

Communication Tips & Tricks for Posters and Pops

PROTO Sagan Pre-Workshop

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Jet Propulsion Laboratory
California Institute of Technology

Key Points

- Consider Your Audience
- Prioritize Readability
- Use a Consistent Format
- Practice Different Versions

The Goals of a Research Poster

- The poster is a tool to help you present your research to an audience.
- Your poster will allow you to:
 - *Quickly convey to your audience the importance of your research topic.*
 - *Share your results with an academic audience.*
 - *Engage with your audience.*
 - *Build your professional network!*

Modeling Protoplanetary Disk Continuum Surface Brightness

INFERENCE FOR HIGH-RESOLUTION ALMA DATA



Anjali Tripathi & Sean Andrews, Harvard-Smithsonian Center for Astrophysics
atripathi@cfa.harvard.edu

Motivation

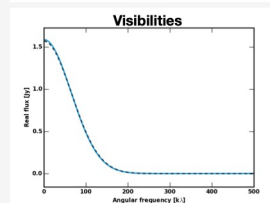
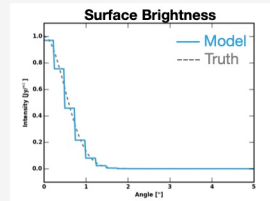
Millimeter continuum emission from dust in disks provides a key observational constraint on planet formation. However, radio interferometry presents challenges for modeling the dust's surface brightness. Previously, the standard approach has used analytic brightness profiles, derived from gas dynamics.

In the ALMA era, modeling now includes ad-hoc complexity to explain features unexplained by simpler analytic models. To find an appropriate model for high-resolution data, we have developed a flexible model to infer the dust surface brightness.

How to model the dust?

Discrete Surface Brightness Model

We don't know the parametric equation for the dust. To easily transform into visibilities, we treat the intensity as the sum of heaviside functions, or annuli. We assume a thin axisymmetric disk.



Discretization of a Gaussian profile

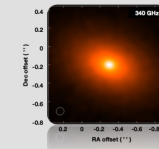
Applications

Find a simple, generalized parametric profile that describes continuum disk emission

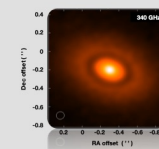
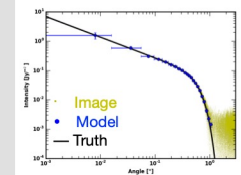
- Characterize disk size
- Characterize gap depths
- Anything you can think of!
Our code will be available for public use.

Examples

We synthesized data for dust distributed according to traditional analytic profiles. Our discrete model recovers these profiles, including injected gaps.



Power law with an exponential taper



With a marginally-resolved gap

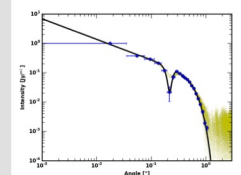
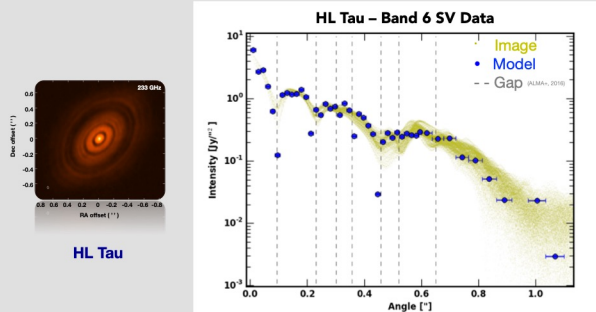


Illustration with HL Tau Gaps

We find a preliminary, coarse model for the surface brightness of HL Tau. Increasing the number of annuli in our model will yield an improved surface brightness profile. Still, we find larger gap depths than in the reconstructed image, as expected of the true profile.



Data from ALMA Partnership, Brogan, Perez et al., 2015

Method overview

- Inputs
- Visibilities
 - Reconstructed image

- Choices
- Distribution of annular bins
 - Inference method

Summary

We have developed a flexible method for modeling high-resolution continuum data. Unlike simple analytic, parametric models, our model is well-suited to highlighting features such as gaps and overdensities – useful in the era of ALMA data.

Astronomers' Research Poster "Secrets"

- You *do not* need to be "good at" art to make a good-looking poster!



Astronomers' Research Poster “Secrets”

- You *do not* need to be “good at” art to make a good-looking poster!
- Most astronomers make their posters in Microsoft PowerPoint / Google Slides
- Change the slide size to your poster dimensions and you are ready to go!
 - For the Sagan Workshop this is no larger than 4ft by 4ft.
 - Always adhere to the poster session guidelines

Necessary Elements of a Research Poster

- The title of your work
- Names of Researchers and Advisors
- Logos / Names of funding sources
- Abstract / Research Question
- Introduction
- Methods
- Results
- Conclusions / Next Steps
- Bibliography
- QR to the paper if work is published

Optional: Work appropriate photo so people know who to look for if you are not standing by your poster.

Practice Presenting Your Poster

- Prepare to present your poster in 30 seconds, 2 minutes, and 5 minutes
- Virtual Presentations will have a fixed amount of presentation time.
- In every version you still want to answer:
 - *What is your research question? (Introduction)*
 - *Why is your topic important? (Background / Motivation)*
 - *How did you answer your research question? (Methods)*
 - *What did you find out? (Results / Conclusions)*

Consider Your Audience

- Will you always be present at your poster? Will people see the poster without you there? Are you presenting virtually?
- Who will you be presenting to?
- Prepare for:
 - *Experts*
 - *People with some background knowledge*
 - *People with very little background knowledge*
 - *You! Participants like you will be visiting other people's posters!*

Consider Your Audience

- Engage with the audience.
 - *Posters can be much more interactive than a standard talk.*
- You can ask them questions!
 - *Feel free a person's familiarity with the topic*
 - *Ask if a particular section interests them*
- Posters can be a great opportunity to network and find common interests with your audience members.
- Presenting Virtually: You can ask an answer questions in the slack channel for your poster session.

Style Considerations

- Your subject area / topic should be obvious at a glance!
- People will look at your figures first!
 - *Then maybe the headers / titles*
 - *Then maybe bulleted lists*
- Put anything you really want people to remember in these locations.

Style Considerations

- Minimalist Text
 - *Limit text to the most important messages.*
 - *While presenting you can fill in additional details or answer questions.*
- Make sure all text and images are a readable size
- Use a consistent font for equations. LaTeX may be helpful here.
- Avoid putting too much content on the poster (especially large blocks of text)
 - There is only so much you can tell a person in about 5 minutes!

Use Consistent Color and Text themes for readability

- Readability is essential in quickly conveying information to your audience.
- Stick with a color theme
 - Dramatically different or overused colors can be hard to read.
 - Check that you have appropriate contrasts between your text and your background using tools like colorbrewer2.org or [adobe color contrast analyzer](#).
 - Check that your poster is legible to those with color blindness with tools like [adobe color accessibility](#).
- Avoid relying solely on color to convey meaning. Instead, use *patterns* or shading in addition to color on charts, graphs, illustrations, and maps where color differences are intended to convey information.

Use Consistent Color and Text themes for readability

- Generally Stick with a very readable font (avoid *overly ornate fonts*, avoid **Comic Sans**)
- A sans serif font is known to be easier to read than a serif font.
- Do not **change** font **size** too **often**.
- Be consistent with how you present information.
 - Eg. Using bullet points vs paragraphs
- Review your poster with the view set to 100 percent to see if it is readable from 4-5 feet away

Practice!

- You need to practice the words you want to say out loud! Many times!
- Prepare different versions of your presentation based on:
 - *Your audience's technical background*
 - *The interest level of your audience*
 - *Time limits: 30 seconds, 2 minutes, and 5 minutes*
- Practice in front of people!
 - Coworkers, other students, family, and friends involved!
 - Even without a technical background, practice audience members can give great constructive feedback!
- Presenting Virtually: If you are recording your poster presentations you can record multiple times and use the best one!

Ask for feedback on your poster

- Ask someone familiar with your project for feedback on drafts of your poster.
 - Give them several days to reply with feedback
- Ask feedback from your peers who may work in other subject areas.
- You may iterate multiple times on feedback, start this process early!
- A great poster can take several hours to make!

Example Posters

- It takes many iterations to make a great poster!
- You will pick up ideas from posters you like the more posters you see and the more times you present a poster.
- There is no “one right way” to make a poster!



Transit Method of Exoplanet Detection In Light Polluted Areas

Alison Duck, Mentor: Elizabeth Warner
University of Maryland, College Park

Exoplanets

Exoplanets are “extra solar” planets which orbit around stars other than our Sun. Around 3,300 exoplanets have been confirmed. The easiest type of planet to detect is a “Hot Jupiter.” This a planet the size of Jupiter or larger with an orbit very close to its host star.

Exoplanet Transit

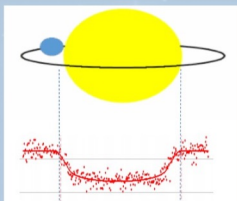


Figure 1
The start of the transit is called the “Ingress” time and the end of the transit is called the “egress” time.

The transit method detects an exoplanet crossing between its host star and Earth’s line of sight. A Charged-Couple Device, or CCD camera is used to count photons received from a star. As the exoplanet transits, the CCD camera collects fewer photons resulting in a dip in the light curve. The depth and duration of the dip can provide information about the exoplanet’s orbit and size.

Differential Photometry

Differential photometry compares the photon counts from the target star and several comparison stars to account for effects resulting from atmospheric conditions like passing clouds. If one star has a drop in photon counts over a period of time in comparison to other stars then an exoplanet transit has occurred. It also considers calibration images to account for dust and heat produced by the camera.

Importance of Amateur Data

- Essential for refining ingress and egress times
- Refined ingress and egress times can provide evidence for other unseen exoplanets
- Accurate ingress and egress times are needed to study the atmospheres of exoplanets
- Amateur organizations like the KELT Follow Up Network work with professional scientists to confirm exoplanets and help refine data about the exoplanet

Procedure

1. Used Czech Exoplanet Transit Database to select targets
2. Filled in Exoplanet Data Sheet
3. Focused 7in telescope on host star’s right ascension and declination
4. Used MaxIm DL to capture images every 60 seconds
5. Observed 30 minutes before and after predicted ingress and egress
6. Took calibration images: Flat Field, Dark, and Bias
7. Used the AAVSO Variable Star Plotting Tool to find comparison stars
8. Conducted Differential Photometry using AstrolmageJ
9. Fit light curve to an Exoplanet Transit Model
10. Compared predicted and observed transit midpoints to determine how well the data fit the model.

WASP-104b Imaging



The star in the green circle is the target star, WASP-104. The two stars in red are comparison stars that are not variable. Comparison stars allow for differential photometry to detect an exoplanet transit.

Equipment

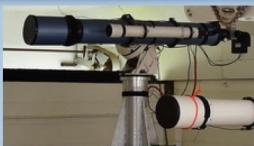
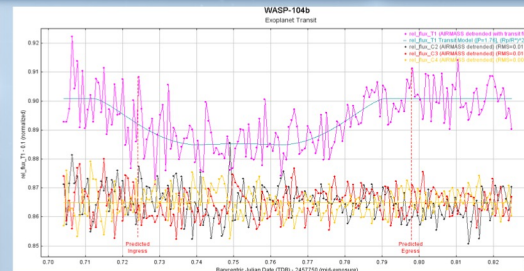


Figure 2
The 7 in refracting telescope is mainly used for imaging planets and star clusters.

- 7 inch Astro-Physics Refracting Telescope
- SBIG ST-7 CCD Camera
- Field of View: 15x10 arcminutes
- MaxIm DL Imaging Software
- AstrolmageJ Data Processing Software

WASP-104b Observed Data



I ran my imaging sequence 30 minutes before and after the ingress and egress times predicted by the Exoplanet Transit Database of the Czech Astronomical Society to get a baseline flux for WASP-104. Then I fit the above light curve to an exoplanet transit model. The predicted transit midpoint was off by 13.6 minutes in comparison to the predicted transit midpoint. The Exoplanet Transit Database predicted the transit would last 105 minutes. I recorded a 110 minute transit. However the database showed that other observers have recorded durations between 95 minutes and 140 minutes so my observation is well within this range. I recorded a transit depth of .014 mag which is close to the accepted .0158 mag reported by the Exoplanet Transit Database. The slope of the observed transit ingress and egress also predicts that the planet has a radius of 1 Jupiter radii which is close to 1.14 Jupiter radii reported by Smith et al. in *Astronomy & Astrophysics*.

References

Conti, D. (n.d.). Transit Cartoon [Digital image]. Retrieved from Astrodenis.com

Conti, D. (2016, July). Seek exoplanets From Your Backyard. *Astronomy*, 44(7), 61-63.

Exoplanet Transit Database of the Czech Astronomical Society
<http://var2.astro.cz/ETD/index.php>

Gendler, R. (2006, January 9). M45: The Pleiades Star Cluster [Digital image]. Retrieved from <http://apod.nasa.gov/apod/ap060109.html>

Howard, A. W., & Seager, S. (2013, May 3). Exoplanets. *Science*, 340(6132), 565-581.

Teuben, P. (2015, August 5). UMD Observatory [Digital image]. Retrieved from <https://www.flickr.com/photos/teuben/20303938025>

Tribick, A., Sturm, C., & Varley, R. (2016, June 21). Open Exoplanet Catalogue. Retrieved from <http://www.openexoplanetcatalogue.com/>

Smith, A. Et al. (2014, October). WASP-104b and WASP-106b: two transiting hot Jupiters in 1.75-day and 9.3-day orbits. *Astronomy & Astrophysics*, 570. doi:10.1051/0004-6361/201424752

KELT-15b: An Exploration of Systematic Uncertainties in Transiting Planets and Their Host Stars

Alison Duck¹, B. Scott Gaudi¹, Jason D. Eastman², and Joseph E. Rodriguez³

¹Department of Astronomy - The Ohio State University, ²Center for Astrophysics - Harvard & Smithsonian, ³Department of Physics and Astronomy, Michigan State University

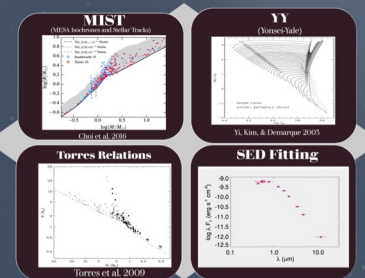


The Mass-Radius Degeneracy

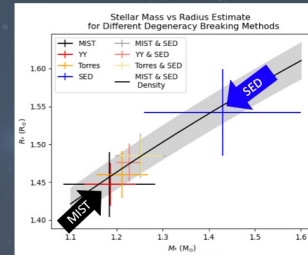
Transit and radial velocity observations of planets like KELT-15b can be used to constrain the density of their host star. However, this leads to a one-parameter degeneracy in the mass and radius of the host star, and by extension the planet. We investigate the systematic uncertainties introduced by different methods of breaking this degeneracy and contribute to the error budget of known planets.

$$\rho_* = \frac{3\pi}{GP^2} \left(\frac{\delta^{\frac{1}{4}} P}{\pi \sqrt{e} T_{fwhm}} \sqrt{1-e^2} \right)^3$$

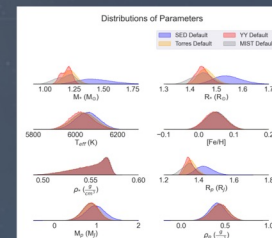
Using Stellar Models to Break the Degeneracy



A 6.5 or 1.8 σ Change in R_* Between the MIST and the SED methods of modelling KELT-15



The stellar density estimate is roughly consistent across all models. The MIST constraint produces the smallest R_* and M_* while the SED constraint produces the largest estimates. This produces a fractional difference of 6.5% or 1.8 σ . The combination constraints (MIST+SED, YY+SED, and Torres+SED) are more tightly grouped with a spread of 0.3 σ .



The posterior distributions show the same spread in R_* and R_p , while maintaining agreement in ρ_* and ρ_p .

Using EXOFASTv2 to Investigate Systematics Uncertainties

We globally modeled the KELT-15 system using EXOFASTv2 (Eastman et al. 2012, 2019) by:

1. Selecting a method of modelling the host star
2. Assuming a circular orbit
3. Providing a spectroscopically derived prior on T
4. Using the Claret limb darkening tables for transits
5. Checking for convergence and comparing the results

We also test eccentric orbits, freely fitting limb darkening, and removing the spectroscopically derived prior on T_{eff} .

Stellar Model Choice Impacts Planet Properties

- Our *single constraint* models display a 6.5% or a 1.8 σ change in R_* and R_p between the smaller MIST estimate and larger SED estimate
- The *combination constraint* model estimate of R_* and R_p span only 0.3 σ
- Imposing circular orbit constraints routinely may artificially reduce the uncertainty in many parameters, even in systems with eccentricities consistent with zero.

Citations

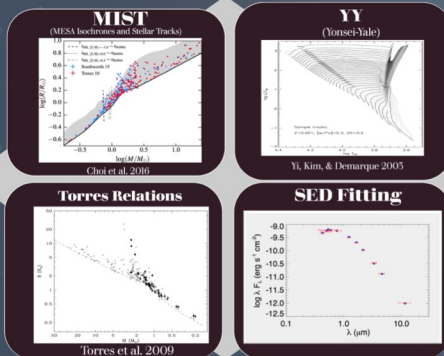
Choi, J. et al. 2016, *Apl*
Claret, A. 2017, *A&A*
Duck, A. et al. 2023, *Apl* submitted, arxiv: 2209.09266
Duck, A., et al. 2023, *MNRAS*
Eastman, J. et al. 2012, *Astrophysics Source Code Library*, ascl:1207.001
Eastman, J. D., et al. 2019, arXiv:1907.09480
Rodríguez, J. E., et al. 2016, *AJ*
Seager, S., & Mallen-Ornelas, G. 2003, *Apl*
Torres, G., et al. 2009, *A&A*
Yi S., Kim, Y., Demarque, P. 2003 *Apl*, 144, 2

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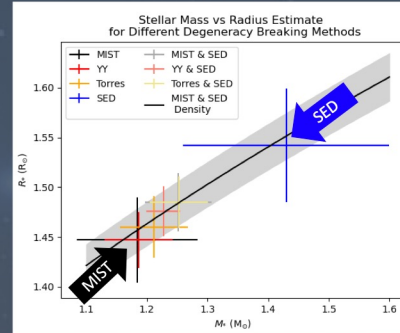
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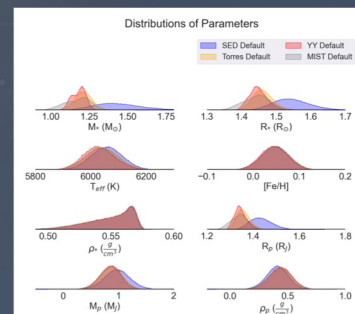
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Citations

- Choi, J et al. 2016, ApJ
Claret, A., 2017, A&A
Duck, A et al. 2023, ApJ submitted, arxiv: 2209.09266
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Eastman, J., et al 2012, Astrophysics Source Code Library, ascl:1207.001
- Eastman, J. D., et al. 2019, arXiv:1907.09480
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Seager, S., & Mallen-Ornelas, G. 2003, ApJ
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Yi S., Kim, Y., Demarque, P. 2003 ApJ, 144, 2

Exploring Systematic Errors in the Inferred Parameters of the Transiting Planet KELT-15b and its Host Star

Robert Hurt¹, E. Scott Shultz¹, Jason D. Eastman¹, Joseph J. Rodriguez²

¹Dept. of Astronomy, The Ohio State University, ²Center for Astrophysics | Harvard & Smithsonian, ³Dept. of Physics and Astronomy, Michigan State University

A.I. Poster:
Claude

MOTIVATION & BACKGROUND

Transiting planet systems allow measurement of masses and radii — but only relative photometry and radial velocity data constrain the HOST STAR DENSITY, leaving a one-parameter degeneracy between M_* and R_* .

Additional information must break this degeneracy. Four common approaches are compared here:

- SED + Gaia parallax (most empirical)
- MST evolutionary tracks (default in EXOPASTv2)
- Yonsei-Wale (Y1) evolutionary tracks
- Times mass-radius relations (semi-empirical)

KELT-15b: A REPRESENTATIVE HOT JUPITER

Host Star Type: G0, $T_e = 6430$ K
V magnitude: $V = 11.2$
Rx: -1.2 (R)
Ri: -1.49 (R)

Planet Period: 3.33 days
Rp: -1.43 R_{Jup}
Mp: -0.95 M_{Jup}
Datasets: TESS + ground RV

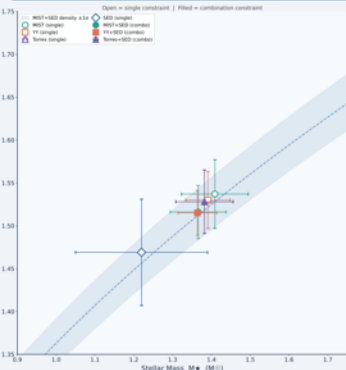
ANALYSIS FRAMEWORK (28 MODEL VARIATIONS)



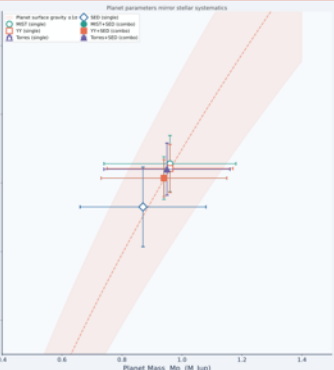
OBSERVATIONAL DATA

- PHOTOMETRY**
- 5 TESS sectors (Jan-Feb 2018; early 2021)
 - KELT-South, LCOGT, PEST, AATwide Obs.
- RADIAL VELOCITY**
- CORALIE @ ESO La Silla
 - AAT / FICOLDS2
- KEY PRIORS**
- T_e from Sousa (2018) (6426±72 K)
 - R_p from -0.2 to 0.2 dex
 - Class (D/K) parallax (constant)
 - Convergence: Gehrmann-Huber v1.01

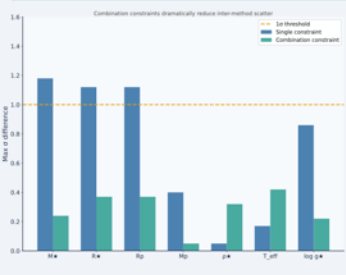
STELLAR MASS vs RADIUS — ALL METHODS



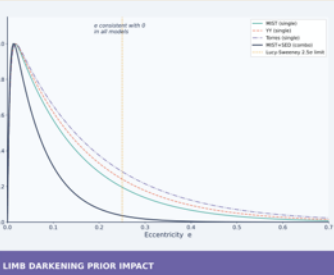
PLANET MASS vs RADIUS — ALL METHODS



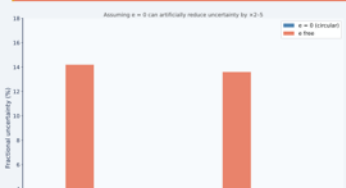
SIGMA DIFFERENCES BETWEEN METHODS



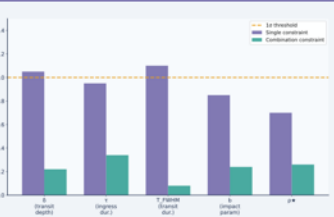
ECCENTRICITY POSTERIORS (FREE @ MODELS)



IMPACT OF ECCENTRICITY & T_e PRIOR



LIMB DARKENING PRIOR IMPACT



EFFECT OF T_e SPECTROSCOPIC PRIOR

Comparison	σ difference	Interpretation
SED default vs SED vs T_e	-0.24x	Sousa+2018 $T_e = SED \cdot T_e$
MST S18 vs MST S16 T_e	-2p in R_*	600 K difference → 6% larger R_*
SED S16 vs SED S18 T_e	-1p in R_*	Different extinction regime

KEY CONCLUSIONS & BEST PRACTICES

- Agreement to $\sim 1.1p$ across all single-constraint methods for R_* and R_p — systematic errors not ubiquitous, but not negligible.
- Combination constraints (e.g. MST+SED) reduce error without scatter to $\sim 0.8p$ across all physical parameters. Strongly recommended.
- Eccentricity prior matters: Forcing $e = 0$ can reduce uncertainties by $\times 2.5$, potentially artificially use free fit as a check.
- T_e spectroscopic prior is critical: A 600 K error in T_e produces a $\sim 2p$ shift in R_* . Cross-check with SED-derived T_e is essential.
- Limb-darkening prior has modest effect: $\sim 1p$ changes in directly observable parameters. Check tables vs free fit, be explicit about choice.
- Global simultaneous fitting (EXOPASTv2) essential — sequential fitting induces critical correlations between stellar and planetary parameters.

KEY REFERENCES

Rodriguez et al. 2016, AJ, 151, 138 | Eastman et al. 2016, EXOPASTv2 (arXiv:1607.08461) | Sousa et al. 2016, AAS, 626, 488 | Teyssier et al. 2012, AAS, 627, 15
 Torres et al. 2009, A&A, 518, 67 | Delfino 2016, AAS, 222, 8 (MST) | Yi et al. 2001, AAS, 136, 437 (Y1) | Claret & Bloeker 2011, AAS, 528, A75

Systematic Errors in the Inferred Parameters of KELT-15b

Alison Duck, B. Scott Gaudi, Jason D. Eastman, Joseph E. Rodriguez

Department of Astronomy, The Ohio State University | arXiv:2209.09266

A.I. Poster:
Gemini

Introduction

Precise measurement of exoplanet mass and radius is vital for understanding planetary compositions.

However, photometry and RV data alone only constrain **host star density**.

This creates a **one-parameter degeneracy** in mass and radius. We test how different "degeneracy-breaking" methods impact inferred parameters

Methodology

We utilized **EXOFASTv2** to perform a global modeling of KELT-15. We explored **28 combinations** of priors and constraints across four methods:

- **Torres Relations:** Empirical mass-radius relations.
- **YY Isochrones:** Yonsei-Yale stellar evolution tracks.
- **MIST Isochrones:** MESA Isochrones & Stellar Tracks.
- **SED Fitting:** Direct stellar radius from SED + Gaia Parallax

Key Results

We find significant systematic differences between models despite high statistical precision:

- **~6% Difference:** Observed in stellar and planetary radii between MIST isochrones and SED fitting.
- **~1.1 σ Agreement:** Broad agreement across most methods, but significant (2σ) shifts based on effective temperature

KELT-15b: An Exploration of Systematic Uncertainties in Transiting Planets and Their Host Stars

Alison Duck¹, B. Scott Gaudi¹, Jason D. Eastman², and Joseph E. Rodriguez³

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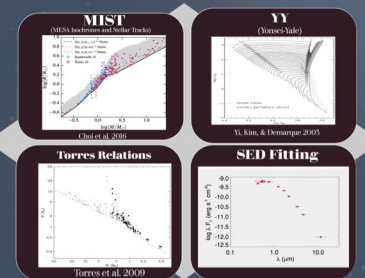


The Mass-Radius Degeneracy

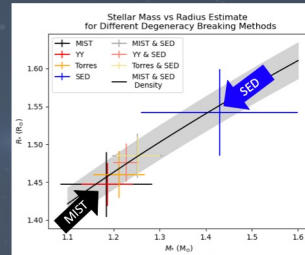
Transit and radial velocity observations of planets like KELT-15b can be used to constrain the density of their host star. However, this leads to a one-parameter degeneracy in the mass and radius of the host star, and by extension the planet. We investigate the systematic uncertainties introduced by different methods of breaking this degeneracy and contribute to the error budget of known planets.

$$\rho_* = \frac{3\pi}{GP^2} \left(\frac{\delta^{\frac{1}{4}} P}{\pi \sqrt{e} T_{fwhm}} \sqrt{1-e^2} \right)^3$$

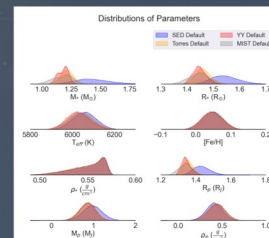
Using Stellar Models to Break the Degeneracy



A 6.5 or 1.8 σ Change in R_* Between the MIST and the SED methods of modelling KELT-15



The stellar density estimate is roughly consistent across all models. The MIST constraint produces the smallest R_* and M_* while the SED constraint produces the largest estimates. This produces a fractional difference of 6.5% or 1.8 σ . The combination constraints (MIST+SED, YY+SED, and Torres+SED) are more tightly grouped with a spread of 0.3 σ .



The posterior distributions show the same spread in R_* and R_p , while maintaining agreement in ρ_* and ρ_p .

Using EXOFASTv2 to Investigate Systematics Uncertainties

We globally modeled the KELT-15 system using EXOFASTv2 (Eastman et al. 2012, 2019) by:

1. Selecting a method of modelling the host star
2. Assuming a circular orbit
3. Providing a spectroscopically derived prior on T
4. Using the Claret limb darkening tables for transits
5. Checking for convergence and comparing the results

We also test eccentric orbits, freely fitting limb darkening, and removing the spectroscopically derived prior on T_{eff} .

Stellar Model Choice Impacts Planet Properties

- Our *single constraint* models display a 6.5% or a 1.8 σ change in R_* and R_p between the smaller MIST estimate and larger SED estimate
- The *combination constraint* model estimate of R_* and R_p span only 0.3 σ
- Imposing circular orbit constraints routinely may artificially reduce the uncertainty in many parameters, even in systems with eccentricities consistent with zero.

Citations

Choi, J. et al. 2016, *Apl*
Claret, A. 2017, *A&A*
Duck, A. et al. 2023, *Apl* submitted, arxiv: 2209.09266
Duck, A., et al. 2023, *MNRAS*
Eastman, J., et al. 2012, *Astrophysics Source Code Library*, ascl:1207.001
Eastman, J. D., et al. 2019, arXiv:1907.09480
Rodríguez, J. E., et al. 2016, *AJ*
Seager, S., & Mallen-Ornelas, G. 2003, *Apl*
Torres, G., et al. 2009, *A&A*
Yi S., Kim, Y., Demarque, P. 2003 *Apl*, 144, 2

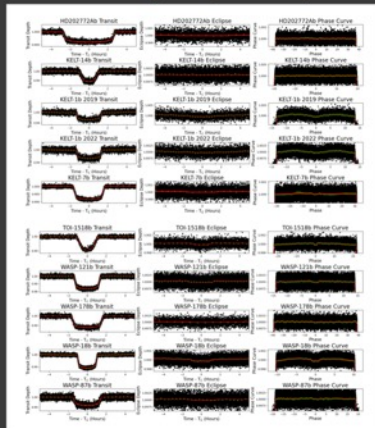


A Uniform Analysis of 9 Secondary Occultations with TESS of Ultra Hot Jupiters and a Brown Dwarf

Alison Duck, NASA Exoplanet Exploration Program Postdoctoral Fellow

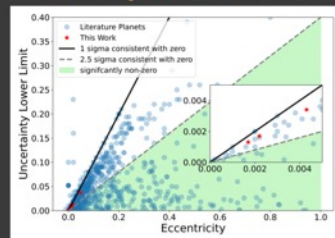
Goal: Characterizing Hot Jupiter secondary eclipse depths, eccentricities, bond albedos, heat recirculation efficiencies, and systematic uncertainties with TESS.

Secondary Eclipse Sample



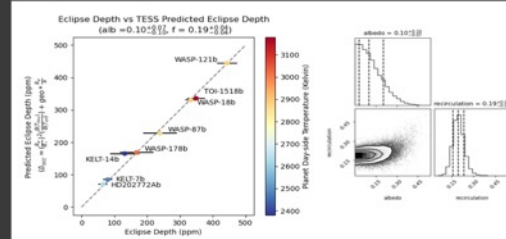
We present **new TESS secondary eclipse observations** for the first time for HD 202772A b and WASP-87 b. We estimated the secondary eclipse signal to noise ratio for the 80 hot Jupiters observed in Cycle 5. We detected secondary eclipses in 9 of the top 20 candidates using EXOFAST2 (Eastman et al. 2019).

Precisely Circular Orbits



We present 3 of the 30 most precisely circular planetary eccentricity measurements in the literature and improve the precision in eccentricity for 7 of our 9 targets. Precisely characterizing eccentricities is essential in understanding the formation mechanism of hot Jupiters.

Sample Average Bond Albedo and Heat Recirculation

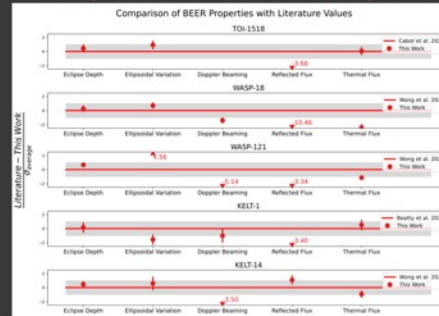


We find that our sample has an average bond albedo (A_B) consistent with zero as expected from detailed multi-band Spitzer studies of hot Jupiters with day side brightness temperatures ($T_{p,d}$) over $\sim 2200\text{K}$ (Garhart et al. 2020). We also find a low sample average heat recirculation efficiency ($\epsilon \sim 0.2$) also found in Spitzer observations of systems with high irradiation (Dang et al. 2025).

$$T_{p,d} = T_{eff} \left(\frac{R_p}{a} \right) (1 - A_B)^{\frac{1}{4}} \left(\frac{2}{3} - \frac{5}{12} \epsilon \right)^{\frac{1}{4}}$$

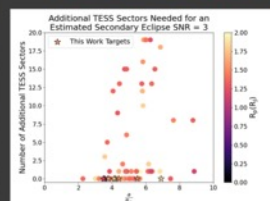
We show that we can recover these population level trends with a single band-pass and publicly available analysis tools.

Eclipse Characterization Comparison



We compare our estimates of the BEER (BEaming, Ellipsoidal, and Reflection) effects (Faigler & Mazeh 2011) using EXOFAST2 to previously published values in the literature. We find good agreement, largely within 1 σ , for eclipse depth, thermal flux, and ellipsoidal variation. We find limitations in the characterization of Doppler beaming and the reflected light contribution due to the single red band-pass of TESS.

Additional Targets in the TESS Extended Mission



Most confirmed planets required many more than 20 additional sectors of observations. Roughly 30 targets currently have an estimated secondary eclipse SNR >3 and ~ 15 need only one additional sector to achieve an estimated SNR = 3.

We estimate the SNR for the secondary eclipse depth (δ_{sec}) using the equation below including the geometric albedo (A_g), the Planck function integrated over the wavelengths of the TESS band-pass (B_λ), and the radius of the planet (R_p), the radius of the host star (R_*), and the brightness temperature of the host star (T_*) and planet ($T_{p,d}$).

$$\delta_{sec} = \left(\frac{R_p}{R_*} \right)^2 \frac{B_\lambda(T_{p,d})}{B_\lambda(T_*)} + A_g \left(\frac{R_p}{a} \right)^2$$

#BetterPoster

- Clearly communicates the main message of your poster
- Leaves audience members quickly skimming with a clear takeaway
- Caveat: can feel more like an advertisement than a presentation aid
- Lots of room for customization!

Resource:

<https://mitcommlab.mit.edu/be/2023/09/27/toward-an-evenbetterposter-improving-the-betterposter-template/>

Title:
Subtitle

PRESENTER:
Leeroy Jenkins

BACKGROUND: Who cares? Explain why your study matters in the fastest, most brutal way possible (feel free to add graphics!).

METHODS

1. Collected [what] from [population]
2. Tested it with X process.
3. Illustrate your methods if you can.
4. Try a flowchart!

RESULTS

- Graph/table with essential results only.
- All the other correlations in the ammo bar.

Main finding goes here, translated into **plain English. Emphasize the important words.**

Visualize your findings with an image, graphic, or a key figure.

Take a picture to download the full paper

AMMO BAR

Delete this and replace it with your...

- Extra Graphs
- Extra Correlation tables
- Extra Figures
- Extra nuance that you're worried about leaving out.
- **Keep it messy!** This section is just for you.

Leeroy Jenkins, author2, author3, author4, author5, author6, author7, author42

Citation: Mike Morrison

Modeling Protoplanetary Disk Continuum Surface Brightness

INFERENCE FOR HIGH-RESOLUTION ALMA DATA



Anjali Tripathi & Sean Andrews, Harvard-Smithsonian Center for Astrophysics
atripathi@cfa.harvard.edu

Motivation

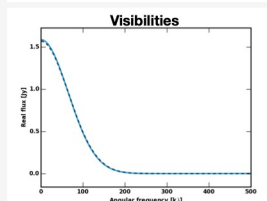
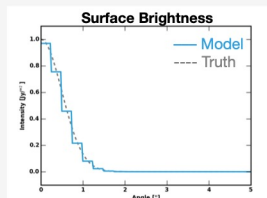
Millimeter continuum emission from dust in disks provides a key observational constraint on planet formation. However, radio interferometry presents challenges for modeling the dust's surface brightness. Previously, the standard approach has used analytic brightness profiles, derived from gas dynamics.

In the ALMA era, modeling now includes ad-hoc complexity to explain features unexplained by simpler analytic models. To find an appropriate model for high-resolution data, we have developed a flexible model to infer the dust surface brightness.

How to model the dust?

Discrete Surface Brightness Model

We don't know the parametric equation for the dust. To easily transform into visibilities, we treat the intensity as the sum of heaviside functions, or annuli. We assume a thin axisymmetric disk.



Discretization of a Gaussian profile

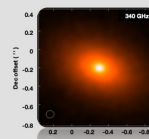
Applications

Find a simple, generalized parametric profile that describes continuum disk emission

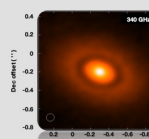
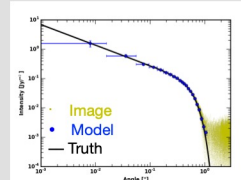
- Characterize disk size
- Characterize gap depths
- Anything you can think of!
Our code will be available for public use.

Examples

We synthesized data for dust distributed according to traditional analytic profiles. Our discrete model recovers these profiles, including injected gaps.



Power law with an exponential taper



With a marginally-resolved gap

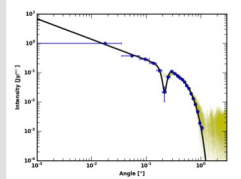
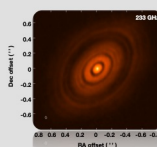
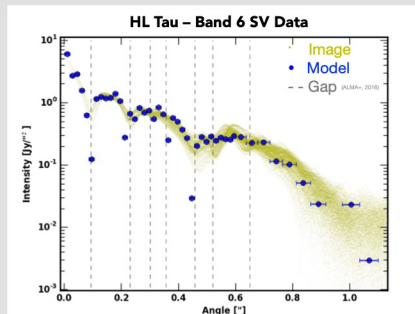


Illustration with HL Tau Gaps

We find a preliminary, coarse model for the surface brightness of HL Tau. Increasing the number of annuli in our model will yield an improved surface brightness profile. Still, we find larger gap depths than in the reconstructed image, as expected of the true profile.



HL Tau



Data from ALMA Partnership, Brogan, Perez et al., 2015

Method overview

- Inputs
- Visibilities
 - Reconstructed image

- Choices
- Distribution of annular bins
 - Inference method

Summary

We have developed a flexible method for modeling high-resolution continuum data. Unlike simple analytic, parametric models, our model is well-suited to highlighting features such as gaps and overdensities – useful in the era of ALMA data.

Poster “Pop” Slides vs Posters

- Poster Pop: A short powerpoint presentation with 1-2 slides summarizing/advertising your poster
- You will present your poster pop, it does not need to stand alone.
- Your chance to highlight your results to a wide audience
- Quickly highlight major result of your work
- Less detail than contained on your full poster

Poster "Pop" Slide

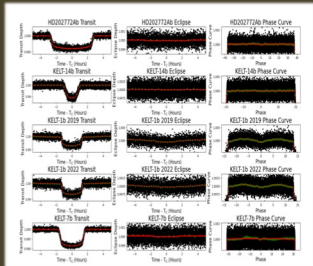


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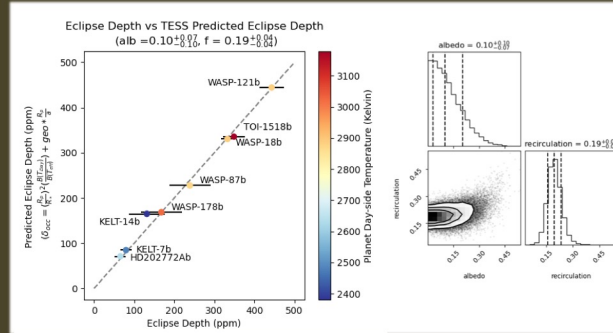
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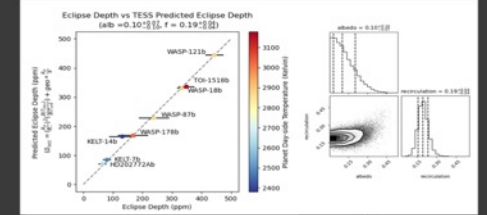


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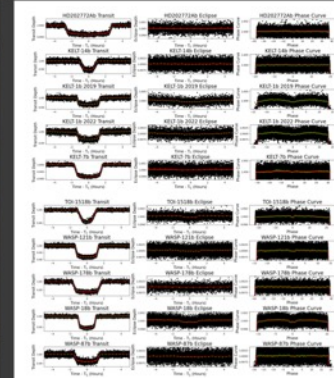
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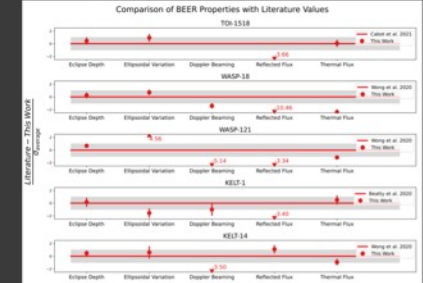
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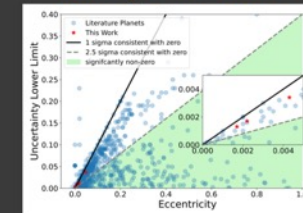
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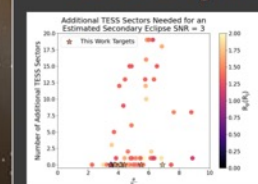
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How to be a Good Poster Session Audience Member

- Ask Questions!
 - You can begin an interaction at a poster by asking “Can you tell me about your work?”
 - If something at the beginning of the presentation is unclear, it is best to ask about it right away!
 - It is very likely that other people listening to the poster presentation have the same question.
- Engage!
 - If you like something about a person’s poster or project, let them know!
 - You could ask for the person’s professional contact information if you would like to continue the scientific discussion beyond the poster session.
- Go to posters on a wide variety of topics!
 - Helps broaden your knowledge of active research.
 - Helps presenters practice talking to someone outside of their field

How to be a Good Poster Session Audience Member

- Posters are often grouped by topic, talk to the presenters nearby or in your session! You likely have research interests in common
- Presenting Virtually: Engage with the slack channel! Feel free to ask and answer questions about your work on slack! You can follow up conversations about your posters with Direct Messages in the slack as well!
 - *Try to find connections between your work and share your posters with each other!*

Thank you!

- Consider your audience
- Prioritize readability
- Use a consistent format
- Practice different versions

Questions?