Arjun B. Savel

Ph.D. Candidate, Astrophysics Researcher

asavel@umd.edu | 0000-0002-2454-768X | www.arjunsavel.com

https://www.linkedin.com/in/arjunsavel | https://github.com/arjunsavel

Education

University of Maryland, College Park — College Park, MD
Ph.D., Astronomy — *Expected*
M.S., Astronomy | Advisor: Prof. Eliza M.-R. Kempton — *2022*

University of California, Berkeley — Berkeley, CA
B.A., Astrophysics; B.A., Physics | Advisor: Asst. Prof. Courtney D. Dressing — *2020*

Positions

Graduate Researcher—University of Maryland, College Park — College Park, MD
Three-dimensionality of exoplanets inferred from spectra of hot and ultra-hot Jupiters | Advisor: Prof. Eliza M.-R. Kempton — *2020–current*

Consultant—ScienceBetter Consulting — New York, NY
Tutorial Jupyter notebooks for MAST science cases | Manager: Prof. Kelle Cruz — *2022–2023*

Pre-doctoral fellow—Center for Computational Astrophysics, Flatiron Institute — New York, NY
The uncertainty budget of high-resolution cross-correlation spectroscopy | Mentor: Dr. Megan Bedell — *2022–2023*

Research Assistant—University of California, Berkeley — Berkeley, CA
Exoplanet occurrence rates and imaging of Kepler stars | Advisors: Asst. Prof. Courtney D. Dressing & Asst. Prof. Lea A. Hirsch — *2018–2020*

Selected & Current Research Interests

- Extracting 3-D information (wind, chemical, aerosol, and thermal structures) from exoplanet atmospheres
- Improving high-resolution cross-correlation spectroscopy techniques
- Characterizing exoplanetary systems and host stars

Publications (* = mentored student)

citations: 413 / h-index: 11 / 4 first-author refereed

Refereed Publications

28 Rasmussen, Kaitlin C.; Currie, Miles H.; Hagee, Celeste; van Buchem, Christiaan *et al.* (17 other co-authors, incl. **Savel, Arjun**) 2023, *A Nondetection of Iron in the First High-resolution Emission Study of the Lava Planet 55 Cnc e*, AJ, 166, 155 (arXiv:2308.10378)

27 Coulombe, Louis-Philippe; Benneke, Björn; Challener, Ryan; Piette, Anjali A. A. *et al.* (73 other co-authors, incl. **Savel, Arjun**) 2023, *A broadband thermal emission spectrum of the ultra-hot Jupiter WASP-18b*, Nature, 620, 292 (arXiv:2301.08192) [13 citations]

26 Kempton, Eliza M. -R.; Zhang, Michael; Bean, Jacob L.; Steinrueck, Maria E. *et al.* (30 other co-authors, incl. **Savel, Arjun**) 2023, *A reflective, metal-rich atmosphere for GJ 1214b from its JWST phase curve*, Nature, 620, 67 (arXiv:2305.06240) [6 citations]

25 Tuson, A.; Queloz, D.; Osborn, H. P.; Wilson, T. G. *et al.* (119 other co-authors, incl. **Savel, Arjun**) 2023, *TESS and CHEOPS discover two warm sub-Neptunes transiting the bright K-dwarf HD 15906*, MNRAS, 523, 3090 (arXiv:2306.04511) [3 citations]

24 Dai, Fei; Schlaufman, Kevin C.; Reggiani, Henrique; Bouma, Luke *et al.* (48 other co-authors, incl. **Savel, Arjun**) 2023, *A Mini-Neptune Orbiting the Metal-poor K Dwarf BD+29 2654*, AJ, 166, 49 (arXiv:2306.08179)

23 Gao, Peter; Piette, Anjali A. A.; Steinrueck, Maria E.; Nixon, Matthew C. *et al.* (12 other co-authors, incl. **Savel, Arjun**) 2023, *The Hazy and Metal-rich Atmosphere of GJ 1214 b Constrained by Near- and Mid-infrared Transmission Spectroscopy*, ApJ, 951, 96 (arXiv:2305.05697) [1 citation]

22 Beltz, Hayley; Rauscher, Emily; Kempton, Eliza M. -R.; Malsky, Isaac *et al.* (2 other co-authors, incl. **Savel, Arjun**) 2023, *Magnetic Effects and 3D Structure in Theoretical High-resolution Transmission Spectra of Ultrahot Jupiters: the Case of WASP-76b*, AJ, 165, 257 (arXiv:2302.13969) [2 citations]

21 Rodriguez, Joseph E.; Quinn, Samuel N.; Vanderburg, Andrew; Zhou, George *et al.* (130 other co-authors, incl. **Savel, Arjun**) 2023, *Another shipment of six short-period giant planets from TESS*, MNRAS, 521, 2765 (arXiv:2205.05709) [9 citations]

20 **Savel**, **Arjun**; Kempton, Eliza M. -R.; Rauscher, Emily; Komacek, Thaddeus D. *et al.*2023, *Diagnosing Limb Asymmetries in Hot and Ultrahot Jupiters with High-resolution Transmission Spectroscopy*, ApJ, 944, 99 (arXiv:2301.01694) [4 citations]

19 Lillo-Box, J.; Gandolfi, D.; Armstrong, D. J.; Collins, K. A. *et al.* (62 other co-authors, incl. **Savel, Arjun**) 2023, *TOI-969: a late-K dwarf with a hot mini-Neptune in the desert and an eccentric cold Jupiter*, A&A, 669 (arXiv:2210.08996) [6 citations]

18 **Savel**, **Arjun**; Hirsch, Lea A.; *Gill, Holden; Dressing, Courtney D. *et al.*2022, *SImMER: A Pipeline for Reducing and Analyzing Images of Stars*, PASP, 134, 124501 (arXiv:2212.00641) [2 citations]

17 Beltz, Hayley; Rauscher, Emily; Kempton, Eliza M. -R.; Malsky, Isaac *et al.* (4 other co-authors, incl. **Savel, Arjun**) 2022, *Magnetic Drag and 3D Effects in Theoretical High-resolution Emission Spectra of Ultrahot Jupiters: the Case of WASP-76b*, AJ, 164, 140 (arXiv:2204.12996) [10 citations]

16 Esparza-Borges, E.; Parviainen, H.; Murgas, F.; Pallé, E. *et al.* (45 other co-authors, incl. **Savel, Arjun**) 2022, *A hot sub-Neptune in the desert and a temperate super-Earth around faint M dwarfs. Color validation of TOI-4479b and TOI-2081b*, A&A, 666 (arXiv:2206.10643) [3 citations]

15 Newton, Elisabeth R.; Rampalli, Rayna; Kraus, Adam L.; Mann, Andrew W. *et al.* (36 other co-authors, incl. **Savel, Arjun**) 2022, *TESS Hunt for Young and Maturing Exoplanets (THYME). VII. Membership, Rotation, and Lithium in the Young Cluster Group-X and a New Young Exoplanet*, AJ, 164, 115 (arXiv:2206.06254) [10 citations]

14 Gandhi, Siddharth; Kesseli, Aurora; Snellen, Ignas; Brogi, Matteo *et al.* (5 other co-authors, incl. **Savel, Arjun**) 2022, *Spatially resolving the terminator: variation of Fe, temperature, and winds in WASP-76 b across planetary limbs and orbital phase*, MNRAS, 515, 749 (arXiv:2206.11268) [10 citations]

13 Yee, Samuel W.; Winn, Joshua N.; Hartman, Joel D.; Rodriguez, Joseph E. *et al.* (69 other co-authors, incl. **Savel, Arjun**) 2022, *The TESS Grand Unified Hot Jupiter Survey. I. Ten TESS Planets*, AJ, 164, 70 (arXiv:2205.09728) [9 citations]

12 Gan, Tianjun; Soubkiou, Abderahmane; Wang, Sharon X.; Benkhaldoun, Zouhair *et al.* (63 other co-authors, incl. **Savel, Arjun**) 2022, *TESS discovery of a sub-Neptune orbiting a mid-M dwarf TOI-2136*, MNRAS, 514, 4120 (arXiv:2202.10024) [14 citations]

11 Murakami, Yukei S.; Jennings, Connor; Hoffman, Andrew M.; **Savel**, **Arjun** *et al.* (7 other co-authors, incl. **Savel, Arjun**) 2022, *PIPS, an advanced platform for period detection in time series - I. Fourier-likelihood periodogram and application to RR Lyrae stars*, MNRAS, 514, 4489 (arXiv:2107.14223) [1 citation]

10 Giacalone, Steven; Dressing, Courtney D.; Hedges, Christina; Kostov, Veselin B. *et al.* (108 other co-authors, incl. **Savel, Arjun**) 2022, *Validation of 13 Hot and Potentially Terrestrial TESS Planets*, AJ, 163, 99 (arXiv:2201.12661) [6 citations]

9 Dong, Jiayin; Huang, Chelsea X.; Zhou, George; Dawson, Rebekah I. *et al.* (56 other co-authors, incl. **Savel, Arjun**) 2022, *NEID Rossiter-McLaughlin Measurement of TOI-1268b: A Young Warm Saturn Aligned with Its Cool Host Star*, ApJ, 926 (arXiv:2201.12836) [11 citations]

8 **Savel**, **Arjun**; Kempton, Eliza M. -R.; Malik, Matej; Komacek, Thaddeus D. *et al.*2022, *No Umbrella Needed: Confronting the Hypothesis of Iron Rain on WASP-76b with Post-processed General Circulation Models*, ApJ, 926, 85 (arXiv:2109.00163) [25 citations]

7 de Leon, J. P.; Livingston, J.; Endl, M.; Cochran, W. D. *et al.* (24 other co-authors, incl. **Savel, Arjun**) 2021, *37 new validated planets in overlapping K2 campaigns*, MNRAS, 508, 195 (arXiv:2108.05621) [14 citations]

6 May, Erin M.; Komacek, Thaddeus D.; Stevenson, Kevin B.; Kempton, Eliza M. -R. *et al.* (15 other co-authors, incl. **Savel, Arjun**) 2021, *Spitzer Phase-curve Observations and Circulation Models of the Inflated Ultrahot Jupiter WASP-76b*, AJ, 162, 158 (arXiv:2107.03349) [27 citations]

5 Cloutier, Ryan; Charbonneau, David; Stassun, Keivan G.; Murgas, Felipe *et al.* (63 other co-authors, incl. **Savel, Arjun**) 2021, *TOI-1634 b: An Ultra-short-period Keystone Planet Sitting inside the M-dwarf Radius Valley*, AJ, 162, 79 (arXiv:2103.12790) [21 citations]

4 Foreman-Mackey, Daniel; Luger, Rodrigo; Agol, Eric; Barclay, Thomas *et al.* (13 other co-authors, incl. **Savel, Arjun**) 2021, *exoplanet: Gradient-based probabilistic inference for exoplanet data & other astronomical time series*, JOSS, 6, 3285 (arXiv:2105.01994) [107 citations]

3 Rodriguez, Joseph E.; Quinn, Samuel N.; Zhou, George; Vanderburg, Andrew *et al.* (115 other co-authors, incl. **Savel, Arjun**) 2021, *TESS Delivers Five New Hot Giant Planets Orbiting Bright Stars from the Full-frame Images*, AJ, 161, 194 (arXiv:2101.01726) [25 citations]

2 **Savel**, **Arjun**; Dressing, Courtney D.; Hirsch, Lea A.; Ciardi, David R. *et al.*2020, *A Closer Look at Exoplanet Occurrence Rates: Considering the Multiplicity of Stars without Detected Planets*, AJ, 160, 287 (arXiv:2011.09564) [23 citations]

1 Demory, B. -O.; Pozuelos, F. J.; Gómez Maqueo Chew, Y.; Sabin, L. *et al.* (70 other co-authors, incl. **Savel, Arjun**) 2020, *A super-Earth and a sub-Neptune orbiting the bright, quiet M3 dwarf TOI-1266*, A&A, 642 (arXiv:2009.04317) [51 citations]

Selected Honors, Prizes, & Awards

11 Winner, Three-Minute Thesis Pre-Candidacy Competition, College of Computer, Mathematical, and Natural Sciences, UMD (2023)

10 CCA Pre-Doctoral Fellowship, Flatiron Institute Center for Computational Astrophysics (2022)

9 Gregor and Donat Wentzel Scholarship, University of Maryland (2020)

8 ARCS fellowship (2020; declined)

7 University Fellowship, Michigan State University (2020; declined)

6 IfA Director's Research Excellence Award (2020; declined)

5 Student commencement speaker, UC Berkeley Astronomy Department (2020)

4 Outstanding Graduate Student Instructor Award, UC Berkeley (2020)

3 1st place, Astronomy Poster Summer Intern Symposium, UC Berkeley (2019)
2 Student Technology Fund grant for ULAB, UC Berkeley (2018)
1 Ongoing Physics Department award for ULAB, UC Berkeley (2018)

Science Talks

12 **Arjun Savel**, 2023. "Knowing when to know: bridging data-driven and physics-driven modeling for exoplanet atmospheres." Center for Theory and Computation Lunch Talk, Department of Astronomy, University of Maryland, College Park, MD.
11 **Arjun Savel**, 2023. "Peering into the black box: the uncertainty budget of high-resolution spectroscopy of exoplanet atmospheres." Flatiron CCA Pre-doctoral Symposium, New York, NY.
10 **Arjun Savel**, 2022. “Phase-resolved asymmetries of (ultra)hot Jupiters in high-resolution transmission: drivers and diagnostics”, Flatiron Exoplanet Atmospheres Symposium, New York, NY.
9 **Arjun Savel**, 2022. “Modeling Lorentz drag in an ultra-hot Jupiter over a range of atmospheric parameters”, Burgers Program Research Symposium on Environmental and Applied Fluid Dynamics, The George Washington University.
8 **Arjun Savel**, 2022. “Phase-resolved asymmetries of (ultra)hot Jupiters in high-resolution transmission: drivers and diagnostics”, Exoplanets IV, Las Vegas, CA.
7 **Arjun Savel**, 2022. “Phase-resolved asymmetries of (ultra)hot Jupiters in high-resolution transmission: drivers and diagnostics”, Bay Area Exoplanet Meeting #40, NASA Ames.
6 **Arjun Savel**, 2021. “No umbrella needed: Confronting the hypothesis of iron rain on WASP-76b with post-processed general circulation models”, ExoCoffee, MPIA Heidelberg (**invited**).
5 **Arjun Savel**, 2021. “No umbrella needed: Confronting the hypothesis of iron rain on WASP-76b with post-processed general circulation models”, Astronomy and Space Physics Seminar, University of Kansas.
4 Courtney D. Dressing, Steven Giacalone, Ellianna S. Abrahams *et al.* (7 other co-authors, incl. **Arjun Savel**), 2020. “Using TESS to Investigate the Frequency of Planetary Systems Orbiting Cool Dwarfs”, AAS 235, Honolulu.
3 **Arjun Savel**, Courtney D. Dressing, Lea Hirsch, David Ciardi, Jordan P.C. Fleming, Steven Giacalone, Andrew W. Mayo, Jessie L. Christiansen, 2019. “A Closer Look at Exoplanet Occurrence Rates: Considering the Multiplicity of Stars without Detected Planets”, Bay Area Exoplanet Meeting #31, NASA Ames
2 **Arjun Savel**, Courtney D. Dressing, Lea Hirsch, David Ciardi, Jordan P.C. Fleming, Steven Giacalone, Andrew W. Mayo, Jessie L. Christiansen, 2019. “A Closer Look at Exoplanet Occurrence Rates: The Impact of Stars Without Exoplanets”, Bay Area Planetary Sciences Meeting, Stanford University.
1 **Arjun Savel**, 2019. “Earth: Rare or Regular?”, Undergraduate Seminars, UC Berkeley.

Misc. Technical Talks

7 **Arjun Savel**, 2023. "Preparing a CV”, UMD, College Park.
6 **Arjun Savel**, 2023. "Scientific Writing”, UMD, College Park.
5 **Arjun Savel**, 2023. "Undergraduate mentoring training”, UMD, College Park.
4 **Arjun Savel**, 2022. “CI / CD”, UMD, College Park.
3 **Arjun Savel**, 2022. "Giving a good presentation”, UMD, College Park.
2 **Arjun Savel**, 2021. “Parallel Computing”, UMD, College Park.
1 **Arjun Savel**, 2020. “CI / CD”, UC Berkeley.

Public Talks

5 **Arjun Savel**. Maryland Science Cafe, Spring 2023 **(invited)**.
4 **Arjun Savel**. STAR astronomy club, October 2022 **(invited)**.
3 **Arjun Savel**. Gloucester Area Astronomy Club, January 2021 **(invited)**.
2 **Arjun Savel**. Amateur Astronomers, Inc. December Meeting, 2020.
1 Courtney D. Dressing, Steven Giacalone, Andrew W. Mayo, **Arjun Savel**. Evening with the Stars, UC Berkeley, 2020.

Posters

7 **Arjun Savel** et al. Burgers Symposium, University of Maryland, College Park. 2023 (upcoming).
6 **Arjun Savel** et al. GMT Community Science Meeting, Washington, D.C., 2023.
5 **Arjun Savel** et al. Exoclimes VI, Exeter, UK. 2023.
4 **Arjun Savel**, Courtney D. Dressing, Lea Hirsch, David Ciardi, Jordan P.C. Fleming, Steven Giacalone, Andrew W. Mayo, Jessie L. Christiansen, 2020. “A closer look at planet occurrence rates: AO follow-up of 71 stars in the Kepler field”, AAS 235, Honolulu.
3 **Arjun Savel**, Courtney D. Dressing, Lea Hirsch, David Ciardi, Jordan P.C. Fleming, Jessie L. Christiansen, 2019. “A closer look: AO follow-up of 109 stars in the Kepler and K2 fields”, APSIS Poster Session, UC Berkeley.

2 Courtney D. Dressing, **Arjun Savel** *et al*. 2019. "Characterizing Planetary Systems Orbiting TESS Cool Dwarfs", TESS Science Conference I, MIT.

1 Steven Giacalone, Courtney Dressing, **Arjun Savel**, 2019. "Validation of TESS Exoplanet Candidates", 3rd Advanced School on Exoplanetary Science, Vietri sul Mare.

Research Mentoring

Kenneth Ellis Arnold III, UMD, College Park (with Prof. Eliza M.-R. Kempton), 2022–present
Modeling limb asymmetries of cloudy hot Jupiter atmospheres

Holden Gill, UC Berkeley (with Asst. Prof. Courtney D. Dressing), 2020–2022
Ground-based imaging follow-up of K2 planet hosts

Peer Mentoring

Yash Gursahani, UMD, College Park, via Astro Grad Buddy Program, 2023
Serena Cronin, UMD, College Park, via Astro Grad Buddy Program, 2021
Lawrence Edmond IV, UC Berkeley, via Astronomy Buddy Program, 2019

Observing Experience

3-meter Shane Telescope (ShARCS): assisted with 14.5 nights (Mt. Hamilton, CA)
10-meter Keck Telescope (NIRC2): assisted with 1/2 night (Mauna Kea, HI)
10-meter Keck Telescope (NIRSPEC): assisted with 1/2 night (Mauna Kea, HI)

Teaching Experience

- **Instructor of Record, Astronomy 288I (Introduction to the Astronomy Major)** *UMD College Park (Spring 2023)*
  Designed lectures on career options in the field of astronomy, preparing websites, writing CVs, and networking. Organized panels on graduate school and industry.
- **Teaching Assistant and Grader, Astronomy 320 (Theoretical Astrophysics)** *UMD College Park, with Prof. Eliza Kempton (Spring 2023)*
  Prepared review sessions and discussion problems. Topics spanned gravitation, fluids, and radiation.
- **Undergraduate Student Instructor, Astronomy C12 (The Planets)** *UC Berkeley, with Asst. Prof. Courtney D. Dressing and Prof. Raymond Jeanloz (Spring 2020)*
  Created review sessions for class with hundreds of students, created discussion problems and quizzes. Topics spanned the geology, the solar system, and other things.
- **Undergraduate Student Instructor, Astronomy C10 (Introduction to General Astronomy)** *UC Berkeley, with Alex Filippenko (Fall 2018, Fall 2019)*
  Designed review sessions for class with hundreds of students, created discussion problems and quizzes. Topics spanned the fundamentals of astronomy, stellar classification, exoplanets, and cosmology.

Community Involvement

- Graduate student website committee member, University of Maryland, College Park (2023–present)
- Lead author / maintainer: High-resolution literature database (2022–present)
- Graduation Gift Organizer, University of Maryland, College Park (2022–2023)
- GRAD-MAP Team Co-Lead, University of Maryland, College Park (2022–present)
- Panelist: Carnegie EPL Summer Undergraduate Research Internship (SURI) Program's graduate school workshop (2022)
- BANG! Seminar Organizing Committee, University of Maryland, College Park (2021–2022)
- "Hot Papers" journal club organizer, University of Maryland, College Park (2020–2022)
- Reviewer, Journal of Open Source Software (3 projects reviewed) (2020–present)
- Equity, Diversity, and Inclusion Committee, University of Maryland, College Park (2020–2022)
- GRAD-MAP Team Member, University of Maryland, College Park (2020–2022)
- Public Liaison for Prof. Alex Filippenko (2019–2022)
- Undergraduate Representative, Astronomy Department, UC Berkeley (2019-2020)
- Mentor, Berkeley Astronomy Scholars Program (2019-20)
- Director of Physics and Astronomy, Undergraduate Lab at Berkeley (ULAB) (2018-2019)
- Night Editor, The Daily Californian (2017)

Workshops & Conferences

- GMT Community Science Meeting, Washington, D.C. (2023)
- Exoclimes VI, Exeter, UK (2023)
- Flatiron-wide Algorithms and Mathematics, New York (2022)
- Building Bridges Across Planet-Related Science, Baltimore (2022, 2023)
- Flatiron Exoplanet Atmospheres Symposium, New York (2022)
- Burgers Program Research Symposium on Environmental and Applied Fluid Dynamics (2022, 2023–upcoming)
- Exoplanets IV, Las Vegas (2022)
- Chesapeake Bay Area Exoplanet Meeting, virtual (Spring 2021)
- Exoplanet atmosphere characterization: from HST and Spitzer to JWST (2021)
- JWST Master Class Workshop, Stanford University (2020)
- AAS Winter Meeting, Honolulu (2020)
- Bay Area Exoplanet Meeting, NASA Ames (Spring 2019, Winter 2019, Spring 2020, Spring 2022)
- Bay Area Planetary Science Meeting, Stanford University (2019)

Professional Affiliations

American Astronomical Society
The AEThER Collaboration
The JWST Transiting Exoplanet Collaboration ERS program (JTEC)

Skills & Assets

- **Programming / Markup Languages**: Python, ADQL/SQL, R, C, HTML, JavaScript, LaTeX
- **Supercomputing Clusters**: *deepthought2* and *zaratan* at UMD, College Park; *moria* at MSU; *rusty* at Flatiron CCA
- **Frameworks / Tools**: git, Slurm, Numba, JAX, SciPy, Pandas, React
- **Misc. Skills**: Statistical sampling, astronomical image reduction, radiative transfer, open-source code management, optimization, web development / automation, copy editing
- **Languages**: English (fluent), Spanish (conversational), Hindi (basic)