Dr. Adam F. Kowalski

Associate Professor (CU)
Tenured Astronomer (NSO)
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Professional Preparation

University of Chicago, Chicago, IL, Physics, BA, 2006

University of Washington, Seattle, WA, Astronomy, PhD, 2012

ORAU NASA Postdoctoral Program, NASA/GSFC, Heliophysics Science Division, 2012–2014

University of Maryland, Research Associate, GSFC/UMD, Department of Astronomy and the Heliophysics Science Division, 2014–2016

Appointments

2023 – present: Joint 50/50 position as Associate Professor at the University of Colorado Boulder, Department of Astrophysical and Planetary Sciences (APS) and tenured astronomer (since 2024) at the National Solar Observatory (NSO); rostered in the Laboratory for Atmospheric and Space Physics (LASP)
8/2016 – 8/2023: Joint 50/50 position as Assistant Professor at the University of Colorado Boulder, Department of Astrophysical and Planetary Sciences (APS) and tenure track astronomer at the National Solar Observatory (NSO); rostered in the Laboratory for Atmospheric and Space Physics (LASP)

Awards and Honors

Recipient of the 2022 American Astronomical Society/Solar Physics Division Karen Harvey Prize. It is awarded in recognition of a significant contribution to the study of the Sun early in a person's professional career (https://spd.aas.org/prizes/harvey/previous):
[Adam Kowalski] is awarded the Karen Harvey Prize for his innovative research into stellar flares towards resolving long-standing problems relating to flares on both the Sun and other stars. Dr. Kowalski has made substantial contributions to understanding the response of lower stellar atmospheres to stellar flares using a combination of computer modeling, ground- and space-based observations, and theory. Dr. Kowalski's research bridges the solar and stellar communities; this cross-cutting approach continues to yield important innovations on long-standing problems relating to flares on both the Sun and other stars. His early career research has advanced the understanding of continuum emission from flares, the interpretation of spectroscopic observations, and the timely subject of exoplanetary habitability.
The award plaque reads: *For his innovative research into stellar flares towards resolving long-standing problems relating to flares on both the Sun and other stars, and for bridging the solar and stellar communities by making substantial contributions to understanding the response of lower stellar atmospheres to stellar flares using a combination of computer modeling, ground- and space-based observations, and theory.*

Expertise

Solar and stellar flares, optical and ultraviolet observational astronomy, optical spectroscopy and photometry, data reduction and analysis, stellar atmosphere (chromosphere and photosphere) models, radiation-hydrodynamics, spectral line broadening, statistics and probability theory, modeling and interpretation of the Balmer jump and hydrogen lines in solar and stellar flare spectra, programming in Python, IDL, and Fortran.

Research Summary

My research focuses on the spectroscopy and modeling of solar and M-dwarf flares. I employ a combination of data analysis techniques and radiative-hydrodynamic modeling to answer questions about the fundamental physical processes that generate the near-ultraviolet and optical radiation in stellar flares. Answers to these questions enable more accurate characterization of the high-energy radiation environment of potentially habitable planets orbiting M stars. A major long-term goal is to serve as scientific lead for a Small Explorer Mission (or equivalent) that observes solar and stellar flares with broadband spectra from 180 – 480 nm, finally providing clear answers to the origin of "white-light" flares on the Sun and other stars. I am an observational astronomer with extensive experience observing at ground-based telescopes, but my current projects heavily rely on spacecraft data from NASA's IRIS mission and the Hubble Space Telescope.

Selected Recent Career Highlights (details follow)

- Awardee of the 2022 AAS/SPD Karen Harvey Prize.
- 93 refereed publications: 19 as first author, h-index = 42.
- Invited sole author of a review article on "Stellar Flares" for the *Living Review in Solar Physics* journal.
- Coauthor on 9 refereed papers in 2025.
- Coauthor on 12 refereed papers in 2023.
- Coauthor on 9 refereed papers in 2021.
- Invited author of the solar-stellar connection section (Section 7; pp. 70 – 74) in the review article by De Pontieu et al. 2021.
- 27 CU students have been trained on the 3.5m at Apache Point Observatory due to field trips (through 3520 and through my own funding) and remote observing sessions that I organized and led.
- Awarded $2.6M in grants (NASA/ADAP, NASA/ECIP, NSF/AGS) to date, $2.15M as PI or LASP PI since joining CU.
- PI of a NASA/ADAP proposal ($600,517; was decreased by NASA to $529,990 due to covid) that has been used to fund a postdoc (Notsu) and a graduate student (Tristan) at CU.
- PI of HST Treasury Program "Fulcrum" (HST GO 17464).
- Awarded 466 ks XMM-Newton Large Programme in Oct 2018, which has been the basis of the work of this postdoc and graduate student at CU.
- Instructor for nine classes at CU (ASTR 1200, ASTR 3520, ASTR 5550, ASTR 3760) covering all division levels (lower-undergrad, upper-undergrad, grad).
- Invited lecturer on Solar Flares and Solar Energetic Particles at the Boulder Space Weather Summer School three years in a row.
- Invited speaker 19 times since joining CU/NSO; invited colloquium speaker twice in Spring 2023.
- Member of the Panel on Physics of the Sun and Heliosphere for the National Academies of Science Decadal Survey on Solar and Space Physics (Oct 2022 - Dec 2024)

Refereed Publications (Total = 93, h–index = 42)

Osten, R. A. and 6 colleagues 2026. Radio and Optical Flares on the dMe Flare Star EV Lac. The Astrophysical Journal 996. doi:10.3847/1538-4357/ae1a74 https://iopscience.iop.org/article/10.3847/1538-4357/ae1a74

Kowalski, A. F. 2026. The Atmospheric Response to Large Electron Beam Fluxes in Solar Flares. III. Comprehensive Modeling of the Brightest Observed Near-ultraviolet Continuum Source in an X9 Solar Flare. The Astrophysical Journal 996. doi:10.3847/1538-4357/ae2011 https://iopscience.iop.org/article/10.3847/1538-4357/ae2011

Notsu, Y., Tristan, I. I., Osten, R. A., Brown, A.,**Kowalski**, A. F., Grady, C. A. 2025. A Seven-day Multiwavelength Flare Campaign on AU Mic. III. Quiescent and Flaring Properties of the X-Ray Spectra and Chromospheric Lines. The Astrophysical Journal 993. doi:10.3847/1538-4357/ae0578 https://iopscience.iop.org/article/10.3847/1538-4357/ae0578

Tamburri, C. A. and 10 colleagues 2025. Unveiling Unprecedented Fine Structure in Coronal Flare Loops with the DKIST. The Astrophysical Journal 990. doi:10.3847/2041-8213/adf95e https://iopscience.iop.org/article/10.3847/2041-8213/adf95e

Criscuoli, S., **Kowalski**, A. F., Case, T., Coddington, O. 2025. Validating Solar Atmosphere Models with High-resolution Spectra: The Case of Balmer Lines. The Astrophysical Journal 988. doi:10.3847/1538-4357/adec8e https://iopscience.iop.org/article/10.3847/1538-4357/adec8e

Mamonova, E., Shan, Y., **Kowalski**, A. F., et al. 2025, A&A, 700, A53. doi:10.1051/0004-6361/202554614. https://www.aanda.org/articles/aa/full_html/2025/08/aa54614-25/aa54614-25.html

Gibson, A., **Kowalski**, A. F., Feinstein, A. D. 2025. Far-ultraviolet Emission Line Investigation of Flares on AU Mic. The Astrophysical Journal 994. doi:10.3847/1538-4357/ae1691 https://iopscience.iop.org/article/10.3847/1538-4357/ae1691

Tristan, I. I. and 8 colleagues 2025. A 7 day Multiwavelength Flare Campaign on AU Mic. II. Electron Densities and Kinetic Energies from High-frequency Radio Flares. The Astrophysical Journal 986. doi:10.3847/1538-4357/adc565 https://iopscience.iop.org/article/10.3847/1538-4357/adc565

Howard, W. S. and 12 colleagues 2025. Separating Flare and Secondary Atmospheric Signals with RADYN Modeling of Near-infrared JWST Transmission Spectroscopy Observations of TRAPPIST-1. The Astrophysical Journal 994. doi:10.3847/2041-8213/ae1960 https://iopscience.iop.org/article/10.3847/2041-8213/ae1960

Kowalski, A. F. and 7 colleagues 2025. Rising Near-ultraviolet Spectra in Stellar Megaflares. The Astrophysical Journal 978. doi:10.3847/1538-4357/ad9395. https://iopscience.iop.org/article/10.3847/1538-4357/ad9395

Kowalski, A. F. 2024. Stellar flares. Living Reviews in Solar Physics 21. doi:10.1007/s41116-024-00039-4. https://link.springer.com/article/10.1007/s41116-024-00039-4

Kowalski, A. F., Allred, J. C., Carlsson, M. 2024. Time-dependent Stellar Flare Models of Deep Atmospheric Heating. The Astrophysical Journal 969. doi:10.3847/1538-4357/ad4148. https://iopscience.iop.org/article/10.3847/1538-4357/ad4148.

Kowalski, A. F. 2023. Bridging High-density Electron Beam Coronal Transport and Deep Chromospheric Heating in Stellar Flares. *The Astrophysical Journal Letters* 943, 23, doi:10.3847/2041-8213/acb144. https://iopscience.iop.org/article/10.3847/2041-8213/acb144

Kowalski, A. F. 2022, "Near-Ultraviolet Continuum Modeling of the 1985 April 12 Great Flare of AD Leo", *Frontiers in Astronomy and Space Sciences* vol. 9, id. 1034458, DOI: 10.3389/fspas.2022.1034458. https://ui.adsabs.harvard.edu/abs/2022FrASS...934458K/abstract

Kowalski, A. F., Allred, J. C., Carlsson, M., Kerr, G. S., Tremblay, P.-E., Namekata, K., Kuridze, D., Uitenbroek, H. 2022. The Atmospheric Response to High Nonthermal Electron-beam Fluxes in Solar Flares. II. Hydrogen-broadening Predictions for Solar Flare Observations with the Daniel K. Inouye Solar Telescope. *The Astrophysical Journal* 928, 190. DOI: 10.3847/1538-4357/ac5174; https://ui.adsabs.harvard.edu/abs/2022ApJ...928..190K

Kowalski, A. F., Butler, E., Daw, A. N., Fletcher, L., Allred, J. C., De Pontieu, B., Kerr, G. S., Cauzzi, G. 2019. Spectral Evidence for Heating at Large Column Mass in Umbral Solar Flare Kernels. I. IRIS Near-UV Spectra of the X1 Solar Flare of 2014 October 25. *The Astrophysical Journal* 878, 135. DOI: 10.3847/1538-4357/ab1f8b; https://ui.adsabs.harvard.edu/abs/2019ApJ...878..135K

Kowalski, A. F., Wisniewski, J. P., Hawley, S. L., Osten, R. A., Brown, A., Fariña, C., Valenti, J. A., Brown, S., Xilouris, M., Schmidt, S. J., et al. 2019. The Near-ultraviolet Continuum Radiation in the Impulsive Phase of

HF/GF-type dMe Flares. I. Data. *The Astrophysical Journal* 871, 167. DOI: 10.3847/1538-4357/aaf058; https://ui.adsabs.harvard.edu/abs/2019ApJ...871..167K

Kowalski, A. F., Allred, J. C. 2018. Parameterizations of Chromospheric Condensations in dG and dMe Model Flare Atmospheres. *The Astrophysical Journal* 852, 61. DOI: 10.3847/1538-4357/aa9d91; https://ui.adsabs.harvard.edu/abs/2018ApJ...852...61K

Kowalski, A. F., Allred, J. C., Uitenbroek, H., Tremblay, P.-E., Brown, S., Carlsson, M., Osten, R. A., Wisniewski, J. P., Hawley, S. L. 2017. Hydrogen Balmer Line Broadening in Solar and Stellar Flares. *The Astrophysical Journal* 837, 125. DOI: 10.3847/1538-4357/aa603e; https://ui.adsabs.harvard.edu/abs/2017ApJ...837..125K

Kowalski, A. F., Allred, J. C., Daw, A., Cauzzi, G., Carlsson, M. 2017. The Atmospheric Response to High Nonthermal Electron Beam Fluxes in Solar Flares. I. Modeling the Brightest NUV Footpoints in the X1 Solar Flare of 2014 March 29. *The Astrophysical Journal* 836, 12. DOI: 10.3847/1538-4357/836/1/12; https://ui.adsabs.harvard.edu/abs/2017ApJ...836...12K

Kowalski, A. F., Mathioudakis, M., Hawley, S. L., Wisniewski, J. P., Dhillon, V. S., Marsh, T. R., Hilton, E. J., Brown, B. P. 2016. M Dwarf Flare Continuum Variations on One-second Timescales: Calibrating and Modeling of ULTRACAM Flare Color Indices. *The Astrophysical Journal* 820, 95. DOI: 10.3847/0004-637X/820/2/95; https://ui.adsabs.harvard.edu/abs/2016ApJ...820...95K

Kowalski, A. F., Hawley, S. L., Carlsson, M., Allred, J. C., Uitenbroek, H., Osten, R. A., Holman, G. 2015. New Insights into White-Light Flare Emission from Radiative-Hydrodynamic Modeling of a Chromospheric Condensation. *Solar Physics* 290, 3487-3523. DOI: 10.1007/s11207-015-0708-x; https://ui.adsabs.harvard.edu/abs/2015SoPh..290.3487K

Kowalski, A. F., Cauzzi, G., Fletcher, L. 2015. Optical Spectral Observations of a Flickering White-light Kernel in a C1 Solar Flare. *The Astrophysical Journal* 798, 107. DOI: 10.1088/0004-637X/798/2/107; https://ui.adsabs.harvard.edu/abs/2015ApJ...798..107K

Kowalski, A. F., Hawley, S. L., Wisniewski, J. P., Osten, R. A., Hilton, E. J., Holtzman, J. A., Schmidt, S. J., Davenport, J. R. A. 2013. Time-resolved Properties and Global Trends in dMe Flares from Simultaneous Photometry and Spectra. *The Astrophysical Journal Supplement Series* 207, 15. DOI: 10.1088/0067-0049/207/1/15; https://ui.adsabs.harvard.edu/abs/2013ApJS..207...15K

Kowalski, A. F., Hawley, S. L., Holtzman, J. A., Wisniewski, J. P., Hilton, E. J. 2012. The Multiple Continuum Components in the White-Light Flare of 16 January 2009 on the dM4.5e Star YZ CMi. *Solar Physics* 277, 21-29. DOI: 10.1007/s11207-011-9839-x; https://ui.adsabs.harvard.edu/abs/2012SoPh..277...21K

Kowalski, A. F., Hawley, S. L., Holtzman, J. A., Wisniewski, J. P., Hilton, E. J. 2010. A White Light Megaflare on the dM4.5e Star YZ CMi. *The Astrophysical Journal* 714, L98-L102. DOI: 10.1088/2041-8205/714/1/L98; https://ui.adsabs.harvard.edu/abs/2010ApJ...714L..98K

Kowalski, A. F., Hawley, S. L., Hilton, E. J., Becker, A. C., West, A. A., Bochanski, J. J., Sesar, B. 2009. M Dwarfs in Sloan Digital Sky Survey Stripe 82: Photometric Light Curves and Flare Rate Analysis. *The Astronomical Journal* 138, 633-648. DOI: 10.1088/0004-6256/138/2/633; https://ui.adsabs.harvard.edu/abs/2009AJ....138..633K

Kerr, G. S., **Kowalski**, A. F., Allred, J. C., Daw, A. N., Kane, M. R. 2024. An optically thin view of the flaring chromosphere: non-thermal widths in a chromospheric condensation during an X-class solar flare. Monthly Notices of the Royal Astronomical Society 527, 2523–2548. doi:10.1093/mnras/stad3135

Notsu, Y. and 14 colleagues 2024. Apache Point Observatory (APO)/SMARTS Flare Star Campaign Observations. I. Blue Wing Asymmetries in Chromospheric Lines during Mid-M-Dwarf Flares from Simultaneous Spectroscopic and Photometric Observation Data. The Astrophysical Journal 961. doi:10.3847/1538-4357/ad062f

Howard, W. S., **Kowalski**, A.F., and 17 colleagues 2023. Characterizing the Near-infrared Spectra of Flares from TRAPPIST-1 during JWST Transit Spectroscopy Observations. The Astrophysical Journal 959. doi:10.3847/1538-4357/acfe75

Tristan, I. I., Notsu, Y., **Kowalski**, A.F., and 13 colleagues 2023. A 7 Day Multiwavelength Flare Campaign on AU Mic. I. High-time-resolution Light Curves and the Thermal Empirical Neupert Effect. *The Astrophysical Journal* 951. doi:10.3847/1538-4357/acc94f. https://ui.adsabs.harvard.edu/abs/2023ApJ...951...33T/abstract

Cañas, C. I. and 32 colleagues 2023. TOI-3984 A b and TOI-5293 A b: Two Temperate Gas Giants Transiting Mid-M Dwarfs in Wide Binary Systems. *The Astronomical Journal* 166. doi:10.3847/1538-3881/acdac7. https://ui.adsabs.harvard.edu/abs/2023AJ....166...30C/abstract

Libby-Roberts, J. E. and 27 colleagues 2023. An In-depth Look at TOI-3884b: A Super-Neptune Transiting an M4Dwarf with Persistent Starspot Crossings. The Astronomical Journal 165. doi:10.3847/1538-3881/accc2f. https://ui.adsabs.harvard.edu/abs/2023AJ....165..249L/abstract

Brown, A. and 10 colleagues 2023. Coronal X-Ray Emission from Nearby, Low-mass, Exoplanet Host Stars Observed by the MUSCLES and Mega-MUSCLES HST Treasury Survey Projects. *The Astronomical Journal* 165. doi:10.3847/1538-3881/acc38a. https://ui.adsabs.harvard.edu/abs/2023AJ....165..195B/abstract

Carlsson, M. and 8 colleagues 2023. The F-CHROMA grid of 1D RADYN flare models. *Astronomy and Astrophysics* 673. doi:10.1051/0004-6361/202346087. https://ui.adsabs.harvard.edu/abs/2023A%26A...673A.150C/abstract

Kerr, G. S. and 7 colleagues 2023. Prospects of Detecting Nonthermal Protons in Solar Flares via Lyman Line Spectroscopy: Revisiting the Orrall-Zirker Effect. *The Astrophysical Journal* 945. doi:10.3847/1538-4357/acb92a. https://ui.adsabs.harvard.edu/abs/2023ApJ...945..118K/abstract

Molnar, M. E., Reardon, K. P., Cranmer, S. R., **Kowalski**, A. F., Milić, I. 2023. Constraining the Systematics of (Acoustic) Wave Heating Estimates in the Solar Chromosphere. *The Astrophysical Journal* 945. doi:10.3847/1538-4357/acbc75; https://ui.adsabs.harvard.edu/abs/2023ApJ...945..154M/abstract

Brasseur, C. E., Osten, R. A., Tristan, I. I., **Kowalski**, A. F. 2023. Constraints on Stellar Flare Energy Ratios in the NUV and Optical from a Multiwavelength Study of GALEX and Kepler Flare Stars. *The Astrophysical Journal* 944. doi:10.3847/1538-4357/acab59; https://ui.adsabs.harvard.edu/abs/2023ApJ...944....5B/abstract

Frazier, R. C. and 29 colleagues 2023. NEID Reveals That the Young Warm Neptune TOI-2076 b Has a Low Obliquity. The Astrophysical Journal 944. doi:10.3847/2041-8213/acba18. https://ui.adsabs.harvard.edu/abs/2023ApJ...944L..41F/abstract

Hinton, P. C. and 7 colleagues 2022. Far-ultraviolet Flares on Accreting Protostars: Weak and Classical T Tauri Stellar Pair Analysis. *The Astrophysical Journal* 939. doi:10.3847/1538-4357/ac8f26; https://ui.adsabs.harvard.edu/abs/2022ApJ...939...82H/abstract

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Molnar, M. E., Reardon, K. P., Cranmer, S. R., **Kowalski**, A. F., Chai, Y., Gary, D. 2021. High-frequency Wave Power Observed in the Solar Chromosphere with IBIS and ALMA. *The Astrophysical Journal* 920, 125. DOI: 10.3847/1538-4357/ac1515; https://ui.adsabs.harvard.edu/abs/2021ApJ...920..125M

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Region Imaging Spectrograph (IRIS). *Solar Physics* 296, 84. DOI: 10.1007/s11207-021-01826-0; https://ui.adsabs.harvard.edu/abs/2021SoPh..296...84D

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