

Kellen D. Lawson

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Professional Summary

As a NASA Postdoctoral Program Fellow at NASA Goddard Space Flight Center, I use high-contrast imaging observations of exoplanets and circumstellar disks from JWST to better understand how planetary systems form and evolve. As part of this work, I led major studies on the AU Mic and Fomalhaut C debris disk systems, co-authored many similar studies, participated in the JWST exoplanet direct imaging Early Release Science program, and developed the *Winnie* software for post-processing and analysis of JWST observations of circumstellar disk systems. Prior to this, I studied similar targets using integral field spectroscopy and spectropolarimetry from the Subaru observatory's SCEXAO/CHARIS instrument — conducting multiple studies of debris disk systems and leading the creation of the data reduction pipeline for CHARIS's spectropolarimetry mode. During this time, I developed many of the starlight subtraction algorithms now implemented in *Winnie*, which were instrumental in our discovery of AB Aurigae b: a candidate deeply-embedded protoplanet in the protoplanetary disk of AB Aurigae.

Education

Doctor of Philosophy (Physics) — Univ. of Oklahoma, 2016 – 2022 (Advisor: John Wisniewski)
Bachelor of Science (Astrophysics) — College of Charleston, 2010 – 2014 (Advisor: Joseph Carson)

Employment

NASA Postdoctoral Program Fellow (2022 – Present)	NASA Goddard Space Flight Center
Graduate Research Assistant (2018 – 2022)	University of Oklahoma
Graduate Research Assistant (2017 – 2018)	Univ. of Oklahoma & Univ. of Washington
Undergraduate Research Assistant (2013 – 2015)	College of Charleston

Astronomy Software Development

Winnie (Lead Developer): tool for post-processing and analysis of resolved circumstellar disks in JWST observations
SpaceKLIP (Contributing Developer): data reduction pipeline for JWST high-contrast imaging observations
CHARIS DPP – SpecPol Module (Lead Developer): pipeline for Subaru/CHARIS integral field spectropolarimetry data
PyVAN (Lead Developer): tool for assessing variability in large samples of irregularly / sparsely-sampled stellar lightcurves

Grants & Awards

JWST GO-08826, PI (2025)	JWST GO Cycle 4
NASA Postdoctoral Program Fellowship (2022)	NASA Goddard Space Flight Center
Bullard Dissertation Completion Fellowship (2021)	OU Graduate College
Grants in Aid of Research (2020)	Sigma Xi
Research Presentation Grant (2014)	College of Charleston
Major Academic Year Support Grant (2014)	College of Charleston
Dunlap Institute Summer School Tuition & Travel Grant (2014)	Univ. of Toronto
Richard Petit Award for Outstanding Undergraduate Research (2014)	Sigma Xi
Summer Undergraduate Research with Faculty Grant (2014)	College of Charleston
Major Academic Year Support Grant (2013)	College of Charleston

Professional Service

HWO Concept of Operations and Post-Processing TAG	Focus Group Co-lead (2024 – present)
JWST Users Group at Goddard	Organizer (2024 – present)
GSFC Exoplanet Seminar Series	Organizer (2023 – present)
ExoPAG SAG 23: The Impact of Exo-Zodiacal Dust on Exoplanet Direct Imaging Surveys	Team Member (2023)
JWST ERS Program for Direct Observations of Exoplanetary Systems	Team Member (2022 – present)
NASA's Exoplanets Research Program	Review Panelist (c.2020)
Astronomy & Astrophysics	Journal Referee (c.2020)

Publications

▷ Journal Articles

Lawson, et al. 2025, “*Winnie: Forward-modeling, PSF-subtraction, and Deconvolution of Resolved Circumstellar Disk Observations from JWST*,” in prep.

- Bogat, Schlieder, **Lawson**, et al. 2025, “*Probing the Outskirts of M Dwarf Planetary Systems with a Cycle 1 JWST NIRCам Coronagraphy Survey*,” submitted to AJ
- Ray, ... **Lawson**, et al. 2025, “*The JWST Early Release Science Program for Direct Observations of Exoplanetary Systems III: Aperture Masking Interferometric Observations of the star HIP 65426 at 3.8 μm* ,” ApJL, 983, L25
- Balmer, ... **Lawson**, et al. 2025, “*JWST-TST High Contrast: Living on the Wedge, or, NIRCам Bar Coronagraphy Reveals CO₂ in the HR 8799 and 51 Eri Exoplanets’ Atmospheres*,” AJ, 169, 209
- Dykes, Currie, **Lawson**, et al. 2024, “*SCEXAO/CHARIS Near-infrared Scattered-light Imaging and Integral Field Spectropolarimetry of the AB Aurigae Protoplanetary System*,” ApJ, 977, 172
- Chen, **Lawson**, Brandt, et al. 2024, “*Multiband polarimetric imaging of HD 34700 with SCEXAO/CHARIS*,” MNRAS, 533, 2473
- Kammerer, **Lawson**, Perrin, et al. 2024, “*JWST-TST High Contrast: JWST/NIRCам Observations of the Young Giant Planet β Pic b*,” AJ, 168, 51
- Vincent, **Lawson**, Currie, et al. 2024, “*SCEXAO/CHARIS Multiwavelength High-contrast Imaging of the BD+45°598 Debris Disk*,” AJ, 168, 6
- Lawson**, Schlieder, Leisenring, et al. 2024, “*JWST / NIRCам Detection of the Fomalhaut C Debris Disk in Scattered Light*,” ApJL, 967, L8
- Rebollido, ... **Lawson**, et al. 2024, “*JWST-TST High Contrast: Asymmetries, Dust Populations, and Hints of a Collision in the β Pictoris Disk with NIRCам and MIRI*,” ApJ, 167, 69
- Petrus, ... **Lawson**, et al. 2024, “*The JWST Early Release Science Program for Direct Observations of Exoplanetary Systems. V. Do Self-consistent Atmospheric Models Represent JWST Spectra? A Showcase with VHS 1256–1257 b*,” ApJL, 966, L11
- Sallum, ... **Lawson**, et al. 2024, “*The JWST Early Release Science Program for Direct Observations of Exoplanetary Systems IV: NIRISS Aperture Masking Interferometry Performance and Lessons Learned*,” ApJL, 963, L2
- Wagner, ... **Lawson**, et al. 2023, “*Direct images and spectroscopy of a giant protoplanet driving spiral arms in MWC 758*,” Nature Astronomy
- Lawson**, Schlieder, Leisenring, et al. 2023, “*JWST / NIRCам Coronagraphy of the Young Planet-hosting Debris Disk AU Microscopii*,” AJ, 166, 150
- Miles, ... **Lawson**, et al. 2023, “*The JWST Early-release Science Program for Direct Observations of Exoplanetary Systems II: A 1 to 20 μm Spectrum of the Planetary-mass Companion VHS 1256-1257 b*,” ApJL, 947, L6
- Carter, ... **Lawson**, et al. 2023, “*The JWST Early Release Science Program for Direct Observations of Exoplanetary Systems I: High-contrast Imaging of the Exoplanet HIP 65426 b from 2 to 16 μm* ,” ApJL, 951, L20
- Currie, ... **Lawson**, et al. 2023, “*Direct imaging and astrometric detection of a gas giant planet orbiting an accelerating star*,” Science, 380, 198–203
- Lawson**, Currie, Wisniewski, et al. 2022, “*Constrained Reference Star Differential Imaging: Enabling High-fidelity Imagery of Highly Structured Circumstellar Disks*,” ApJL, 935, L25
- Kuzuhara, ... **Lawson**, et al. 2022, “*Direct-imaging Discovery and Dynamical Mass of a Substellar Companion Orbiting an Accelerating Hyades Sun-like Star with SCEXAO / CHARIS*,” ApJL, 934, L18
- Currie, **Lawson**, Schneider, et al. 2022, “*Images of embedded Jovian planet formation at a wide separation around AB Aurigae*,” Nature Astronomy
- Uyama, Ruane, **Lawson**, et al. 2022, “*A Spatially-resolved Large Cavity of the J0337 Protoplanetary Disk in Perseus*,” AJ, 163, 204
- Lawson**, Currie, Wisniewski, et al. 2021, “*Multiband imaging of the HD 36546 debris disk: a refined view from SCEXAO / CHARIS*,” AJ, 162, 293
- Currie, ... **Lawson**, et al. 2020, “*SCEXAO / CHARIS Direct Imaging Discovery of a 20 au Separation, Low-mass Ratio Brown Dwarf Companion to an Accelerating Sun-like Star*,” ApJL, 904, L25
- Lawson**, Currie, Wisniewski, et al. 2020, “*SCEXAO / CHARIS Near-IR Integral Field Spectroscopy of the HD 15115 Debris Disk*,” AJ, 160, 163
- Schutte, **Lawson**, Wisniewski, et al. 2020, “*Discovery of a Nearby Young Brown Dwarf Disk*,” AJ, 160, 156

- Silverberg, ... **Lawson**, et al. 2020, “*Peter Pan Disks: Long-lived Accretion Disks Around Young M Stars*”, ApJ, 890, 106
- Lawson**, Wisniewski, Bellm, Kowalski, & Shupe 2019, “*Identification of Stellar Flares Using Differential Evolution Template Optimization*”, AJ, 158, 119
- Blunt, ... **Lawson**, et al. 2019, “*Radial Velocity Discovery of an Eccentric Jovian World Orbiting at 18 au*”, AJ, 158, 181
- Wisniewski, ... **Lawson**, et al. 2019, “*High-fidelity Imaging of the Inner AU Mic Debris Disk: Evidence of Differential Wind Sculpting?*”, ApJL, 883, L8
- Currie, ... **Lawson**, et al. 2019, “*No Clear, Direct Evidence for Multiple Protoplanets Orbiting LkCa 15: LkCa 15 bcd are Likely Inner Disk Signals*”, ApJL, 877, L3
- ▷ **Conference Proceedings & White Papers**
- Lawson**, Ren, et al. 2025, “*Telemetry-Aided Post-Processing with Machine Learning Methods for the Habitable Worlds Observatory Coronagraph*,” HWO Coronagraph Concept of Operations and Post-processing Technical Assessment Group
- Wisniewski, ... **Lawson**, et al. 2022, “*UV spectropolarimetry with Polstar: protoplanetary disks*,” Astrophysics and Space Science, 367, 12, 122
- Lawson**, Currie, Wisniewski, et al. 2021, “*High-contrast integral field spectropolarimetry of planet-forming disks with SCEXAO / CHARIS*,” Proc. SPIE 11823, 118230D
- Currie, ... **Lawson**, et al. 2021, “*A new type of exoplanet direct imaging search: a SCEXAO / CHARIS survey of accelerating stars*,” Proc. SPIE 11823, 1182304
- Currie, ... **Lawson**, et al. 2020, “*On-sky performance and recent results from the Subaru coronagraphic extreme adaptive optics system*,” Proc. SPIE 11448, 114487H

Selected Presentations

▷ Invited

- “*Telemetry-Aided Post-Processing with Machine Learning Methods for the Habitable Worlds Observatory Coronagraph*,” HWO Coronagraph Concept of Operations and Post-processing Technical Interchange Meeting, Apr 2025
- “*JWST Coronagraphy of Debris Disk Systems*,” Carnegie EPL Astronomy Seminar, Apr 2025
- “*Coronagraphic JWST/NIRCam Images of a Young Planet-Hosting Debris Disk System*,” AAS 241 Press Conference, Jan 2023
- “*The Lord of the Rings: Understanding Planet Formation Through Imaging of Planet-Forming Disks*,” GSFC Exoplanet Seminar Series, Nov 2022
- “*Direct Imaging of Exoplanetary Systems with JWST: On-sky Capabilities & Early Results*”, SPICE Community Workshop, Sep 2022
- “*High-contrast integral field spectropolarimetry of planet-forming disks with SCEXAO/CHARIS*,” University of Kansas Astronomy and Space Physics Seminar, Nov 2021

▷ Contributed

- “*JWST Coronagraphy of Debris Disk Systems: Early Results and Lessons Learned*,” Chesapeake Bay Area Exoplanet Meeting, May 2024
- “*First Scattered Light Detection of the Fomalhaut C Debris Disk with JWST/NIRCam*,” Dust Devils - Debris Disks in the Sonoran Desert, March 2024
- “*High-contrast Polarimetry as a Complement for Total Intensity Circumstellar Disk Imaging*,” ExoPAG 25, Jan 2022
- “*High-contrast integral field spectropolarimetry of planet-forming disks*,” STScI ESPF Seminar Series, Nov 2021
- “*High-contrast integral field spectropolarimetry of planet-forming disks with SCEXAO/CHARIS*”, SPIE Optical Engineering + Applications, Aug 2021
- “*SCEXAO/CHARIS Near-IR Integral Field Spectroscopy of the HD 15115 Debris Disk*”, AAS 236, Jun 2020

Selected Outreach

Speaker: NASA’s Universe of Learning Science Briefing (2023) — Presented a summary of our JWST study of the AU Mic debris disk to science educators.

Member: Lunar Sooners (Univ. of Oklahoma; 2016 – 2022) — A student organization introducing under-served Oklahoma

communities to astronomy using a portable planetarium, public telescope observing, discussion panels, and demonstrations.

Event Host: SW OKC Public Library astronomy day (2019) — Astronomy demos and Q&A for children

Event Host: Planetarium at Jay Elementary – Jay, Oklahoma (2019) — Educational event using a portable planetarium

Event Host: Boys and Girls Club of Norman (2018) — Astronomy demonstrations for K-12 students