JAMILA PEGUES

Postdoctoral Fellow at the **Space Telescope Science Institute (STScI)**
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AT A GLANCE

Astrophysics/Research Science: Conducts observational surveys and crafts theoretical models of the chemistry within *protoplanetary disks* - i.e., the disks of gas and dust around young stars that one day birth exoplanets.

Computer Science: Has formal education, experience, and a passion for software development, pipeline development, and the design of intelligent systems.

Leadership and Project Management: Highlights include serving as PI/Team Lead of an ALMA Cycle 11 Large Program (Code 2024.1.01001.L), and as Team Lead/Manager for projects within the Science Policies Group (SPG) and the Library Division at the Space Telescope Science Institute (STScI).

EDUCATION AND EMPLOYMENT

STScI Postdoctoral Fellow, Baltimore, MD — *September 2021 - Present*
4-Year Fellowship, with time split between 50% independent research and 50% functional service in support of STScI's missions.

Harvard University, Cambridge, MA, USA — *August 2016 - May 2021*
Ph.D in `Astronomy`
Master of Science in `Computational Science and Engineering`

Princeton University, Princeton, NJ, USA — *September 2012 - May 2016*
Bachelor of Arts in `Astrophysical Sciences` — GPA: 3.30/4.00
Certificate of Proficiency in `Applications of Computing`
Certificate of Proficiency in `Robotics and Intelligent Systems`

TECHNICAL SKILLS, FOCUSES, AND INTERESTS

Astrophysics	Protoplanetary disks, planet formation, astrochemistry; surveys and models
Computer Science	Software development, intelligent system design, data science
Computer Tools	Python, Java, MATLAB, R; LaTeX, GitHub; CASA
Outreach	Science policy and communication, informal education, equity and inclusion
Languages	English *(Fluent)*; Japanese *(Intermediate)*

FIRST-AUTHOR RESEARCH AND SOFTWARE DEVELOPMENT

Investigations of Ultraviolet Spectral Approximations for Computing Photochemical Reaction Rates
Co-Authors: L. I. Cleeves, K. I. Öberg, et al.
Submitted to ApJ

- Used photochemical cross-sections and approximated ultraviolet stellar spectra to compute and compare photodissociation and photoionization reaction rates, ultimately investigating the accuracy of the rates as a function of 1) the spectral approximation and 2) the host star.
- Developed the codebase *argonaut* to model protoplanetary disk chemistry using publicly available tools, with particular care toward the treatment of the stellar radiation fields and its propagation throughout the modeled disks.

· Generated a series of *argonaut* astrochemical disk models using different ultraviolet spectral approximations and host stars; analyzed how inaccuracies in the approximated rates propagated through to the modeled chemistry.

***bibcat*: Bibliography Automation Prototype for the STScI Library Division**
Prototype complete; paper in prep.

· Developed the user-friendly codebase *bibcat*, a prototype codebase for automating the classification of papers based on how they use (or do not use) data from a given mission (e.g., the Hubble Space Telescope or *TESS*). Features of the codebase included the ability to:
  - Flexibly allow the user to define missions, such that the codebase is agnostic to the mission itself and therefore potentially useful beyond STScI's own missions.
  - Internally train, operate, and employ machine learning tools to classify given text; designed so as to decrease the burden on the user to manage these tools directly.
  - Reduce the fundamental complexity of the text fed into the embedded machine learning tool in different and experimental ways, including via mission-anonymization and the removal of clauses.
  - Screen for and flag false positive terms (such as 'Hubble constant') to help maintain purity of the final classified dataset.

An SMA Survey of Chemistry in Disks Around Herbig AeBe Stars
Co-Authors: K. I. Öberg, Chunhua Qi, et al.
Published in ApJ (May 2023)

· Calibrated, imaged, and analyzed observations from the Submillimeter Array (SMA) of a sample of five protoplanetary disks around Herbig stars.
· Searched and compiled fluxes of targeted molecules published in the literature, forming a statistically significant database of chemistry observed in protoplanetary disks across the stellar spectrum.
· Investigated and characterized trends in the molecular fluxes across the combined SMA and literature sample as a function of the host star.

An Atacama Large Millimeter/submillimeter Array Survey of Chemistry in Disks around M4-M5 Stars
Co-Authors: K. I. Öberg, J. B. Bergner, et al.
Published in ApJ (April 2021)

· Systematically performed individual data reduction on ALMA observations towards five protoplanetary disks for a suite of molecular lines and dust continuum in the millimeter regime.
· Used data analysis techniques to compare the emission morphologies and fluxes between M4-M5 star disks in this work and T Tauri disks from previous works.
· Used a Markov-Chain Monte Carlo (MCMC) approach and linear algebra techniques to fit models of the hyperfine structure of C_2H and HCN molecular lines and to extract excitation temperatures, column densities, and optical depths for the molecules and disks.

Dynamical Masses and Stellar Evolutionary Model Predictions of M Stars
Co-Authors: I. Czekala, S. M. Andrews, et al.
Published in ApJ (February 2021)

· Dynamically measured the stellar masses for a small sample of protoplanetary disks around low-mass ($\leqslant 0.5 M_\odot$) M-stars using the Markov-Chain Monte Carlo (MCMC)-based software `DiskJockey`.
· Evaluated the performance of stellar evolutionary models, which predict stellar mass based on secondary stellar properties, that assumed different underlying stellar physics. This evaluation was carried across a combined sample of low-mass stars (from this work and from the literature) with dynamically-measured stellar masses and precise distance measurements from *GAIA*.

An ALMA Survey of H_2CO in Protoplanetary Disks
Co-Authors: K. I. Öberg, J. B. Bergner, et al.
Published in ApJ (February 2020)

- Performed individual data reduction on ALMA observations of multiple transition lines of H_2CO, along with observations of CO, towards 15 protoplanetary disks in total.
- Wrote a Python module that theoretically calculates masks for a protoplanetary disk's emission at all velocities, given that disk's stellar and geometric properties, and assuming a turbulence structure and that the disk is Keplerian. This module is available on Github: https://github.com/jpegues/kepmask.
- Statistically summarized the H_2CO and CO emission of each disk in several ways, including through channel maps, integrated emission maps, radial profiles, and spectral histograms.

MAJOR RESEARCH COLLABORATIONS

PI of ALMA CHEER: Chemistry of Herbig Environments and their Exoplanet Relationships Fall 2024 - Present
PI: Dr. J. Pegues — Project Code: 2024.1.01001.L

- Currently PI of the ALMA CHEER collaboration, where ALMA CHEER is an ALMA Cycle 11 Large Program that targets ions, cold molecules, complex organics, and much more for a sample of 20 Herbig disks, in order to characterize the unique chemical and planet-forming environments of Herbig stars.
- As PI, is leading, organizing, and coordinating the efforts of the entire collaboration.
- Is working with subteams within the collaboration to develop software pipelines for 1) imaging all target disks in the sample and 2) systematically and flexibly measuring emission products of the sample, including fluxes, spectra, and column densities.
- Once all data has been observed and processed, will spearhead projects that *) microanalyze the ion and cold chemistry across the sample and *) place Herbig disk chemistry into the context of the overarching pre-main-sequence stellar distribution.

Co-I of ALMA DECO: The ALMA Disk-Exoplanet C/Onnection Fall 2022 - Present
PI: Dr. L. I. Cleeves — Project Code: 2022.1.00875.L

- Currently an active member of the ALMA DECO collaboration, where ALMA DECO is an ALMA Cycle 9 Large Program that targets C/O tracers in a very large sample of ∼80 T Tauri disks.
- Developed software for the team to algorithmically automate a variety of initial data-inspection tasks, including:
  - Estimating the degree to which emission is likely (un)detected for each disk.
  - Systematically extracting and compiling grids of fluxes, velocity-integrated emission maps, and spectra for each target.
  - Marking disks likely to have extended or large-scale structure.
  - Flagging disks with asymmetries in their Keplerian emission.
- Once all data has been observed and processed, will spearhead a project that investigates the three-dimensional environmental effects and footprints on disk chemistry within each star-forming region.

FUNCTIONAL MANAGEMENT AND LEADERSHIP ROLES

JWST DD Review Team Lead, Science Policies Group, STScI *July 2023 - Present*
JWST DD Review Team Member, Science Policies Group, STScI *July 2022 - Present*

- As Team Lead, key tasks include, but are certainly not limited to:
  - Organizing, coordinating, and assigning submitted JWST Director's Discretionary (DD) proposals to members of the review subteam.
  - Monitoring all DD proposals and their deadlines, and ensuring that team members complete the external peer review processes within the time allotted.

- Working with members of the science subteam to determine the validity of submitted DDs, and to decide on the final consensus for recommendation of approval, rejection, or disqualification to the Director.
- Fully processing approved/rejected/disqualified proposals, and communicating the final verdicts to the proposal PIs.
- For self-assigned DD proposals: Coordinating the external peer review process. This includes researching and recruiting external peer reviewers for each assigned proposal, with special care to invite early-career reviewers and/or reviewers from underrepresented backgrounds.

HST and JWST Panel Manager, Science Policies Group, STScI *Multiple observing cycles*

- *Cycles served so far:* HST Cycle 30, JWST Cycle 2, JWST Cycle 3, JWST Cycle 4.
- Key tasks include, but are certainly not limited to:
  - For each cycle, reading through previous cycles of abstracts, proposals, and topical keywords well beyond her own research subjects to determine the balance and expertise necessary for recruitment of assigned panels.
  - Recruiting all panelists for both Discussion Panels (panels including virtual meeting component) and External Panels (panels with no virtual meeting component) within each assigned topical area (one topical area per cycle). Pays especially close attention to balancing, e.g., diversity and background, with the aim of increasing panel/service opportunities and representation for researchers from traditionally underrepresented backgrounds, and/or in early career stages.
  - Attending the virtual meeting components of Discussion Panels for each cycle served. Answers and/or redirects science policy questions asked by the panel, and helps monitor the meetings, e.g., the discussion itself and the proposal ranking phases.
  - *Software development:* Wrote code to provide a number of recruitment assistant tools, including the extraction of keywords and panelists from abstract catalogues of previous cycles, and using output cosine-similarity scores from PACMan (Strolger et al. 2017, 2023) to generate statistics filtered by user-given keywords and topics. Streamlined, presented, and shared this code with the rest of the Science Policies Group during JWST Cycle 4 recruitment.

Active Member, Science Policies Group, STScI *Fall 2021 - Present*

- Attends and contributes to discussion affecting the science policies implemented for both HST and JWST.

Coordinator for the HST Cycle 32 Call for Proposals, Science Policies Group, STScI

- Key tasks included, but were certainly not limited to:
  - Coordinating, updating, reviewing, and finalizing the Call for Proposals for HST Cycle 32.
  - Communicating with different divisions and stakeholders; monitoring their input for, and implementing their suggested changes into, the Call for Proposals.
  - Designing the front page cover for the final published Call!

TALKS, CONFERENCES, COMMITTEES, AND AWARDS

Informal talk (institution): August 24, 2024
Stars and Planet Formation Group Meeting, STScI, USA

Formal talk (institution): June 12, 2024
"Bibliography Categorization (bibcat) Final Prototype Presentation", the STScI Library and Metrics Divisions, STScI, USA.

Accepted proposal (ALMA): Cycle 11 (started Fall 2024)
ALMA Cycle 11 Large Program, *"A Survey of Planet-Forming Chemistry in the Precursor Environments of Giant Planets"*.

Formal talk (university): April 18, 2024
"Modeling Protoplanetary Disk Photochemistry around a Variety of Young Stars", Princeton University Science Visit + DEI Panel, Princeton University, USA.

Formal talk (institution): April 09, 2024
"Modeling Protoplanetary Disk Photochemistry around a Variety of Young Stars", Earth & Planets Laboratory Astro Seminar Series, Carnegie Institute in Washington DC, USA.

Formal talk (institution): August 16, 2023
"Know Thy Star, Know Thy Chemistry", STScI HotSci Seminar Series, STScI, USA.

Poster (conference): July 10-14, 2023
IAU Astrochemistry VIII Conference, USA.

JWST Spring 2023 Symposium Organizing Committee (member): Spring, 2023
Member of the committee for organizing and running the JWST Spring 2023 Symposium at STScI.

Formal talk (workshop): May 23-26, 2023
"Insights and Statistics from Disk Chemistry Surveys", ALMA DECO Workshop Spring 2023, Virginia, USA.

Poster (conference): April 10-15, 2023
Protostars and Planets VII Conference, Kyouto, Japan.

STScI Postdoctoral Fellowship Selection Committee (member): October-December, 2022
Member of the committee for reviewing and selecting STScI Postdoctoral Fellowship applicants.

Formal talk (conference): October 03-07, 2022
"Models of Protoplanetary Disk Chemistry across the Stellar Spectrum (Early Progress)", From Clouds to Planets II Conference; Berlin, Germany.

Attendee (workshop): August 22-26, 2022
Astronomy, Astrochemistry, & the Origin of Life Summer School; Heidelberg, Germany.

Formal talk (conference): December 7, 2020
5 Years after HL Tau Conference; Remote conference, hosted by the ESO, NRAO (NAASC+ngVLA), and ALMA in Chile.

Formal talk (university): November 16, 2020
UChicago Exoplanet Journal Club Seminar; Remote Seminar, hosted by the astronomy and geophysics departments at the University of Chicago, IL, USA.

Formal talk (university): November 9, 2020
UCSC Planetary Lunch Seminar; Remote Seminar hosted by the astronomy and planetary science departments at the University of California Santa Cruz, CA, USA.

Formal talk (university): September 14, 2020
Origins Seminar Series; Virtual Seminar hosted by the astronomy departments at the University of Arizona, AZ, USA.

Formal talk (conference): June 15, 2020
Astrochemical Frontiers Conference; Virtual Meeting hosted by the IAU Commission H2 Steering Committee.

Formal talk (conference): January 8, 2020
American Astronomical Society 235^{th} Meeting; Hawaii, USA.

Informal talk (university): December 3, 2019
CfA Exoplanet Lunch Series; Center for Astrophysics | Harvard & Smithsonian, MA, USA.

Formal talk (institution): August 12, 2019
Exoplanet/Stars and Planet Formation Seminar; Space Telescope Science Institute, USA.

Poster (conference): March, 2017
International Astronomical Union Symposia (IAUS) 332; Puerto Varas, Chile.

Awarded fellowship:
5-year National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) fellowship.

PUBLICATION HIGHLIGHTS

1. Diop, A., Cleeves, L. I., Anderson, D. E., **Pegues, J.** & Plunkett, A. Disentangling CO Chemistry in a Protoplanetary Disk Using Explanatory Machine-learning Techniques. **962,** 90. arXiv: 2312.05254 [astro-ph.EP] (Feb. 2024).
2. **Pegues, J.,** Öberg, K. I., Qi, C., Andrews, S. M., Huang, J., Law, C. J., Le Gal, R., Matrà, L. & Wilner, D. J. An SMA Survey of Chemistry in Disks Around Herbig AeBe Stars. **948,** 57. arXiv: 2303.02167 [astro-ph.EP] (May 2023).
3. Strolger, L.-G., **Pegues, J.,** King, T., Miles, N., Ramsahoye, M., Ceruti Keith, I., Blacker, B. & Reid, I. N. PACMan2: Next Steps in Proposal Review Management. **165,** 215. arXiv: 2303.04220 [astro-ph.IM] (May 2023).
4. **Pegues, J.,** Czekala, I., Andrews, S. M., Öberg, K. I., Herczeg, G. J., Bergner, J. B., Ilsedore Cleeves, L., Guzmán, V. V., Huang, J., Long, F., Teague, R. & Wilner, D. J. Dynamical Masses and Stellar Evolutionary Model Predictions of M Stars. *ApJ* **908,** 42. arXiv: 2101.05838 [astro-ph.SR] (Feb. 2021).
5. **Pegues, J.,** Öberg, K. I., Bergner, J. B., Huang, J., Pascucci, I., Teague, R., Andrews, S. M., Bergin, E. A., Cleeves, L. I., Guzmán, V. V., Long, F., Qi, C. & Wilner, D. J. An Atacama Large Millimeter/submillimeter Array Survey of Chemistry in Disks around M4-M5 Stars. *ApJ* **911,** 150. arXiv: 2105.04681 [astro-ph.GA] (Apr. 2021).
6. **Pegues, J.,** Öberg, K. I., Bergner, J. B., Loomis, R. A., Qi, C., Gal, R. L., Cleeves, L. I., Guzmán, V. V., Huang, J., Jørgensen, J. K., Andrews, S. M., Blake, G. A., Carpenter, J. M., Schwarz, K. R., Williams, J. P. & Wilner, D. J. An ALMA Survey of H2CO in Protoplanetary Disks. *ApJ* **890,** 142. https://doi.org/10.3847%2F1538-4357%2Fab64d9 (Feb. 2020).
7. Le Gal, R., Öberg, K. I., Loomis, R. A., **Pegues, J.** & Bergner, J. B. Sulfur Chemistry in Protoplanetary Disks: CS and H_2CS. **876,** 72. arXiv: 1903.11105 [astro-ph.GA] (May 2019).
8. Piso, A.-M. A., **Pegues, J.** & Öberg, K. I. The Role of Ice Compositions for Snowlines and the C/N/O Ratios in Active Disks. **833,** 203. arXiv: 1611.00741 [astro-ph.EP] (Dec. 2016).

REFERENCES

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Dr. Neill Reid

· *Current Functional Supervisor*
· Multi-Mission Project Scientist, Space Telescope Science Institute (STScI), Baltimore, MD, USA
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Dr. Karin Öberg

· *Ph.D Advisor and Current Research Collaborator*
· Professor of Astronomy, Center for Astrophysics | Harvard & Smithsonian, Cambridge, MA, USA
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Dr. Alessandra Aloisi

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· Former Head of the STScI Science Mission Office, currently at NASA Headquarters, Baltimore, MD, USA
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