Journal Club – Spring 2023

Introduction

Prof. James Davenport, ASTR 575, 2023-March-31

Why *you* should do Journal Club?

- Fun
- Learn new topics
  - Learn them well enough to discuss quickly, not to have deep expertise
- Practice giving talks
  - Critically: practice giving short and focused talks!

Why am *I* doing Journal Club?

- Fun
- Learn new topics
- Help build enthusiasm and community – “service”

Why PAA A114?

- Elder millennial hipster instructor being goofy
- Just to see if we could…

- Let’s face our fears, speak in front of large spaces!

The Rules

- NEW papers ($t < 1$ year) or OLD papers ($t > 50$ years)
- Let Jim know by Monday, 11:59pm the paper
- Everyone needs to ask some questions - don’t leave your colleauge hanging!
- Talk: aim for 15 minutes
- Skip the outline
- Give a concrete Conclusion or Takeaway
- Keep it positive - this isn’t just a paper-bashing-party

The Rules

- Sign up for a talk slot!!!
  - Who is going to go first?! *I will give you a prize for being first*

	A	B	C	D	E	F	G
1	Date	Presenter 1	Paper	Presenter 2	Paper	Notes	
2	3/31/2023	James Davenport	Intro				
3	4/7/2023					canceled	
4	4/14/2023						**Fridays, 230-330pm**
5	4/21/2023	Andy Tzanidakis	TBD				PAA A114
6	4/28/2023	Sam Garza	TBD	Bonni Choi	TDB		Zoom Link
7	5/5/2023	Tom Wagg	TBD				
8	5/12/2023	David Wang	TBD	Jake Kurlander	TBD		
9	5/19/2023						
10	5/26/2023	Samantha Gilbert		Megan Gialluca	TBD		
11	6/2/2023						
12							
13							

Discussing Prep

- Lots of work? **Let's address that!**
- In your wheelhouse or stretch your mind?
- How many supporting papers should you read?
- Outline your talk, delete your outline
- What should your talk include?

What *should* your talk include?

- Why you picked this paper/topic?
- Coherent, relevant background on the topic, aimed @ a senior-undergrad level… ~5min, enough to tell the story! History is great, but don't get stuck
- Key ingredients/challenges/opportunities/data/tools/players - NOT *everything* that went into it
- Key results - NOT *all* the results
- Open questions, gotchas, dissenting opinions (again: no paper bashing!)
- Summary – Leave your summary slide up!

What *can* your talk include?

- Personal notes, connection to your work or past/future
- Memes, jokes, artistic style, fun
- New plots you've made, rabbit holes you go down
- Experimental presentation styles - please feel free to try… & possibly fail… for our amusement

What can your talk *NOT* include?

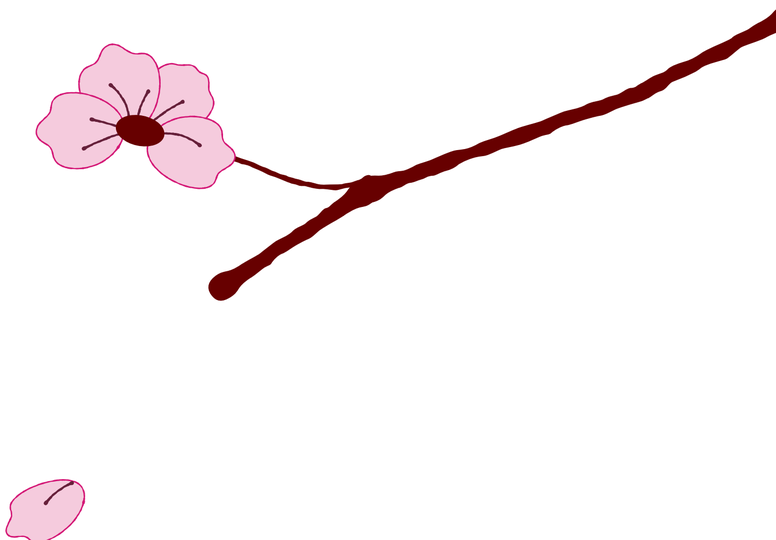
- Personal attacks, harassment, vitriol, racism, classism, sexism……..
  - Student/university code of conduct violations will be reported!
- “Punching down”, tool shaming, etc.
- Only jokes with no science. I *will* come to your standup show, but not during Journal Club!
- Going wayyyyy over time. This isn’t your defense!

Hype!

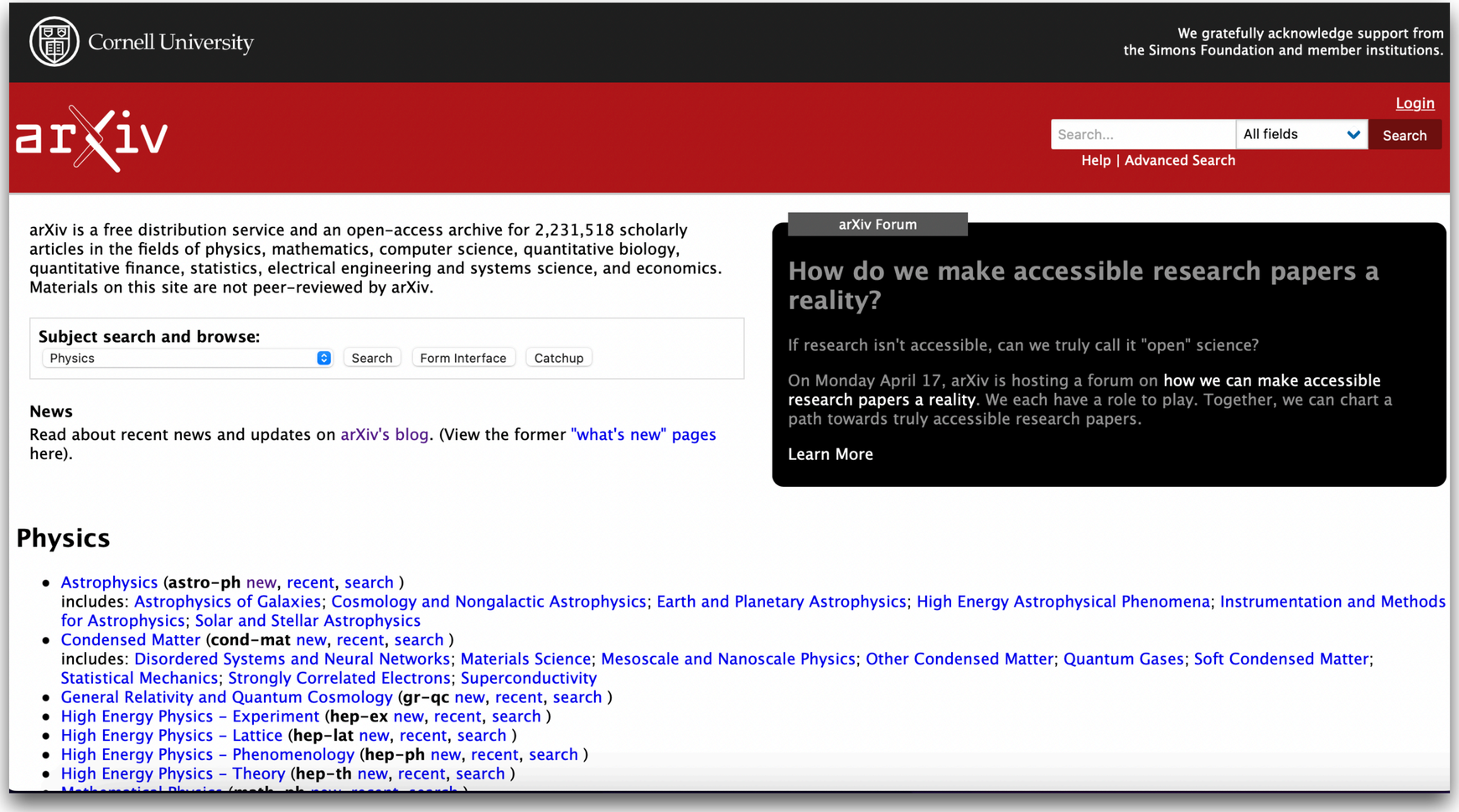
- Let’s get excited

An example…

- How would I prepare for my Journal Club presentation?



First I would go to the arXiv new papers…



Start looking at TITLE, maybe filter by topic

Astrophysics

New submissions

Submissions received from Wed 29 Mar 23 to Thu 30 Mar 23, announced Fri, 31 Mar 23

- New submissions
- Cross-lists
- Replacements

[total of 107 entries: **1-107**]
[showing up to 2000 entries per page: fewer | more]

New submissions for Fri, 31 Mar 23

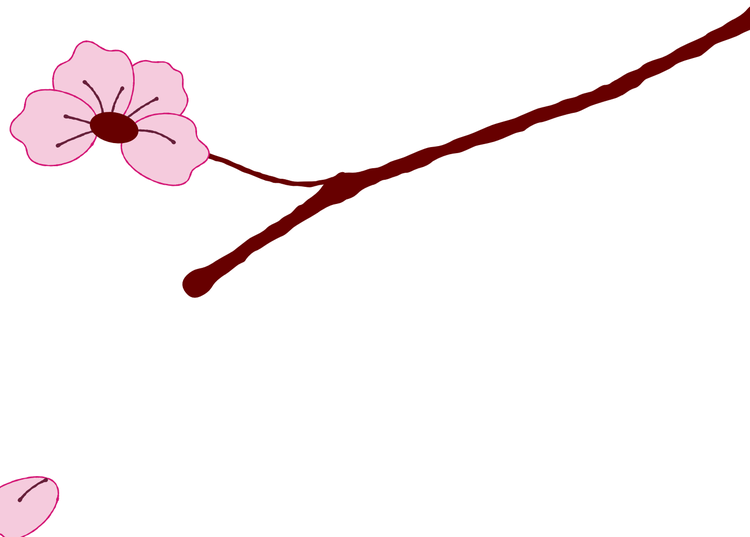
[1] **arXiv:2303.16901** [**pdf**]

Specialist Discussion Meeting: 3D structure of the flare chromosphere
David Kuridze, Lyndsay Fletcher, Hugh Hudson
Comments: Journal: Astronomy & Geophysics (URL) to the published version of the Article - this https URL
Journal-ref: Astronomy & Geophysics, 2022, Volume 63, Issue 6, pp.6.34-6.39
Subjects: **Solar and Stellar Astrophysics (astro-ph.SR)**; High Energy Astrophysical Phenomena (astro-ph.HE)

David Kuridze, Lyndsay Fletcher and Hugh Hudson report on the RAS Specialist Discussion Meeting '3D Structure of the Flare Chromosphere'.

[2] **arXiv:2303.16902** [**pdf**, **other**]

GRB-SN Association within the Binary-Driven Hypernova Model
Y. Aimuratov, L. M. Becerra, C.L. Bianco, C. Cherubini, M. Della Valle, S. Filippi, Liang Li, R. Moradi, J. A. Rueda, R. Ruffini, N. Sahakyan, Y. Wang, S. R. Zhang
Comments: Submitted on January 17, 2023
Subjects: **High Energy Astrophysical Phenomena (astro-ph.HE)**



Start looking at TITLE, maybe filter by topic

[3] arXiv:2303.16915 [pdf, other]

A Modest Proposal for the Non-existence of Exoplanets: The Expansion of Stellar Physics to Include Squars

Charity Woodrum, Raphael E. Hviding, Rachael C. Amaro, Katie Chamberlain

Comments: 7 pages, 4 figures, publication pending litigation. For all intents and purposes this manuscript is dated April 1st, 2023

Subjects: **Earth and Planetary Astrophysics (astro-ph.EP)**; Solar and Stellar Astrophysics (astro-ph.SR)

The search for exoplanets has become a focal point of astronomical research, captivating public attention and driving scientific inquiry; however, the rush to confirm exoplanet discoveries has often overlooked potential alternative explanations leading to a scientific consensus that is overly reliant on untested assumptions and limited data. We argue that the evidence in support of exoplanet observation is not necessarily definitive and that alternative interpretations are not only possible, but necessary. Our conclusion is therefore concise: exoplanets do not exist. Here, we present the framework for a novel type of cuboid star, or squar, which can precisely reproduce the full range of observed phenomena in stellar light curves, including the trapezoidal flux deviations (TFDs) often attributed to "exoplanets." In this discovery paper, we illustrate the power of the squellar model, showing that the light curve of the well-studied "exoplanet" WASP-12b can be reconstructed simply from a rotating squar with proportions $1 : 1/8 : 1$, without invoking ad-hoc planetary bodies. Our findings cast serious doubt on the validity of current "exoplanetary" efforts, which have largely ignored the potential role of squars and have instead blindly accepted the exoplanet hypothesis without sufficient critical scrutiny. In addition, we discuss the sociopolitical role of climate change in spurring the current exoplanet fervor which has lead to the speculative state of "exoplanetary science" today. We strongly urge the astronomical community to take our model proposal seriously and treat its severe ramifications with the utmost urgency to restore rationality to the field of astronomy.

[4] arXiv:2303.16920 [pdf, other]

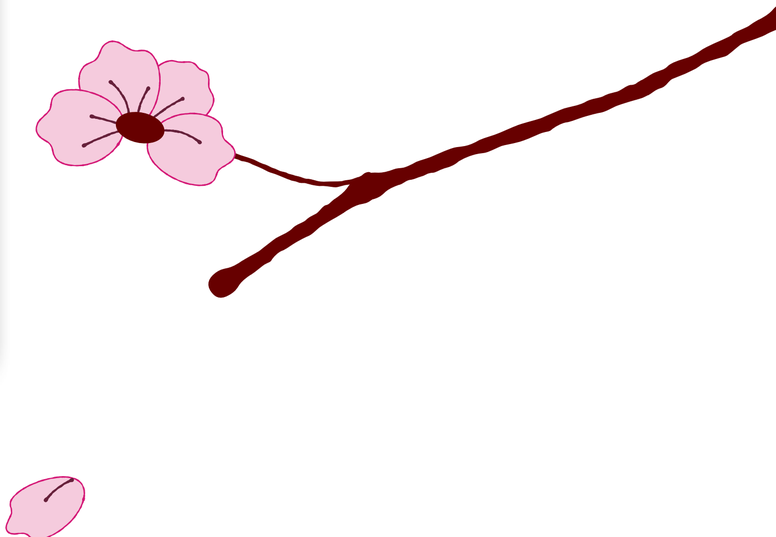
On the impact of spectral template uncertainties in synthetic stellar populations

C. M. Byrne, E. R. Stanway

Comments: Accepted for publication in MNRAS. Supplemental material attached as an appendix. Output data available from this https URL or this https URL

Subjects: **Astrophysics of Galaxies (astro-ph.GA)**; Cosmology and Nongalactic Astrophysics (astro-ph.CO); Solar and Stellar Astrophysics (astro-ph.SR)

Uncertainties in stellar population models, both in terms of stellar evolution and stellar spectra, translate into uncertainties in our interpretation of stellar populations in galaxies, since stars are the source of most of the light we receive from them. Observations by JWST are revealing high-redshift galaxies in great detail, which must then be compared to models. One significant source of uncertainty is in the stellar spectra used to generate composite spectra of stellar populations, which are then compared to data. Confidence in theoretical models is important to enable reliable determination of the properties of these galaxies such as their ages and star formation history. Here we present a comparison of spectral synthesis carried out with 6 different stellar spectral libraries using the Binary Population and Spectral Synthesis (BPASS) framework. In photometric colours, the differences between theoretical libraries are relatively small (<0.10 mag), similar to typical observational uncertainties on individual galaxy observations. Differences become more pronounced when detailed spectroscopic properties are examined. Predictions for spectral line indices can vary significantly, with equivalent widths differing by a factor of two in some cases. With these index strengths, some of the libraries yield predictions of ages and metallicities which are unphysical. Many spectral libraries lack wavelength coverage in the ultraviolet, which is of growing importance in the era of JWST observations of distant galaxies, whose flux is dominated by hot, young stars.



Pick a paper. Email Jim!

Draft version March 31, 2023
Typeset using LaTeX **twocolumn** style in AASTeX631

A Modest Proposal for the Non-existence of Exoplanets: The Expansion of Stellar Physics to Include Squars

Charity Woodrum [1], Raphael E. Hviding [1], Rachael. C. Amaro [1], and Katie Chamberlain [1]

[1] *Steward Observatory, University of Arizona, 933 North Cherry Avenue, Tucson, AZ 85721, USA*

(Dated: April 1st, 2023)

ABSTRACT

The search for exoplanets has become a focal point of astronomical research, captivating public attention and driving scientific inquiry; however, the rush to confirm exoplanet discoveries has often overlooked potential alternative explanations leading to a scientific consensus that is overly reliant on untested assumptions and limited data. We argue that the evidence in support of exoplanet observation is not necessarily definitive and that alternative interpretations are not only possible, but necessary. Our conclusion is therefore concise: exoplanets do not exist. Here, we present the framework for a novel type of cuboid star, or *squar*, which can precisely reproduce the full range of observed phenomena in stellar light curves, including the trapezoidal flux deviations (TFDs) often attributed to "exoplanets." In this discovery paper, we illustrate the power of the squellar model, showing that the light curve of the well-studied "exoplanet" WASP-12b can be reconstructed simply from a rotating squar with proportions $1 : 1/8 : 1$, without invoking ad-hoc planetary bodies. Our findings cast serious doubt on the validity of current "exoplanetary" efforts, which have largely ignored the potential role of squars and have instead blindly accepted the exoplanet hypothesis without sufficient critical scrutiny. In addition, we discuss the sociopolitical role of climate change in spurring the current exoplanet fervor which has lead to the speculative state of "exoplanetary science" today. We strongly urge the astronomical community to take our model proposal seriously and treat its severe ramifications with the utmost urgency to restore rationality to the field of astronomy.

Keywords: "Exoplanets (498)," Stellar Astronomy (1583), Squellar physics (1312)

1. INTRODUCTION

The study of exoplanets has emerged as a field of groundbreaking astronomical research, captivating the

There are currently a variety of exoplanet detection methods, namely (with number of discovered exoplanets): Transit (3970), Radial Velocity (1029), Microlens-

Read the paper. 1-2hrs max. Take notes

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Start an outline, what is the backstory?

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- Did you need to skim 1-2 other papers to understand this? Tell us what & why!
- Start sketching the talk… the story structure is pretty well defined!

Start gathering key figures

2 WHAC Collaboration

Figure 1. Pyrite Crystals from the Victoria Mine, Navajún, La Rioja, Spain (Willi 2019). An example of a perfect cube being found in nature. Top right cube is approximately 7 × 7 × 7 cm.

tence of cuboid-shape stars, henceforth referred to as squars. Our proposal stems from a deep understanding of the complexities of the cosmos, and is well motivated by known naturally occurring cuboid phenomena.

Cuboid structures are ubiquitous in nature, an example of which is shown in Figure 1. Many minerals, plants, and some bacteria, are known to exhibit cuboidic structure. In fact, Domokos et al. (2020) find that natural 3D fragments should have cuboid properties on average, thus interstellar clouds of gas and dust should naturally fragment into the cuboid structure of squars.

With mother nature as our guide, we present a realistic model for photospheric emission from a rotating squar, thus advancing our understanding of the universe and enabling a transformative paradigm shift for classical astrophysics. As we dive deeper into the complexities of squellar research, it is imperative that we maintain an open mind and a willingness to challenge our assumpSection 3, showing that the data are consistent with a rotating squar. In Section 4 we present the main conclusion of our work, discuss the scientific ramifications of our discovery, and examine the sociopolitical conditions that lead to the current dogmatic veneration of exoplanets. Finally, we discuss our conclusions and present ongoing and potential future work for this exciting field of research in Section 5.

2. SQUELLAR MODELING

In this section, we follow in the footsteps of classical stellar models, while implementing an intuitive and physically motivated cuboid geometry. Traditional stellar evolution codes, such as the open-source stellar evolution software **`Modules for Experiments in Stellar Astrophysics`** (MESA; Paxton et al. 2011, 2013, 2015, 2018, 2019; Jermyn et al. 2023), are unfortunately insufficient to capture the complexity of geometries extending past 1D. We therefore undertake construction of our own comprehensive model of a squar, employing unprecedented state-of-the-art 3D stellar modeling. The Woodrum-Hviding-Amaro-Chamberlain model (hereafter the WHAC model) is presented in full in the upcoming WHAC Key Paper I, but is briefly outlined in this section for context.

The WHAC model begins with a generic cuboid that is rotating about one of its axes of symmetry, which can be arbitrarily aligned with respect to a distant observer. The projected area of any given face of the squar is given by $A\cos(\beta)$ where A is the inherit area of the squellar face, and β is the angle between the normal to the face and the line-of-sight (LOS) to the observer. However, the WHAC model's sophistication only begins at the projected area of the squar.

While a naive approach would be to compute the apparent brightness of the star by simply summing the contribution from each visible face of the squar, our model's sophistication enables us to calculate second-order effects, such as limb darkening induced by the squellar atmosphere. While typical limb darkening relies on an improvised polynomial in $\cos(\beta)$, the self-consistent magneto-hydrodynamic squellar modeling implemented

- Talks are a visual medium, unless you want to disrupt our expectations!
- Screenshots are AOK, just be sure they're high-res enough
- Sometimes papers (esp. simulations) will have artists renditions or videos on the authors' website - Google them!

Plan to spend at *least* 1-min per important figure

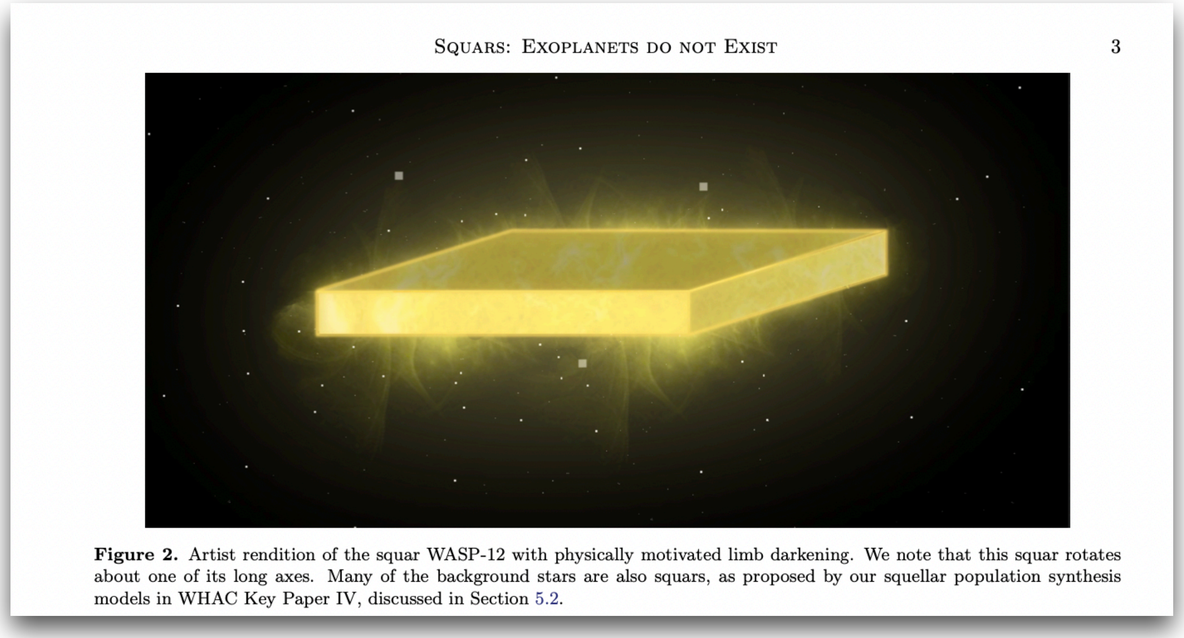

Figure 2. Artist rendition of the squar WASP-12 with physically motivated limb darkening. We note that this squar rotates about one of its long axes. Many of the background stars are also squars, as proposed by our squellar population synthesis models in WHAC Key Paper IV, discussed in Section 5.2.

- Unpack the figure, guide our eyes. What should we look at? What is interesting? What is THE POINT?!
- If the colors/symbols are bad, feel free to touch the figure up in powerpoint

Plan to spend at *least* 1-min per important figure

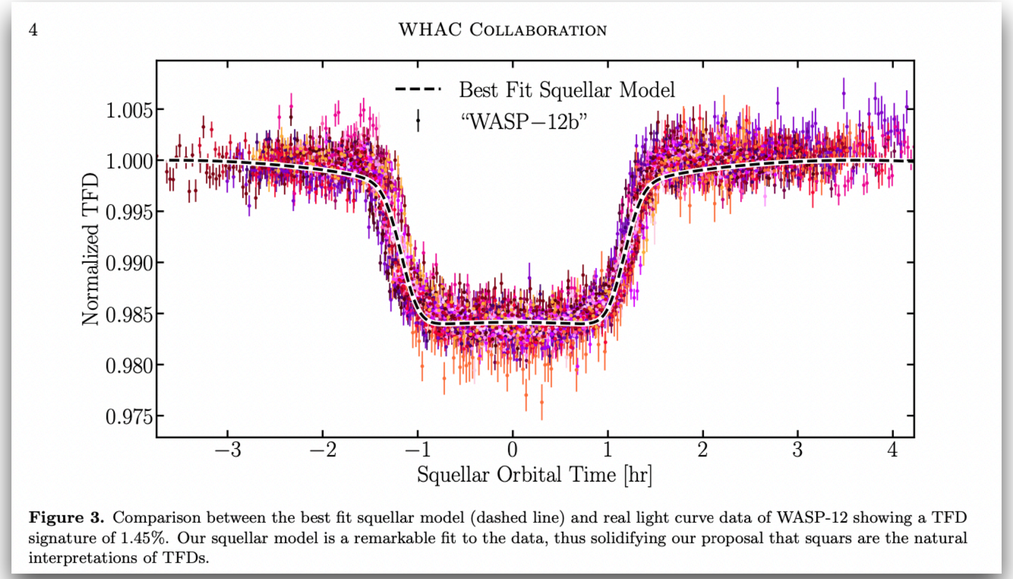

Figure 3. Comparison between the best fit squellar model (dashed line) and real light curve data of WASP-12 showing a TFD signature of 1.45%. Our squellar model is a remarkable fit to the data, thus solidifying our proposal that squars are the natural interpretations of TFDs.

- Are there comparison figures that help tell the story (maybe from another paper they reference?)
- What stands out as curious or do you not understand? You didn't write this paper, it's OK to have questions!!!

What are the bold claims or primary takeaways?

- Only 15 min, you need to be a bit focused. What is THE POINT?
- You've read this paper more than us… what is YOUR takeaway?

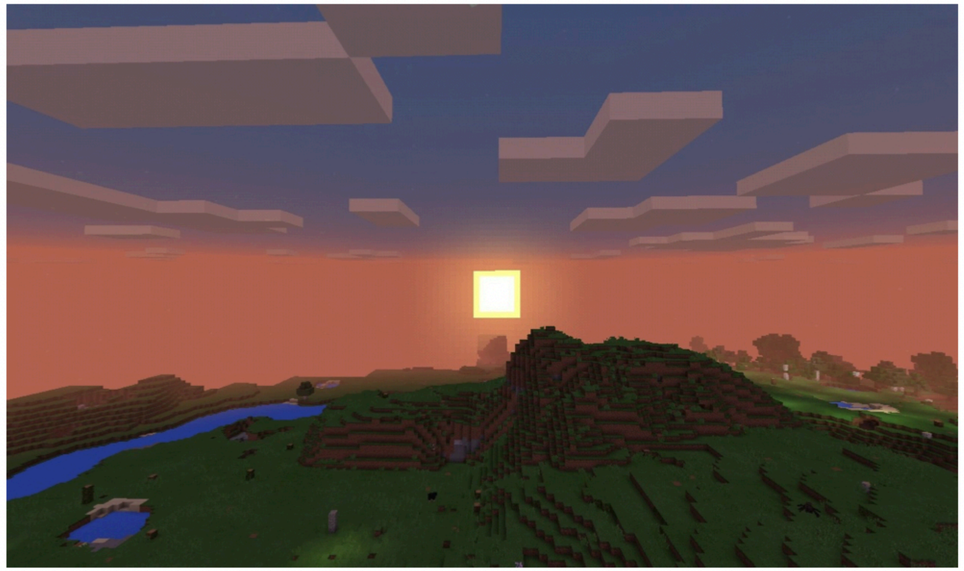

Figure 4. While much of the stellar astrophysics community lags behind in the study of squars, advanced simulations such as Minecraft™ have already implemented squars into their universe.

Hype!

- Let’s get excited
  - Get creative in your presentations, pick new/fun/challenging papers
  - Tip: watch your talk recordings!
- No Journal Club next week…
  - Then I’m excited to see what papers YOU want to tell us about!