grating using `Winlens3D` to model the optical design, `Onshape` to 3D print a housing, and unique `Python` packages like `PyWebIO` to create a web-based interface for observation planning and spectral analysis
· Began integrating a 19-fiber high-resolution (~1 Å) spectrometer into the robotic telescope by designing and building a prototype for a custom pickoff mirror
· Managed an array of instrumentation and performed regular maintenance tasks
· Compiling the robotic control software into a complete package called `pyScope` and serving as advisor for transfer of the *Robert L. Mutel Telescope* to the MACRO consortium on Jan 1, 2023

Skynet Robotic Telescope Network Jan '22–Jun '22
Student Programmer – University of North Carolina, Chapel Hill
· Assisted in developing a light curve plotting tool in Typescript for use in introductory labs

Teaching Experience

ASTR:4850 Astronomical Laboratory Spring '22
Undergraduate Teaching Assistant – University of Iowa, Prof. Hai Fu

HONR:1350 Presidential Scholar Program Honors Seminar Spring '22
Undergraduate Teaching Assistant – University of Iowa, Mr. Addison Woll

Student-Athlete Academic Services Jan '22–present
Physics, Astronomy, and Math Tutor – University of Iowa

Publications

ADS Library

In Press

"Time lapse VLBI imaging of the Close Active Binary HR 1099," **Walter W. Golay**, R.L. Mutel, and E. E. Abbuhl, submitted to *The Astrophysical Journal* in Jan '24

Refereed

"A search for thermal gyro-synchrotron emission from hot stellar coronae," **Walter W. Golay**, Robert L. Mutel, Dani Lipman, and Manuel Güdel, April 2023, *Monthly Notices of the Royal Astronomical Society*, 2023MNRAS.522.1394G – plotting code

Non-refereed

"Radio observations of Tidal Disruption Event AT2023mfm," **Walter W. Golay**, Y. Cendes, K. D. Alexander, E. Berger, T. Eftekhari, D. R. Pasham, C. T. Christy, J. Miller-Jones, and T. Laskar, October 2023, *Transient Name Server AstroNote*, 2023TNSAN.266....1G

"Beam me up, SCOTTY! New algorithms for characterizing the beams of next-generation CMB experiments," **Walter W. Golay** and the Bicep/Keck Collaboration, Jan 2023, *241st Meeting of the American Astronomical Society*, 2023AAS...24146503G

Talks

The Iowa Robotic Observatory & the MACRO Consortium – view here
University of Iowa 2023 Awards Colloquium Contributed Apr '23

Bayesian inference in astrophysics II – view here
University of Iowa Astronomy and Space Physics Seminar Contributed Apr '23

Beam me up, SCOTTY! New algorithms for characterizing the beams of next-generation CMB experiments – view here
University of Iowa Astronomy and Space Physics Seminar Contributed Jan '23
University of Iowa Summer Undergraduate Research Colloquium Contributed Oct '22
University of Iowa Society of Physics Students Colloquium Contributed Sept '22
Center for Astrophysics | Harvard & Smithsonian Symposium – watch here Invited Aug '22

A search for thermal gyro-synchrotron emission from hot stellar coronae – view here
University of Connecticut Astrophysics Seminar Invited Apr '23
University of Arizona Transients Group Journal Club Invited Mar '23
University of Iowa Society of Physics Students Colloquium Invited Oct '22
Harvard University Kovac CMB Lab Invited Jun '22

Bayesian inference in astrophysics – view here
University of Iowa Astronomy and Space Physics Seminar Contributed Apr '22

Development of spectroscopic instrumentation for small optical telescopes – view here
University of Iowa Summer Undergraduate Research Colloquium Contributed Oct '21
University of Iowa Society of Physics Students Colloquium Contributed Oct '21
University of Iowa Public Observing Night Contributed Aug '21

The darkest of matters – view here
University of Iowa Public Observing Night — Contributed Jul '21

Posters

Beam me up, SCOTTY! – view here
241st Meeting of the American Astronomical Society — Contributed Jan '23
University of Iowa Fall Undergraduate Research Fair — Contributed Nov '22

A search for thermal gyro-synchrotron emission from hot stellar coronae – view here
New Eyes on the Universe: SKA & ngVLA Conference — Contributed May '23
The VLA Sky Survey in the Multiwavelength Spotlight Conference — Contributed Sept '22
University of Iowa Spring Undergraduate Research Fair — Contributed Mar '22

Development of spectroscopic instrumentation for small optical telescopes – view here
University of Iowa Fall Undergraduate Research Fair — Contributed Nov '21

Workshops

IAA-CSIC Severo Ochoa SKA Open Science School, Virtual Attendee — May 8–10, 2023
JIVE CASA VLBI Workshop 2023, Virtual Attendee — Jun 5–9, 2023

Grants

Primary Investigator (Total awards: $25,650+)
John & Elsie Mae Ferentz Undergraduate Research Grant ($1,000) — Feb '23
Iowa Space Grant Consortium Undergraduate Research Grant ($5,000) — Jul '22
NSF REU Grant ($6,000 plus housing (~$6,000) and AAS241 conference (~$2,500)) — Jun '22
University of Iowa Office of the President Student Impact Grant ($1,000) — Apr '22
Wert Summer Undergraduate Research Grant ($1,500) — Mar '22
John & Elsie Mae Ferentz Undergraduate Research Grant ($1,000) — Dec '21
Wert Summer Undergraduate Research Grant ($1,650) — Mar '21

Co-Investigator (Total awards: $30,160)
University of Iowa Student Technology Fund Grant ($9,810) — Mar '21
Title: 1280 Physics 21102 Off-Cycle Gemini Improvements – New CMOS camera
University of Iowa Student Technology Fund Grant ($20,350) — Jan '21
Title: 1280 Physics 22002 VAO and Astronomy Labs – High-efficiency miniature grism

Telescope Time (As PI)

Very Large Array (VLA) — 0.5 hr
Very Long Baseline Array (VLBA) — 8 hr

Honors and Awards

Total awards: $77,300
University of Iowa Distinguished Service Award ($300) — Jan '23
University of Iowa Physics & Astronomy Undergraduate Scholar Award ($500) — Jan '23
SMACNA College of Fellows Scholarship ($4,000) — Jul '22
University of Iowa President's List — Spring '22
University of Iowa Dean's List — Spring '20–Fall '22
George S. Schaeffer Scholarship in Science ($2,500) — May '22
Honors Collegiate Rhodes Dunlap Award for Excellence ($1,500) — May '22
Barry M. Goldwater Scholarship Nominee — Jan '22
Guy D. and Betty J. Williams Scholarship ($2,500) — May '21
Honors Presidential Scholarship ($20,000) — Aug '19
Iowa Flagship Award Scholarship ($34,000) — Aug '19
National Merit Scholarship ($12,000) — Aug '19

Service and Outreach

College of Liberal Arts and Sciences Teaching Awards Committee — Jul '22–present
College of Liberal Arts and Sciences Dean's Student Advisory Committee — Jan '22–present
American Astronomical Society Member — Oct '21–present
Presidential Scholar Program Executive Board Communications Co-Chair — May '21–present
University of Iowa Society of Physics Students
Peer Mentor — Sept '21–present
Van Allen Observatory Public Observing Night Host — Sept '20–present
Member — Sept '19–present

Technical Skills

Python: conda, jupyter, IPython (widgets), numpy, scipy, astropy, pandas, matplotlib, seaborn, multiprocess, pickle, lmfit, emcee, pocoMC, corner, tensorflow, PyWebIO, Tkinter, and more
Other programming: Matlab, Mathematica, Java, Visual Basic, Ruby, SQL, Typescript, HTML, Markdown, shell/scripting (bash, zsh, crontab, Powershell), Xcode, CASA, AIPS, difmap
Methods: Bayesian inference, Markov Chain Monte Carlo, Preconditioned Monte Carlo, auto-correlation analysis, model selection techniques, significance testing, de-convolution algorithms, digital signal processing, (un)supervised machine learning, convolutional neural networks, reinforcement learning, high-performance/cluster computing
Optical: Winlens3D, spectroscopy, fiber optics, optical bench testing and integration
Mechanical: 3D printing, optical telescope operation and maintenance
Design: OnShape, CAD, Adobe Premiere Pro, Adobe Photoshop
Operating systems: MacOS, Linux (CentOS, Ubuntu), Windows
Productivity: VSCode, Git, GitHub Pages, LaTeX, DS9, Zotero, office applications