

# Lyra Cao

VIDA Postdoctoral Fellow  
Stellar Magnetic Fields and Star Spots  
Stellar Evolution and Gyrochronology  
Near-Infrared Survey Spectroscopy

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**EDUCATION**      **The Ohio State University**      Advisor: Marc Pinsonneault  
*Doctor of Philosophy, Astronomy, Summer 2023*  
*Master of Science, Astronomy, May 2021*

**California Institute of Technology**      Advisor: Lynne Hillenbrand  
*Bachelor of Science, Astrophysics, June 2017*  
Thesis: The Effects of Accretion on the Age Spreads of Young Stars

**AWARDS**      SDSS-IV Early Career Scientist Travel Fund Award, \$2000  
Ohio State University Distinguished University Fellowship Award (2017–2018)

**PUBLICATIONS**      **First Author Publications**

1. **Cao, L.**, Pinsonneault, M. H., & Sharifi, K. Star spots and the Pleiades lithium spread. *ApJL*, in prep.
2. **Cao, L.**, Pinsonneault, M. H., & van Saders, J. L. Core-envelope decoupling drives radial shear dynamos in cool stars. *ApJL*, in press. arXiv:2301.07716.
3. **Cao, L.** & Pinsonneault, M. H. Star-spots and magnetism: testing the activity paradigm in the Pleiades and M67. *MNRAS*, **517**, 2165–2189 (2022).
4. **Cao, L.**, Pinsonneault, M. H., Hillenbrand, L. A., Kuhn, M. A. Age Spreads and Systematics in  $\lambda$  Orionis with Gaia DR2 and the SPOTS Tracks. *ApJ*, **924**, 84 (2022).

**Contributing Author Publications**

5. Claytor, Z. R., van Saders, J. L., **Cao, L.** and 3 coauthors. TESS Stellar Rotation up to 80 days in the Southern Continuous Viewing Zone. *ApJ*, submitted. arXiv:2307.05664.
6. Phillips, A., Kochanek, C. S., Jayasinghe, T., **Cao, L.** and 3 coauthors. Seven Classes of Rotational Variables From a Study of 50,000 Spotted Stars with ASAS-SN, Gaia, and APOGEE. *MNRAS*, submitted. arXiv:2305.09715.
7. Patton, R., Pinsonneault, M. H., **Cao, L.** and 4 coauthors. Spectroscopic identification of rapidly rotating red giant stars in APOKASC-3 and APOGEE DR16. *MNRAS*, submitted. arXiv:2303.08151.
8. Wanderley, F., Cunha, K., Souto, D., Smith, V. S., **Cao, L.**, and 21 coauthors. Stellar characterization and radius inflation of Hyades M dwarf stars from the APOGEE survey. *ApJ*, **951**, 90 (2023).

9. Kounkel, M. and 17 coauthors incl. **Cao, L.** ABYSS I: Targeting strategy for APOGEE & BOSS young star survey in SDSS-V. *ApJS*, **266**, 10 (2023).
10. Serna, J. and 19 coauthors incl. **Cao, L.** Rotational Evolution of Classical T Tauri Stars: Models and Observations. *ApJ*, submitted.
11. Alzate, J. A., and 6 coauthors incl. **Cao, L.** Constraints on star formation in Orion A from Gaia. *MNRAS*, **523**, 4821 (2023).
12. Smith, A., and 8 coauthors incl. **Cao, L.** `pynucastro`: A Python Library for Nuclear Astrophysics. *ApJ*, **947**, 65 (2023).
13. Binks, A. S., Jeffries, R. D., Sacco, G. G., Jackson, R. J., **Cao, L.**, and 11 coauthors. The Gaia-ESO survey: constraining evolutionary models and ages for young low mass stars with measurements of lithium depletion and rotation. *MNRAS*. **513**, 5727–5751 (2022).
14. Somers, G., **Cao, L.**, & Pinsonneault, M. H. The SPOTS Models: A Grid of Theoretical Stellar Evolution Tracks and Isochrones for Testing the Effects of Starspots on Structure and Colors. *ApJ*. **891**, 29 (2020).

#### PROPOSALS

1. CFHT University of Hawaii (IfA). PI: van Saders, J. L., Co-I: 2 incl. **Cao, L.** “Probing Surface Activity During the Epoch of Core-Envelope Recoupling”, awarded.
2. TESS Guest Investigator Cycle 5, PI: Pinsonneault, M. H., Co-I: 4 incl. **Cao, L.** “Rotation, Star Spots And Activity In Tess Cycle 5”, \$70,000.

#### CONFERENCE TALKS

##### Invited Conference Talks

- δ Fifty Years of the Skumanich Relations (March 2022). “Detecting Starspots in APOGEE Spectra”.

##### Contributed Talks & Posters

- δ SDSS-V Collaboration Meeting (July 2023). “Starspots, magnetism, and Milky Way Mapper: the LEOPARD spot catalog”. Contributed talk.
- δ TASC7/KASC14 (July 2023). “LEOPARD Starspots Catalog: Impact of Stellar Magnetism on Dwarfs and Giants”. Contributed talk.
- δ AAS 241, Seattle (January 2023). “Starspots and Magnetism: Testing the Activity Paradigm in the Pleiades and M67”. Dissertation talk.
- δ AAS 241, Seattle (January 2023). Press conference: “Starspots and Magnetism: Testing the Activity Paradigm in the Pleiades and Messier 67 Star Clusters”.
- δ Cool Stars 21, Toulouse (July 2022). “Spectroscopic Starspot Filling Factor Measurements with APOGEE”. Poster.

- δ SDSS Collaboration Meeting, Johns Hopkins University (August 2021). “Spots and Pre-MS Stellar Characterization from APOGEE DR17 Spectra”. Talk.
- δ Cool Stars 20.5, Virtual (March 2021). “Age Spreads and Systematics in  $\lambda$  Orionis with Gaia DR2 and the SPOTS tracks”. Poster.
- δ SciPy 2020 (July 2020). “pynucastro: A Python Library for Exploring Nuclear Reaction Rates”. Poster.
- δ AAS DPS 48 (October 2016). “A Study of Saturn’s Normal Mode Oscillations and Their Forcing of Density Waves in the Rings”. Poster.

### Department Talks, Seminars & Colloquia

- δ Carnegie Observatories, Pasadena (December 2022). “Magnetochronology: The Stellar Dynamo Revealed”. Department talk.
- δ Keele University, Keele (December 2022). “Magnetochronology: The Stellar Dynamo Revealed”. Invited seminar.
- δ Department of Physics, Boise State University (March 2022). “Starspot Detections and the Evolution of the Stellar Dynamo”. Invited seminar.

### MENTORING

- ★ *Kayvon Sharifi*, Ohio State University, former undergraduate. Supervising on two papers in preparation.
- ★ *Alyssa Whalen*, Ohio State University, undergraduate. Co-supervised with Pinsonneault, M. H. as part of the Summer Undergraduate Research Program.
- ★ *Erin Duell*, Ohio State University, undergraduate. Supervised as part of the Polaris mentorship program.

### TEACHING

#### Graduate Teaching Assistant, Ohio State University

- *Stellar Evolution* (Spring 2022). Senior-level major course in theoretical stellar astrophysics.
- *Methods of Astronomical Observation & Data Analysis* (Fall 2021). Junior-level major course in computational astrophysics.
- *Basic Astrophysics & Planetary Astronomy* (Fall 2021). Sophomore-level major course in the principles of astrophysics.
- *Life in the Universe* (Fall 2018, Spring 2022). Non-major course in astronomy.
- *Planets and the Solar System* (Spring 2019). Non-major course in astronomy.
- *From Planets to the Cosmos* (Fall 2018, Spring 2019). Non-major laboratory course in astronomy.

#### Undergraduate Teaching Assistant, Caltech

- *The Evolving Universe* (Spring 2016). Non-major course in astronomy.

— *Analog Electronics for Physicists* (Fall 2015, Fall 2015). Sophomore-level major laboratory course in analog electronics.

OUTREACH

- ⊕ *Polaris Mentorship Program*. Mentored traditionally underrepresented undergraduate students at the Ohio State University to prepare them for research opportunities in astronomy.
- ⊕ *Friends of Ohio State Astronomy and Astrophysics*. Volunteered and met with interested members of the public about my research.
- ⊕ *Arne Slettebak Planetarium*. Presented planetarium programs at the Arne Sletteback Planetarium.
- ⊕ *Science Olympiad*. Ran events and regularly supervised *Astronomy C* and *Solar System B* events in the Los Angeles Regionals and Southern California States competitions from 2014–2017; assisted in the Columbus Regionals competition (2019).

OBSERVING

Palomar Observatory 200" Hale, Large Format Camera

1 night