

# Arjun B. Savel

Graduate Student Astrophysics Researcher

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## EDUCATION

### University of Maryland, College Park

Ph.D., Astronomy

M.S., Astronomy | Advisor: Prof. Eliza M.-R. Kempton

College Park, MD

Expected

2022

### University of California, Berkeley

B.A., Astrophysics; B.A., Physics | Advisor: Asst. Prof. Courtney D. Dressing

Berkeley, CA

2020

## POSITIONS

### Pre-doctoral fellow—Center for Computational Astrophysics, Flatiron Institute

Data-driven tellurics treatment in high-resolution spectroscopy of exoplanet atmospheres | Mentor: Dr. Megan Bedell

New York, NY

2022–current

### Consultant—ScienceBetter Consulting

Tutorial Jupyter notebooks for MAST science cases | Manager: Prof. Kelle Cruz

New York, NY

2022

### Graduate Researcher—University of Maryland, College Park

Three-dimensionality in high-resolution transmission spectra of ultra-hot Jupiters | Advisor: Prof. Eliza M.-R. Kempton

College Park, MD

2020–current

### Research Assistant—University of California, Berkeley

Exoplanet occurrence rates and ground-based imaging follow-up of Kepler stars | Advisor: Asst. Prof. Courtney D. Dressing

Berkeley, CA

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
- Distinguishing between equilibrium and disequilibrium chemistry in exoplanet atmospheres
- Modeling time-independent magnetohydrodynamics in hot planet atmospheres
- Characterizing exoplanetary systems and host stars

## PUBLICATIONS (\* = MENTORED STUDENT)

citations: 215 / h-index: 8 / 3 first-author refereed, 2 under review (2022-12-14)

### REFEREED PUBLICATIONS

- 17 **Savel, Arjun**; Hirsch, Lea A.; \*Gill, Holden; Dressing, Courtney D.; *et al.*, 2022, *SimMER: A Pipeline for Reducing and Analyzing Images of Stars*, ArXiv ([arXiv:2212.00641](https://arxiv.org/abs/2212.00641)) (in press)
- 16 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](https://arxiv.org/abs/2204.12996)) [2 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](https://arxiv.org/abs/2206.06254)) [3 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](https://arxiv.org/abs/2206.11268)) [1 citation]
- 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](https://arxiv.org/abs/2205.09728)) [2 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) [6 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) [3 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) [6 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) [14 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) [10 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) [18 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) [15 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) [57 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) [21 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) [19 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) [34 citations]

#### UNDER REVIEW

- 3 **Savel, Arjun et al.** 2022, *Diagnosing limb asymmetries in hot and ultra-hot Jupiters with high-resolution transmission spectroscopy*, submitted
- 2 Lillo-Box, J.; Gandolfi, D.; Armstrong, D. J.; Collins, K. A.; *et al.* (60 other co-authors, incl. **Savel, Arjun**), 2022, *TOI-969: a late-K dwarf with a hot mini-Neptune in the desert and an eccentric cold Jupiter*, ArXiv (arXiv:2210.08996)
- 1 Rodriguez, Joseph E.; Quinn, Samuel N.; Vanderburg, Andrew; Zhou, George; *et al.* (118 other co-authors, incl. **Savel, Arjun**), 2022, *Another Shipment of Six Short-Period Giant Planets from TESS*, ArXiv (arXiv:2205.05709) [3 citations]

#### SELECTED HONORS, PRIZES, & AWARDS

- 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

- 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.

- <sup>6</sup> **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**).
- <sup>5</sup> **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.
- <sup>4</sup> 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.
- <sup>3</sup> **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
- <sup>2</sup> **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.
- <sup>1</sup> **Arjun Savel**, 2019. “Earth: Rare or Regular?”, Undergraduate Seminars, UC Berkeley.

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## POSTERS

- <sup>4</sup> **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.
- <sup>3</sup> **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.
- <sup>2</sup> Courtney D. Dressing, **Arjun Savel** *et al.* 2019. “Characterizing Planetary Systems Orbiting TESS Cool Dwarfs”, TESS Science Conference I, MIT.
- <sup>1</sup> Steven Giacalone, Courtney Dressing, **Arjun Savel**, 2019. “Validation of TESS Exoplanet Candidates”, 3rd Advanced School on Exoplanetary Science, Vietri sul Mare.

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## RESEARCH ADVISING

Kenneth Ellis Arnold, UMD College Park (with Prof. Eliza M.-R. Kempton), 2022–present  
 Holden Gill, UC Berkeley (with Asst. Prof. Courtney D. Dressing), 2020–2022

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## PUBLIC TALKS

- <sup>4</sup> **Arjun Savel**. STAR astronomy club, October 2022.
- <sup>3</sup> **Arjun Savel**. Gloucester Area Astronomy Club, January 2021.
- <sup>2</sup> **Arjun Savel**. Amateur Astronomers, Inc. December Meeting, 2020.
- <sup>1</sup> Courtney D. Dressing, Steven Giacalone, Andrew W. Mayo, **Arjun Savel**. Evening with the Stars, UC Berkeley, 2020.

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## 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)

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## TEACHING EXPERIENCE

**Undergraduate Student Instructor, Astronomy C12 (The Planets)**: UC Berkeley, with Courtney D. Dressing and Raymond Jeanloz (2020)  
**Undergraduate Student Instructor, Astronomy C10 (Introduction to General Astronomy)**: UC Berkeley, with Alex Filippenko (2018-19)

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## COMMUNITY INVOLVEMENT

- Lead author / maintainer: [High-resolution literature database](#) (2022–present)
- Graduation Gift Organizer, University of Maryland, College Park (2022–present)
- Panelist: Carnegie EPL Summer Undergraduate Research Internship (SURI) Program’s graduate school workshop (2022)
- GRAD-MAP Team Co-Lead, University of Maryland, College Park (2022–present)
- BANG! Seminar Organizing Committee, University of Maryland, College Park (2021–2022)
- Peer mentor, 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

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- Flatiron-wide Algorithms and Mathematics (2022)
- Building Bridges Across Planet-Related Science (2022)
- Flatiron Exoplanet Atmospheres Symposium (2022)
- Burgers Program Research Symposium on Environmental and Applied Fluid Dynamics (2022)
- Exoplanets IV (2022)
- Chesapeake Bay Area Exoplanet Meeting (Spring 2021)
- Exoplanet atmosphere characterization: from HST and Spitzer to JWST (2021)
- JWST Master Class Workshop, Stanford University (2020)
- AAS Winter Meeting (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

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American Astronomical Society  
The [AETHER](#) Collaboration

## SKILLS & ASSETS

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- **Programming / Markup Languages:** Python, ADQL/SQL, R, C, HTML, JavaScript,  $\text{\LaTeX}$
- **Supercomputing Clusters:** *deephought2* and *zaratan* at UMD, College Park; *moria* at MSU; *rusty* at Flatiron CCA
- **Frameworks / Tools:** git, Slurm, Numba, JAX, SciPy, Pandas, React
- **Misc. Skills:** MCMC, neural networks, astronomical image reduction, radiative transfer, open-source code management, optimization, web development / automation, copy editing
- **Languages:** English (fluent), Spanish (conversational), Hindi (basic)