Chris Karwin

NASA Postdoctoral Program Fellow

CONTACT

Goddard Space Flight Center
Astroparticle Physics Laboratory (661)
8800 Greenbelt Rd
Greenbelt, MD 20771

Email: christopher.m.karwin@nasa.gov
Web: ckarwin.com
Citizenship: USA

PROFESSIONAL APPOINTMENTS

NASA Postdoctoral Program (NPP) Fellow — Sep 2022 – Present
NASA Goddard Space Flight Center
- Focus: Probing the Galactic Diffuse Continuum Emission and Extragalactic Gamma-ray Background in the MeV Gap with the Compton Spectrometer and Imager (COSI)
- Advisor: Dr. Carolyn Kierans

Postdoctoral Fellow — Aug 2019 – Sep 2022
Clemson University
- Focus: high-energy gamma-ray astronomy; multi-wavelength analysis
- Advisor: Prof. Marco Ajello

EDUCATION

University of California, Irvine
- Ph.D., Physics — 2019
  - Focus: observational astroparticle physics
  - Dissertation: *Fermi*-LAT Observations of γ-Ray Emission Towards the Galactic Center and the Outer Halo of M31
  - Adviser: Prof. Simona Murgia

University of California, Irvine
- M.S., Physics — 2017

University of Colorado at Colorado Springs
- B.S., Physics — 2013
  - Cum Laude, with highest distinction

SKILLS

Physics and Astronomy
- Compton Telescopes (COSI, AMEGO-X), *Fermi* Large Area Telescope, γ-ray astronomy, dark matter, Galactic diffuse emission, cosmic rays, active galactic nuclei, extragalactic gamma-ray background, the Local Group, multi-wavelength analysis

Data Analysis
- data analysis pipeline development, data modeling, data visualization, probability and statistics, maximum likelihood estimation, hypothesis testing, uncertainty quantification, Monte Carlo simulation, machine learning

Programming and Computing
- object-oriented programming, Python (packages: pandas, astropy, numpy, scipy, xml, os, sys, yaml, matplotlib, aplpy, PySimpleGUI, email, smtplib, ssl, etc.), Jupyter, PyPI, Sphinx, high performance computing clusters, PBS, SLURM, Linux, Mac OS X, GitHub, COSITools, Fermi Science Tools, Fermipy, GALPROP, CLUMPY, TOPCAT, MEGAlib, LaTeX, Mathematica, SQL, Java, R, Octave, Ubuntu, Mode, VirtualBox

Teaching
- Extensive experience in teaching math and physics as a tutor, teaching assistant, and instructor. Passion for communicating complex ideas in clear and simple ways. Experience with active learning methodology and courses.

FUNDING

Summary: PI funding: $150k, Total funding: $300k

- **NASA, Fermi Guest Investigator Program, Cycle 15, 2022**
  - Proposal: Characterizing the Gamma-Ray Emission from Low-Luminosity AGN
  - Role: PI
  - Award: $75k
- **NASA, Fermi Guest Investigator Program, Cycle 15, 2022**
  - Proposal: A Legacy Analysis of the Milky Way Dwarfs
  - Role: PI
  - Award: $75k
- **NASA, Fermi Guest Investigator Program, Cycle 14, 2021**
  - Proposal: Gamma-Rays from AGN-Driven Galactic Outflows
  - Role: Co-I (PI: Marco Ajello)
  - Award: $75k

- **NASA, Fermi Guest Investigator Program, Cycle 14, 2021**
  - Proposal: Bridging the Gap: A Sensitive Catalog of MeV Sources
  - Role: Co-I (PI: Lea Marcotulli)
  - Award: $75k

LEADERSHIP ROLES AND AWARDS

- **Data challenge lead for COSI collaboration**
  - September 2022 - Present
- **Galactic Science group co-lead for COSI collaboration**
  - September 2022 - Present
- **NASA Postdoctoral Program fellowship**
  - September 2022 - Present
- **Dark Matter New Physics (DMNP) group coordinator for *Fermi*-LAT collaboration**
  - March 2020 - March 2022

PROFESSIONAL INVOLVEMENT

- **Member of local organizing committee for the 11th International Fermi Symposium**
  - Conference dates: September 9 - 13, 2024
- **Reviewer for Fermi Guest Investigator Program**
  - February 2023
- **Co-Organizer for Special Session at HEAD 19**
  - Meeting: 19th Divisional Meeting of the High Energy Astrophysics Division (HEAD 19)
  - Session title: MeV gamma rays and multimessenger astronomy
  - March 13 - 17, 2022
- **Member of the COSI collaboration**
  - Jan 2021 - present
- **Member of the AMEGO-X team**
  - Jan 2020 - present
- **Referee for Physical Review D**
  - May 2019 - present
- **Referee for The Astrophysical Journal**
  - May 2019 - present
- **Member of the American Physical Society (APS)**
  - March 2019 - present
- **Member of the American Astronomical Society (AAS)**
  - Jan 2019 - present
- **Member of the *Fermi*-LAT collaboration**
  - Jan 2016 - present

SELECTED PUBLICATIONS

Summary: first/primary author: 11; contributing author: 17; total papers: 28 (23/28 peer reviewed)
– Google Scholar statistics: h-index: 11, total citations: 1197, highest cited first-author (overall) paper: 113 (518).
– First/primary author papers are indicated with a star.

⋆28. **Characterizing the γ-Ray Emission from Low-Luminosity Active Galactic Nuclei**
Karwin, C. M., Khatiya, N., Boughelilba, M., Ajello, M., Reimer, A., and Hartmann, D., In Prep.

27. **Constraining Dark Matter Annihilation with Fermi-LAT Observations of Ultra-Faint Compact Stellar Systems** (link)
Circiello, A., McDaniel, A., Drlica-Wagner, A., Karwin, C. M., Ajello, M., Di Mauro, M., and Sánchez-Conde, M., Submitted to Physical Review D.

⋆26. **Atmospheric Response for MeV Gamma Rays Observed with Balloon-Borne Detectors**
Karwin, C. M., Kierans, C., Shih, A., Martinez-Castellanos, I., Lowell, A., Siegert, T., Roberts, J., Gallego, S., Zoglauer, A., Tomsick, J., and Boggs, S. E., Prepared for submission to The Astrophysical Journal.

⋆25. **Probing the Galactic Diffuse Continuum Emission with COSI** (link)
Karwin, C. M., Siegert, T., Beechert, J., Tomsick, J., Porter, T., Negro, M., Kierans, C., Ajello, M., Martinez-Castellanos, I., Shih, A., Zoglauer, A., and Boggs, S. E., The Astrophysical Journal 959.2 (2023): 90.

24. **Gamma-Ray Emission from Radio Galaxies and their Contribution to the Isotropic Gamma-ray Background**
Circiello, A., McDaniel, A., Di Mauro, M., Karwin, C. M., Khatiya, N., Ajello, M., Donata, F., and Hartmann, D., In prep.

23. **Legacy Analysis of Dark Matter Annihilation from the Milky Way Dwarf Spheroidal Galaxies with 14 Years of *Fermi*-LAT Data** (link)
McDaniel, A., Ajello, M., Karwin, C. M., Di Mauro, M., Drlica-Wagner, A., and Sánchez-Conde, M., Physical Review D 109.6 (2024): 063024.
– Press release from Clemson University (link)

⋆22. **Sub-GeV Gamma Rays from Nearby Seyfert Galaxies and Implications for Coronal Neutrino Emission** (link)
Murase, K., Karwin, C. M., Kimura, S. S., Ajello, M., and Buson, S., The Astrophysical Journal Letters 961.2 (2024): L34.

21. **Revealing High-Z *Fermi*-LAT BL Lacs Using Swift and SARA Data with Photometric Analysis** (link)
Sheng, Y., Rajagopal, M., Kaur, A., Ajello, M., Domingues, A., Rau, A., Cenko, S. B., Greiner, J., Hartmann, D., Cox, I., Joffre, S., Karwin, C. M., McDaniel, A., Silver, R., and Torres-Alba, N., The Astrophysical Journal 964.1 (2024): 63.

20. **Characterizing the γ-ray Emission from FR0 Radio Galaxies** (link)
Khatiya, N., Boughelilba, M., Karwin, C. M., McDaniel, A., Zhao, X., Ajello, M., Reimer, A., and Hartmann, D., Submitted to The Astrophysical Journal, arXiv:2310.19888 (2023).

19. **The Cosipy Library: COSI's High-Level Analysis Software** (link)
Martinez-Castellanos, I., Gallego, S., Huang, C., Karwin, C. M., and 72 additional authors, PoS ICRC2023, arXiv:2308.11436 (2023).
– COSI collaboration paper, authors are listed in alphabetical order (except for first author).

18. **The Compton Spectrometer and Imager** (link)
Tomsick, J., Boggs, S. E., Zoglauer, A., Hartmann., D., Ajello, M., Burns, E., Fryer, C., Karwin, C. M., and 67 additional authors, PoS ICRC2023, arXiv:2308.12362 (2023).
– COSI collaboration paper, authors are listed in alphabetical order (except for first four authors).

17. **Gamma-ray Emission from Galaxies Hosting Molecular Outflows** (link)
McDaniel, A., Ajello, M., and Karwin, C. M., The Astrophysical Journal 943.2 (2023): 168.

16. **Deep Learning Models of the Discrete Component of the Galactic Interstellar Gamma-Ray Emission** (link)
Shmakov, A., Mohammadamin, T., Baldi, P., Karwin, C. M., Broughton, A., and Murgia, S., Physical Review D 107.6 (2023): 063018.

⋆15. **Improved Modeling of the Discrete Component of the Galactic Gamma-Ray Emission and Implications for the *Fermi*-LAT Galactic Center Excess** (link)
Karwin, C. M., Broughton, A., Murgia, S., Shmakov, A., Mohammadamin, and T., Baldi., P., Physical Review D 107.12 (2023): 123032.

14. **The All-sky Medium Energy Gamma-ray Observatory eXplorer (AMEGO-X) Mission Concept** (link)
Caputo, R., Ajello, M., Kierans, C. A., Perkins, J. S., Racusin, J. L., ..., Karwin, C. M., and 49 additional authors, Journal of Astronomical Telescopes, Instruments, and Systems 8.4 (2022): 044003.
– AMEGO-X collaboration paper, authors are listed in alphabetical order (except for first five authors).

13. **Improving the Low-Energy Transient Sensitivity of AMEGO-X Using Single-Site Events** (link)
Martinez-Castellanos, I., Fleischhack, H., Karwin, C. M., Negro, M., Tak, D., Lien, A., Kierans, C., Wadiasingh, Z., Fukazawa, Y., Ajello, M., Baring, M., Burns, E., Caputo, R., Hartmann, D., Perkins, J., Racusin, J. L., and Sheng, Y., The Astrophysical Journal 934.2 (2022): 92.

12. **Snowmass2021 Cosmic Frontier: The Landscape of Cosmic-Ray and High-Energy Photon Probes of Particle Dark Matter** (link)
Aramaki, T., Boezio, M., Buckley, J., Bulbul, E., von Doetinchem, P., Donato, F., Harding, J. P., Karwin, C. M., and 17 additional authors, contribution to Snowmass 2021, arXiv:2203.06894 (2022).
– My contributed section: Fermi Gamma-ray Space Telescope Current Status

11. **The Future of Gamma-Ray Experiments in the MeV-EeV Range** (link)
Edited by Engel, K., Goodman, J., Huentemeyer, P., Kierans, C., Lewis, T. R., Negro, M., Santander, M., and Williams, D. A., contribution to Snowmass 2021, arXiv:2111.10600 (2022).
– My contributed section: Neutrino Gamma-Ray Connection

10. **Modeling and Simulations of TXS 0506+056 Neutrino Events in the MeV Band** (link)
Lewis, T., Karwin, C. M., Venters, T. M., Fleischhack, H., Sheng, Y., Kierans, C. A., Caputo, R., and McEnery, J., arXiv:2203.07360 (2021).

⋆9. **Gamma Rays from Fast Black-Hole Winds** (link)
Ajello, M., ..., Karwin, C. M., and 103 additional authors, The Astrophysical Journal 921 (2021): 144.
– *Fermi*-LAT collaboration paper, authors are listed in alphabetical order.
– I am one of five contact/primary authors.
– Press release from Clemson University (link)
– Highlighted in AAS Nova (link)

8. **Dark Matter Explanations of the Gamma-Ray Excesses from the Galactic Center and M31** (link)
Burns, K., Fieg, M., Rajaraman, A., and Karwin, C. M., Physical Review D 103.6 (2021): 063023.

⋆7. **Dark Matter Interpretation of the *Fermi*-LAT Observations Toward the Outer Halo of M31** (link)
Karwin, C. M., Murgia, S., Moskalenko, I. V., Fillingham, S., Burns, A, and Fieg, M., Physical Review D 103.2 (2021): 023027.

6. **Search for Gamma-ray Emission from P-Wave Dark Matter Annihilation in the Galactic Center** (link)
Johnson, C., Caputo, R., Karwin, C. M., Murgia, S., Ritz, S., and Shelton, J., Physical Review D 99 (2019): 103007.

⋆5. ***Fermi*-LAT Observations of γ-Ray Emission Towards the Outer Halo of M31** (link)
Karwin, C. M., Murgia, S., Campbell, S., and Moskalenko, I. V., The Astrophysical Journal 880.2 (2019): 95.

⋆4. **Dark Matter Interpretation of the *Fermi*-LAT Observations Toward the Galactic Center** (link)
Karwin, C. M., Murgia, S., Tait, T. M. P., Porter, T., and Tanedo, P., Physical Review D 95.10 (2017): 103005.

3. ***Fermi*-LAT Observations of High-Energy γ-Ray Emission Toward the Galactic Center** (link)
Ajello, M., ..., Karwin, C. M., and 121 additional authors, The Astrophysical Journal 819.1 (2016): 44.
– *Fermi*-LAT collaboration paper, authors are listed in alphabetical order.

⋆2. **Microwave Properties of Twisted and Supertwisted Nematic Liquid Crystals with Weak Anchoring** (link)
Karwin, C. M., and Livesey, K. L. Liquid Crystals 41.5 (2014): 707-716.

⋆1. **Liquid Crystal Phase Shifters with a Twist** (link)
Karwin, C. M., and Livesey, K. L. Applied Physics Letters 103.6 (2013): 063508.

TEACHING EXPERIENCE

Teaching Associate Jun 2017 – Sep 2017
University of California, Irvine
- Instructor for undergraduate physics (120 students)
- Courses:
  - Physics 7D, Classical Electromagnetism
  - Physics 7LD, Classical Electromagnetism Lab

Teaching Assistant Sep 2013 – Mar 2019
University of California, Irvine
- Courses:
  - Physics 113B, Quantum Physics, Discussion; Physics 50, Mathematical Methods for Physics, Fall 2018
    Active learning course with an emphasis on coding in Mathematica.
  - Physics 52C, Fundamentals of Experimental Physics, Lab, Spring 2018
    Experiments: Frank-Hertz, radioactive counting, gamma absorption, photoelectric effect, Rydberg constant
  - Physics 125A, Mathematical Methods for Physics; Physics 121W, Advanced Physics Lab, Winter 2018
    Experiments: superconductors, plasma, Faraday effect, Millikan oil drop, muon decay, Mossbauer effect.
  - Physics 7LC, Classical Physics, Lab, Fall 2017
  - Physics 3LC, Basic Physics, Lab, Summer 2015
  - Physics 7D and 7LD, Classical Electromagnetism, Lab and Discussion, Spring 2015
  - Physics 7C and 7LC, Classical Physics, Lab and Discussion, Winter 2015
  - Physics 3A, Basic Physics, Discussion, Fall 2014
  - Physics 7D and 7LD, Classical Electromagnetism, Lab and Discussion, Summer 2014
  - Physics 7D and 7LD, Classical Electromagnetism, Lab and Discussion, Spring 2014
  - Physics 3LB, Basic Physics, Lab, Winter 2014
  - Physics 7C and 7LC, Classical Physics, Lab and Discussion, Fall 2013

Physics Instructor Jan 2012 – May 2012
After School University
- Designed and implemented physics courses for kids in grades K - 12.

Math and Physics Tutor Jan 2010 – May 2013
The Center for Excellence in Mathematics
- Tutored math and physics at the walk-in tutoring center for the University of Colorado at Colorado Springs.
- Led weekly study sessions for undergraduate math courses.
- Received weekly pedagogical training, including instruction in methods of active learning.

PRESENTATIONS

Summary: invited talks: 11; total talks: 23

American Association for the Advancement of Science Annual Meeting, February 15-17, 2024, Denver, Colorado
- invited talk: Three Ways Scientist are Searching for Dark Matter
- Also invited guest on The Economist Podcast: How to detect the undetectable–new ideas in the hunt for dark matter (link)

Kavli Institute for the Physics and Mathematic of the Universe (APEC Seminar), August 9, 2023, Kashiwa, Japan
- invited talk: Anomalies in the Galactic Diffuse Gamma-Ray Continuum Spanning the MeV and GeV Bands (link)

38th International Cosmic Ray Conference, July 26-August 3, 2023, Nagoya, Japan
- talk: The All-Sky Medium Energy Gamma-ray Observatory eXplorer (AMEGO-X) Mission Concept

- poster: Observations of the Galactic Diffuse Continuum Emission from the 2016 COSI Balloon Flight

Würzburg Dark Matter Workshop, May 11, 2023, Würzburg, Germany
- invited talk: Indirect Dark Matter Searches with *Fermi*-LAT (link)

20th Divisional Meeting of the High Energy Astrophysics Division, March 26 - 30, 2023, Waikoloa, Hawai'i
- invited talk (special session): Gamma rays from Fast Black-Hole Winds
- poster: Probing the Galactic Diffuse Continuum Emission with the 2016 COSI Balloon Flight

Texas A&M University, Mitchell Institute Seminar, Mar 8, 2023, College Station, Texas
- invited talk: Anomalies in the Galactic Diffuse Gamma-Ray Continuum Spanning the MeV and GeV Bands

Theory Meeting Experiments (TMEX-2023), Jan 5 - 11, 2023, Quy Nhon, Vietnam
- invited talk: The All-Sky Medium Energy Gamma-ray Observatory eXplorer (AMEGO-X) Mission Concept (link)

Tenth International Fermi Symposium, Oct 9 - 15, 2022, Johannesburg, South Africa
- invited talk: Indirect Dark Matter Searches with *Fermi*-LAT (link)

NASA GSFC Fermi Speakeasy, July 14, 2022, Greenbelt, Maryland
- invited talk: Probing the Galactic Diffuse Continuum Emission in the MeV Gap with the Compton Spectrometer and Imager (COSI)

19th Divisional Meeting of the High Energy Astrophysics Division, March 13 - 17, 2022, Pittsburgh, Pennsylvania
- poster: The COSI Data Challenges and Simulations

Particles and Nuclei International Conference (PANIC, 22nd edition), September 5-10, 2021, Lisbon, Portugal (virtual)
- invited talk: Dark Matter Interpretation of the *Fermi*-LAT Observations Toward the Outer Halo of M31 (link)

***Fermi*-LAT Collaboration Meeting**, August 30 - September 3, 2021 (virtual)
- talk: Characterizing the Gamma-Ray Emission from Low-Luminosity AGN

37th International Cosmic Ray Conference, July 12-23, 2021, Berlin, Germany (virtual)
- talk: Gamma Rays from Fast Black-Hole Winds

ESO Hypatia Colloquium, April 20, 2021 (virtual)
- talk: Gamma Rays from Fast Black-Hole Winds (link)

American Physical Society (APS) April Meeting, April 17, 2021 (virtual)
- talk: Gamma Rays from Fast Black-Hole Winds

9th International Fermi Symposium, April 12-17, 2021 (virtual)
- talk: A Legacy Analysis of the Milky Way Dwarfs

***Fermi*-LAT Collaboration Meeting**, March 15-19, 2021 (virtual)
- plenary talk: Gamma Rays from AGN Outflows

237th Meeting of the American Astronomical Society (AAS), January 10-15, 2021 (virtual)
- talk: Detecting Cosmic Neutrino Counterparts with Next-Generation Gamma-Ray Telescopes

***Fermi*-LAT Collaboration Meeting**, August 31-September 4, 2020 (virtual)
- talk: Dark Matter Interpretation of the *Fermi*-LAT Observations Toward the Outer Halo of M31

***Fermi*-LAT Collaboration Meeting**, August 31-September 4, 2020 (virtual)
- talk: Optimizing the Sensitivity of Source Stacking Using Cuts Based on the Background Counts

***Fermi*-LAT Collaboration Meeting**, March 23-27, 2020 (virtual)
- talk: The Gamma-Ray Emission of Ultra-Fast Outflows

36th International Cosmic Ray Conference, July 24-August 1, 2019, Madison, WI
- talk: *Fermi*-LAT Observations of Gamma-Ray Emission Towards the Outer Halo of M31 (link)

University of California Irvine, March 25, 2019, Irvine, CA
- talk: *Fermi*-LAT Observations of Gamma-Ray Emission Towards the Galactic Center and the Outer Halo of M31

Los Alamos National Laboratory, January 8, 2019, Los Alamos, New Mexico
- invited talk: *Fermi*-LAT Observations of Gamma-Ray Emission Towards the Outer Halo of M31

8th International Fermi Symposium, Oct. 14-19, 2018, Baltimore, MD
- poster (link)

UCLA Dark Matter, Feb. 18-23, 2018, Los Angeles, CA
- poster (link)

OBSERVING EXPERIENCE

SARA Observatory Sep 2019 – Dec 2020
- SARA is a consortium of optical telescope, operated remotely with Radmin Viewer

- Telescopes: Kitt Peak, Arizona (SARA-KP, 0.9 m); Cerro Tololo, Chile (SARA-CT; 0.6 m); Roque de los Muchachos, Spain (SARA-RM, 1 m)
- Observed on average 2 full nights per month