Kellen D. Lawson

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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)

Research Interests

- ▷ High-contrast imaging of circumstellar disks & exoplanets
- ▷ Integral field spectroscopy and polarimetry
- ▷ Software development
- ▷ Optimization algorithms

Employment

NASA Postdoctoral Program Fellow (2022–Present) NASA Goddard Space Flight Center
Advisors: Mike McElwain, Josh Schlieder, Tyler Groff; developing and applying advanced PSF-subtraction and modeling techniques to study exoplanetary systems using high contrast imagery from both ground- and space-based observatories.

Graduate Research Assistant (2018–Present) University of Oklahoma
Advisor: John Wisniewski; dissertation work reducing, analyzing, and modeling high-contrast integral field spectroscopic and polarimetric imagery from the Subaru observatory's SCExAO/CHARIS to study circumstellar disks and exoplanets.

Graduate Research Assistant (2017–2018) Univ. of Oklahoma & Univ. of Washington
Advisors: John Wisniewski & Eric Bellm; developed techniques for the identification of flare star candidates in sparsely sampled time-series photometry from the Palomar Transient Factory (PTF).

Undergraduate Research Assistant (2013–2015) College of Charleston
Advisor: Joseph Carson; worked to identify and assess planet candidates in high-contrast imagery from the Subaru Observatory's HiCIAO as part of the Strategic Exploration of Exoplanets and Disks with Subaru (SEEDS) survey.

Publications

▷ Refereed Journal Articles

Lawson, K., Currie, T., Wisniewski, J. et al. 2022, "*Constrained Reference Star Differential Imaging: Enabling High-fidelity Imagery of Highly Structured Circumstellar Disks*", ApJL, 935, L25

Kuzuhara, M., ... **Lawson, K.** 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, T., **Lawson, K.**, Schneider, G. et al. 2022, "*Images of embedded Jovian planet formation at a wide separation around AB Aurigae*", Nature Astronomy

Uyama, T., Ruane, G., **Lawson, K.** et al. 2022, "*A Spatially-resolved Large Cavity of the J0337 Protoplanetary Disk in Perseus*", AJ, 163, 204

Lawson, K., Currie, T., Wisniewski, J. et al. 2021, "*Multiband imaging of the HD 36546 debris disk: a refined view from SCExAO/CHARIS*", AJ, 162, 293

Currie, T., ... **Lawson, K.** 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, K., Currie, T., Wisniewski, J. et al. 2020, "*SCExAO/CHARIS Near-IR Integral Field Spectroscopy of the HD 15115 Debris Disk*", AJ, 160, 163

Schutte, M., **Lawson, K.**, Wisniewski, J. et al. 2020, "*Discovery of a Nearby Young Brown Dwarf Disk*", AJ, 160, 156

Silverberg, S., Wisniewski, J., Kuchner, M., **Lawson, K.** et al. 2020, "*Peter Pan Disks: Long-lived Accretion Disks Around Young M Stars*", ApJ, 890, 106

Lawson, K., Wisniewski, J., Bellm, E., Kowalski, A., & Shupe, D. 2019, "*Identification of Stellar Flares Using Differential Evolution Template Optimization*", AJ, 158, 119

Blunt, S., ... **Lawson, K.** et al. 2019, "*Radial Velocity Discovery of an Eccentric Jovian World Orbiting at 18 au*", AJ, 158, 181

Wisniewski, J., … **Lawson, K.** et al. 2019, "*High-fidelity Imaging of the Inner AU Mic Debris Disk: Evidence of Differential Wind Sculpting?*", ApJL, 883, L8

Currie, T., … **Lawson, K.** 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**

Lawson, K., Currie, T., Wisniewski, J. et al. 2021, "*High-contrast integral field spectropolarimetry of planet-forming disks with SCExAO/CHARIS*", Proc. SPIE 11823, 118230D

Currie, T., … **Lawson, K.** et al. 2021, "*A new type of exoplanet direct imaging search: a SCExAO/CHARIS survey of accelerating stars*", Proc. SPIE 11823, 1182304

Currie, T., … **Lawson, K.** et al. 2020, "*On-sky performance and recent results from the Subaru coronagraphic extreme adaptive optics system*", Proc. SPIE 11448, 114487H

Presentations

▷ **Invited**

"High-contrast integral field spectropolarimetry of planet-forming disks with SCExAO/CHARIS", University of Kansas Astronomy and Space Physics Seminar, Nov 2021

▷ **Contributed**

"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 High-Contrast Integral Field Spectropolarimetry of Planet-Forming Disks", Subaru Users Meeting FY2020, Mar 2021

"SCExAO/CHARIS Near-IR Integral Field Spectroscopy of the HD 15115 Debris Disk", AAS 236, Jun 2020

Grants & Awards

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

Outreach & Service

Lunar Sooners (2016 – Present) — University of Oklahoma

A student organization that introduces under-served Oklahoma communities to astronomy using a portable planetarium, public telescope observing, discussion panels, and demonstrations. Selected Lunar Sooners events that I co-hosted:

- ▷ SW OKC Public Library (Jun 2019) – Astronomy demos and Q&A with children ages 5-12
- ▷ "Soonertarium" at Jay Elementary (Oct 2018) – All-day elementary school event using our portable planetarium
- ▷ Boys and Girls Club of Norman (Jun 2018) – Astronomy demonstrations for K-12 students

CHARIS DPP – spectropolarimetry module (2021) — github.com/thaynecurrie/charis-dpp

An addition to the publicly available IDL data processing pipeline for Subaru/CHARIS data. This module provides calibrated final products for data from CHARIS's integral field spectropolarimetry mode.

PyVAN (2019) — github.com/kdlawson/pyvan

A publicly available Python package for assessing variability of candidate lightcurves, especially suited to irregularly sampled light-curves from ground based astronomical surveys (Lawson et al., 2019).

Proficiencies

Data Processing and Analysis

- ▷ Advanced optimization for complex/multidimensional parameter spaces
- ▷ High contrast imaging data extraction, calibration, PSF subtraction, and disk/planet forward modeling
- ▷ 3D radiative transfer and scattered light modeling of circumstellar disks
- ▷ Time-series / lightcurve analysis

Programming Languages

- ▷ Python: image processing and analysis, optimization algorithms, time-series analysis, multi-threading, GPU computing, plotting, animation
- ▷ IDL: image processing and analysis, optimization algorithms, plotting