# Arjun B. Savel

Ph.D. Candidate, Astrophysics Researcher

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## 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 in high-resolution 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–current*

**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: 337 / h-index: 10 / 5 first-author refereed

### Refereed Publications

30 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 [3 citations]

29 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*, ArXiv (arXiv:2306.08179)

28 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

27 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*, ArXiv (arXiv:2305.05697)

26 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 [8 citations]

25 **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 [1 citation]

24 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) [4 citations]

23 **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 [2 citations]

22 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 [8 citations]

21 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 [1 citation]

20 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 [10 citations]

19 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 [6 citations]

18 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 [9 citations]

17 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 [9 citations]

16 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 [1 citation]

15 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*, ArXiv (arXiv:2206.10643)

14 Rodriguez, Joseph E.; Quinn, Samuel N.; Vanderburg, Andrew; Zhou, George *et al.* (119 other co-authors, incl. **Savel, Arjun**) 2022, *Another Shipment of Six Short-Period Giant Planets from TESS*, ArXiv (arXiv:2205.05709)

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

12 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 [5 citations]

11 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) [10 citations]

10 **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 [20 citations]

9 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 [13 citations]

8 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 [22 citations]

7 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 [18 citations]

6 **Savel**, **Arjun**; Kempton, Eliza M. -R.; Malik, Matej; Komacek, Thaddeus D. *et al.*2021, *No umbrella needed: Confronting the hypothesis of iron rain on WASP-76b with post-processed general circulation models*, ArXiv (arXiv:2109.00163)

5 Murakami, Yukei S.; Jennings, Connor; Hoffman, Andrew M.; **Savel**, **Arjun** *et al.* (7 other co-authors, incl. **Savel, Arjun**) 2021, *PIPS, an advanced platform for period detection in time series – I. Fourier-likelihood periodogram and application to RR Lyrae Stars*, ArXiv (arXiv:2107.14223)

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 [97 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 [24 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 [22 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) [44 citations]

## Under Review

4 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*, ArXiv (arXiv:2305.06240) [1 citation]

3 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*, ArXiv (arXiv:2301.08192) [13 citations]

2 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*, ArXiv (arXiv:2205.09728)

1 Gan, Tianjun; Soubkiou, Abderahmane; Wang, Sharon X.; Benkhaldoun, Zouhair *et al.* (60 other co-authors, incl. **Savel, Arjun**) 2022, *TESS discovery of a sub-Neptune orbiting a mid-M dwarf TOI-2136*, ArXiv (arXiv:2202.10024)

## 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 (upcoming). Center for Theory and Computation Lunch Talk, Department of Astronomy, University of Maryland, College Park, MD.
11 **Arjun Savel**, 2023. 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

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.

## Posters

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

Serena Cronin, UMD, College Park, via Astro Grad Buddy Program, 2021

Lawrence Edmond IV, UC Berkeley, via Astronomy Buddy Program, 2019

## 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.

## 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)
- **Teaching Assistant and Grader, Astronomy 320 (Theoretical Astrophysics)** UMD College Park, with Prof. Eliza Kempton (Spring 2023)
- **Undergraduate Student Instructor, Astronomy C12 (The Planets)** UC Berkeley, with Asst. Prof. Courtney D. Dressing and Prof. Raymond Jeanloz (Spring 2020)
- **Undergraduate Student Instructor, Astronomy C10 (Introduction to General Astronomy)** UC Berkeley, with Alex Filippenko (Fall 2018, Fall 2019)

## Community Involvement

- Lead author / maintainer: High-resolution literature database (2022–present)
- Graduation Gift Organizer, University of Maryland, College Park (2022–present)
- 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)
- Mentor, TARDIS Google Summer of Code (2020)
- Public Liaison for Prof. Alex Filippenko (2019–present)
- 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

- Exoclimes VI, Exeter, UK (2023)
- Flatiron-wide Algorithms and Mathematics, New York (2022)
- Building Bridges Across Planet-Related Science, Baltimore (2022)
- Flatiron Exoplanet Atmospheres Symposium, New York (2022)
- Burgers Program Research Symposium on Environmental and Applied Fluid Dynamics, Washington, D.C. (2022)
- 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)