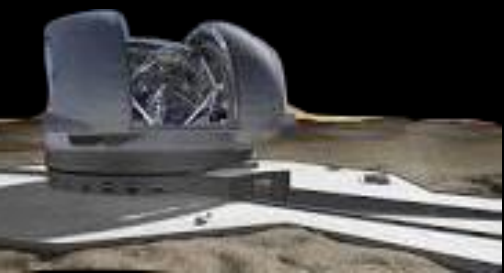


AST4762/5765

Advanced astronomical data analysis



Dr. Theodora Karalidi (she/her)
Associate Professor
PSB 104

TA: Megan Firdard

Part 1 - Procedural info

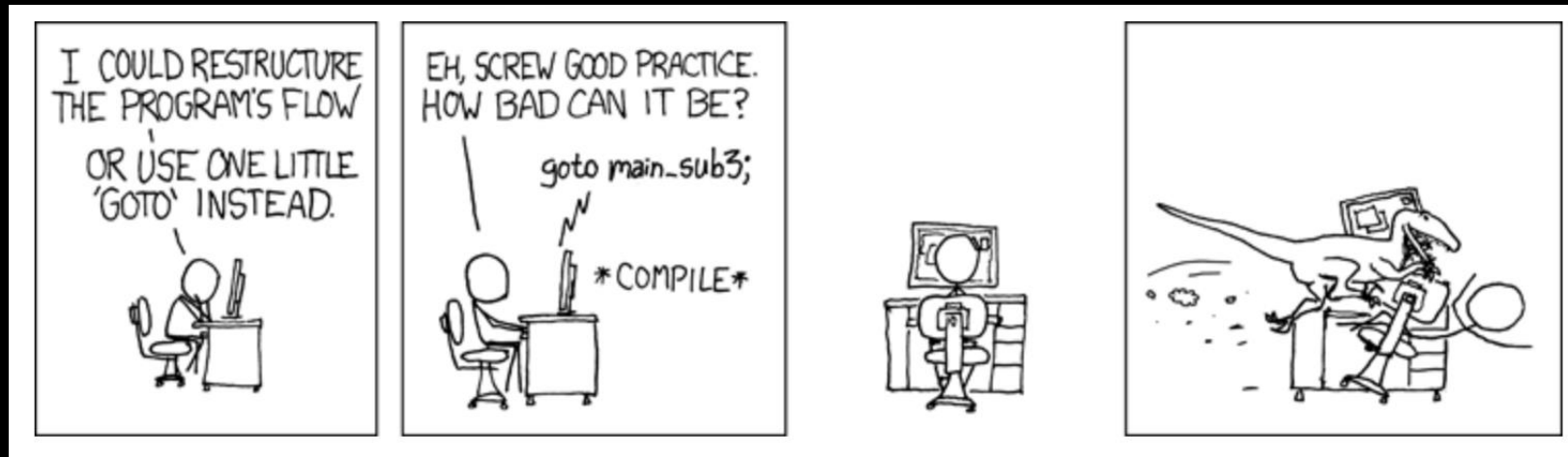
- The quiz
- Your input
- HW0+1

The quiz

In this class we use the Python language. Students will need to become functional in Python within the first two weeks of the course, so **programming proficiency is required for success in this course**. Students who have taken the course without programming experience have struggled a great deal. Some have failed. **A programming evaluation will be given on the first week of class**. Students not demonstrating proficiency will be encouraged to get disenrolled.

Coding Quiz Wednesday

- Lots of things to learn, too little time to focus on coding.
- You need to be fluent enough in Python (or be able to catch up. Check <https://greenteapress.com/wp/think-python-3rd-edition/> out for the basics)



<https://xkcd.com/292/>

Coding Quiz Wednesday

- Lots of things to learn, too little time to focus on coding.
- You need to be fluent enough in Python (or be able to catch up...check <https://greenteapress.com/wp/think-python-3rd-edition/> out for the basics)
- Pen & paper, write a function



(Hitchhiker's Guide to the Galaxy)

The quiz

In this class we use the Python language. Students will need to become functional in Python within the first two weeks of the course, so **programming proficiency is required for success in this course**. Students who have taken the course without programming experience have struggled a great deal. Some have failed. **A programming evaluation will be given on the first week of class**. Students not demonstrating proficiency will be encouraged to get disenrolled.



Please take my recommendation seriously into account!



The quiz

In this class we use the Python language. Students will need to become functional in Python within the first two weeks of the course, so **programming proficiency is required for success in this course**. Students who have taken the course without programming experience have struggled a great deal. Some have failed. **A programming evaluation will be given on the first week of class.** Students not demonstrating proficiency will be encouraged to get disenrolled.



Please take my recommendation seriously into account!



Your input is important!

- Will ask for feedback occasionally
 - Revisit topics
 - Update material for future iterations



HWO

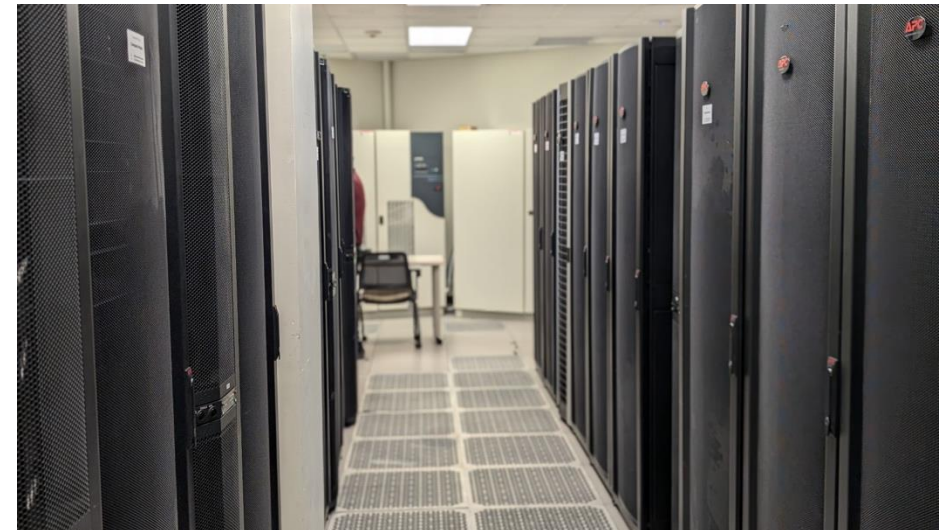
- Will work on it W start of class, after the coding quiz
 - It's just starting your log and we will use it
 - To show academic activity in class
 - to do peer evaluations in class on W (counts towards grade; see later)



(Hitchhiker's Guide to the Galaxy)

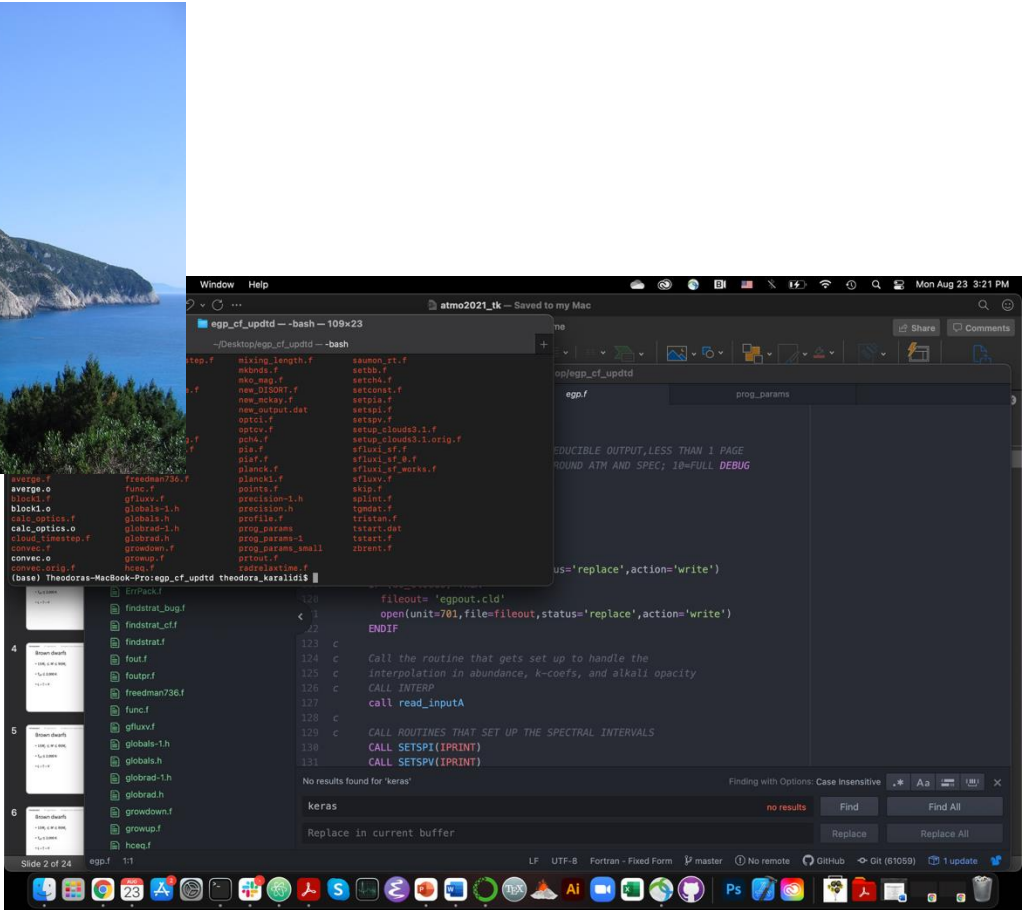
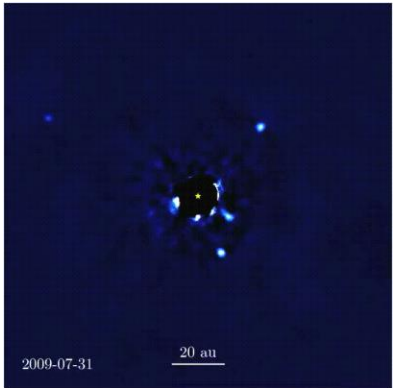
Updates from last year

- 🖥️ We meet 3 times per week for 2 hr;
 - 🖥️ F are full 'practicum' days: we will work on coding and our HW
- 🖥️ We will use Stokes: you get real time experience with working on a remote PC/cluster
 - You don't need to install WSL on Windows



Introductions

- Theodora Karalidi (*Kar-ah-IEE-dee*)
- TA: Megan Firdard (Fridays)



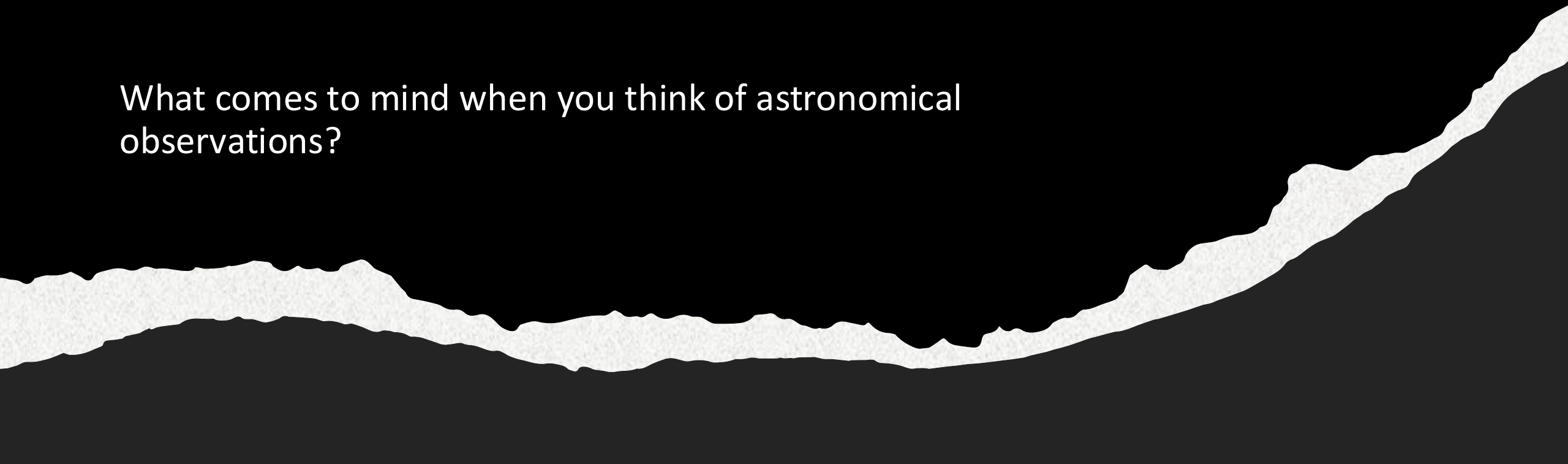
Introductions

- Student introductions
 - Name, major, year
 - Tell us something about yourself not related to school
 - Computer experience, OS preference and why

Part 2 - Why are you here?

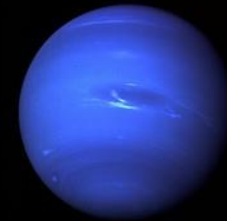
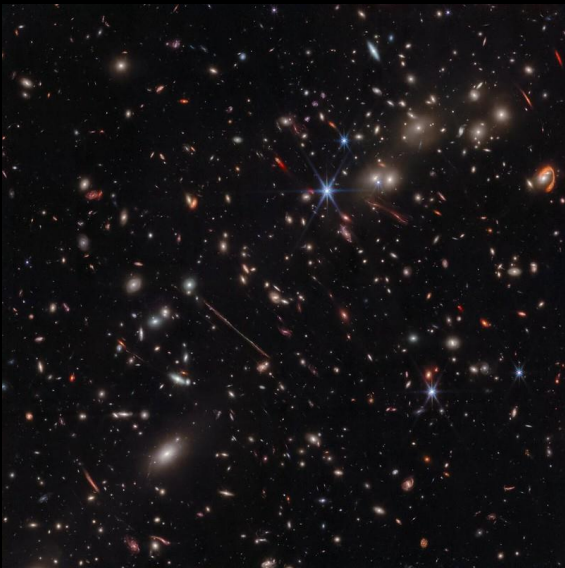
Astronomical Observations

What comes to mind when you think of astronomical observations?

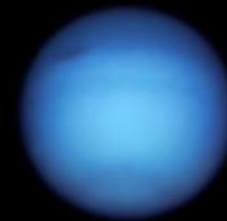


Astronomical Observations

- What comes to mind when you think of astronomical observations?



Voyager 2 (1989)

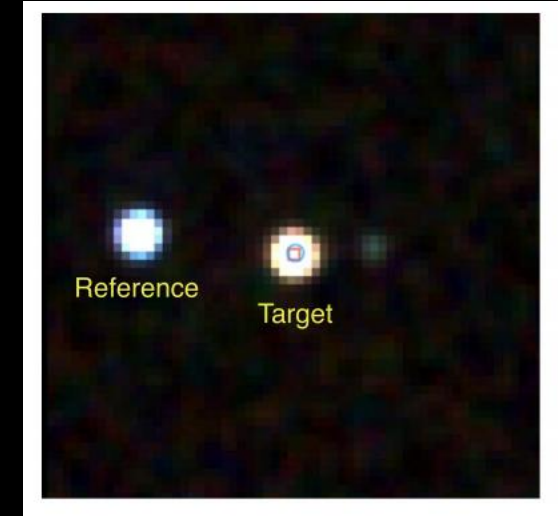
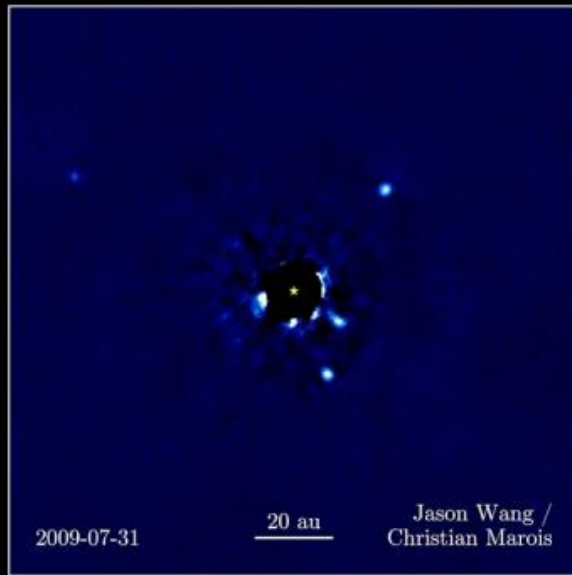


Hubble (2021)

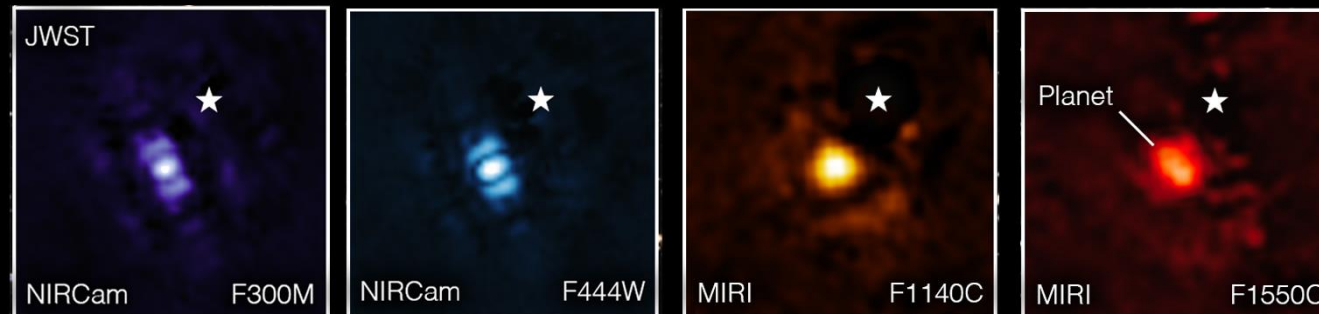


Webb (2022)

Astronomical Observations

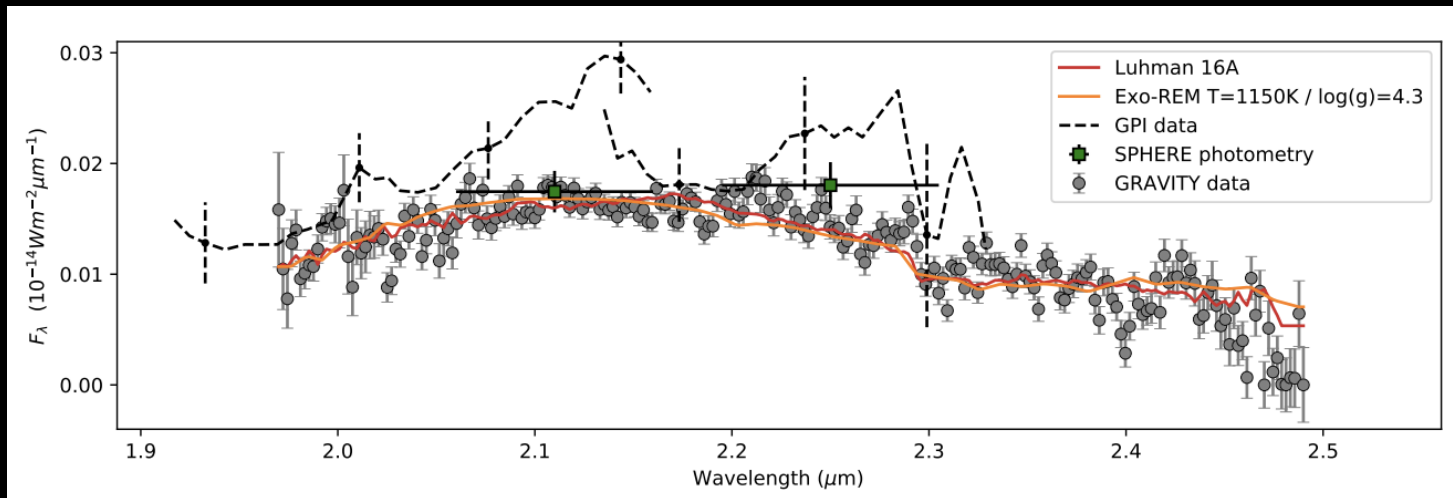


Schlawin+ 2017

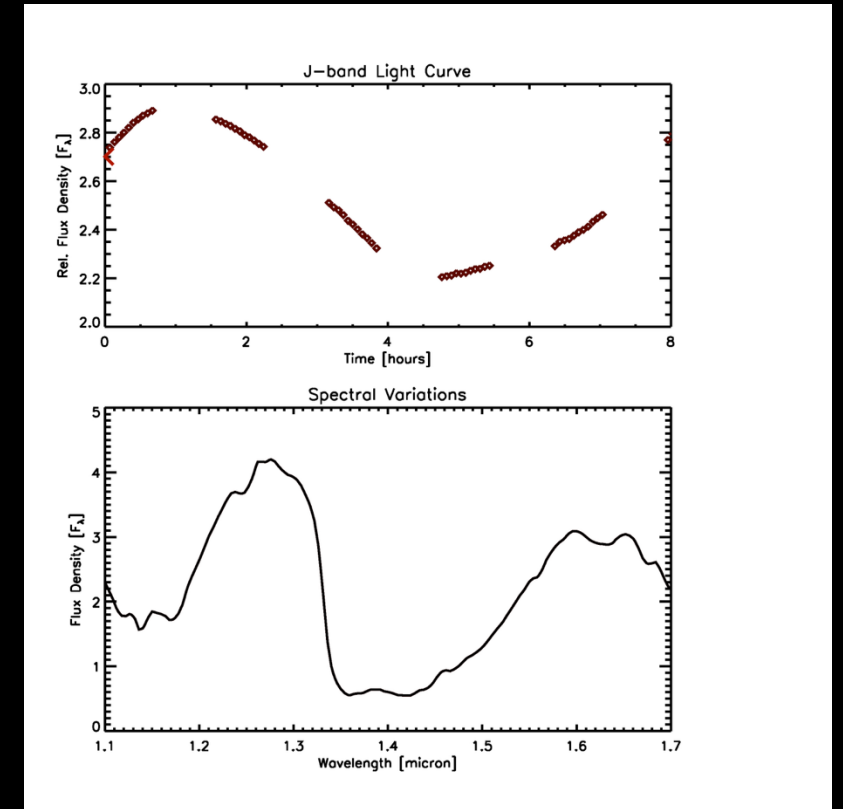


JWST ERS 2022

Astronomical Observations - the reality check

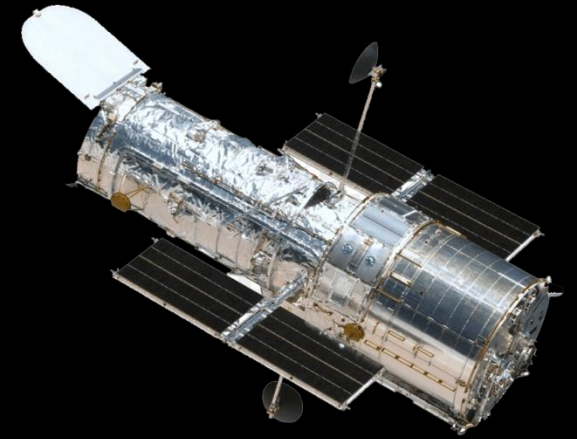
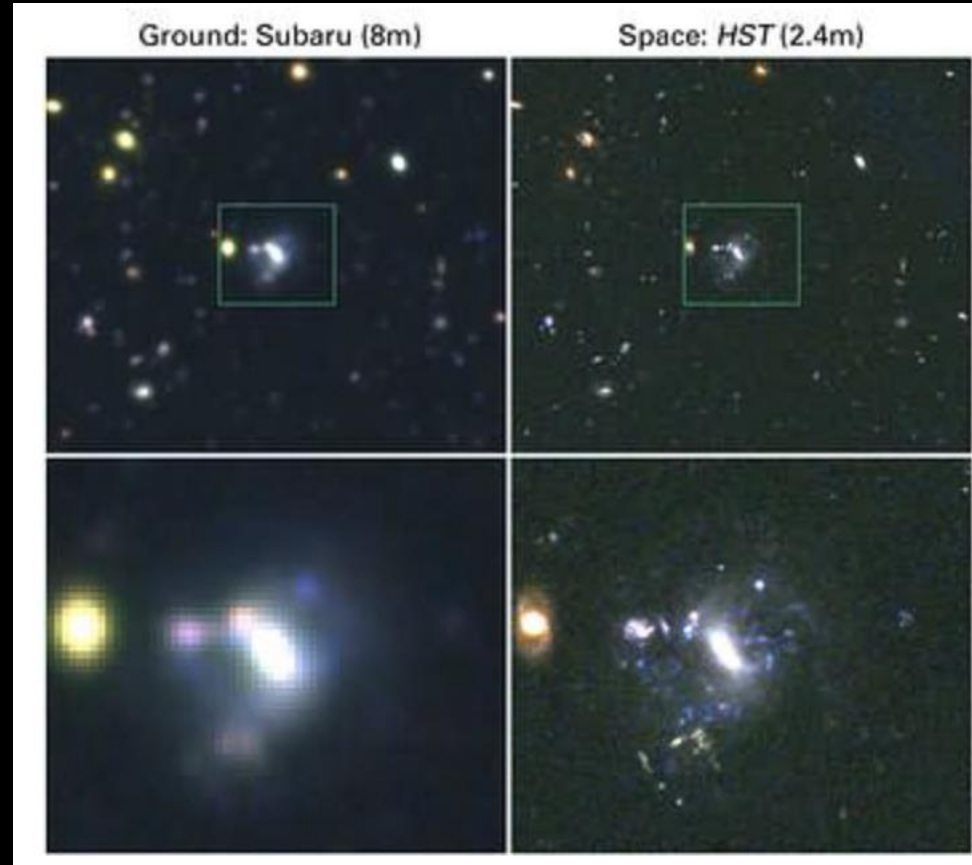


GRAVITY collaboration: Lacour+2019



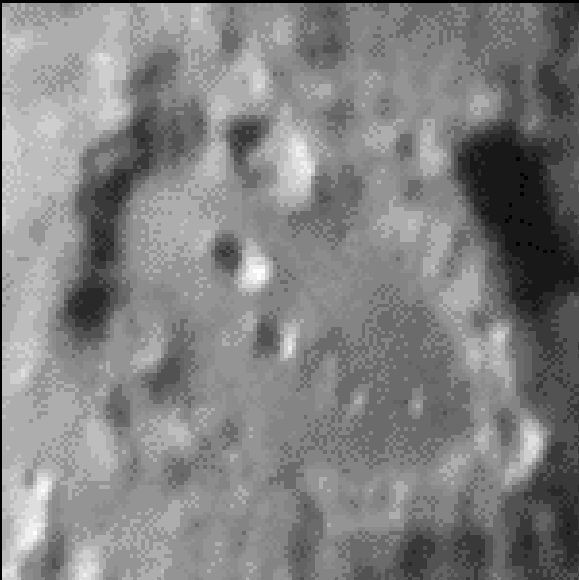
Credit: D. Apai (2013)

Astronomical Observations - the reality check

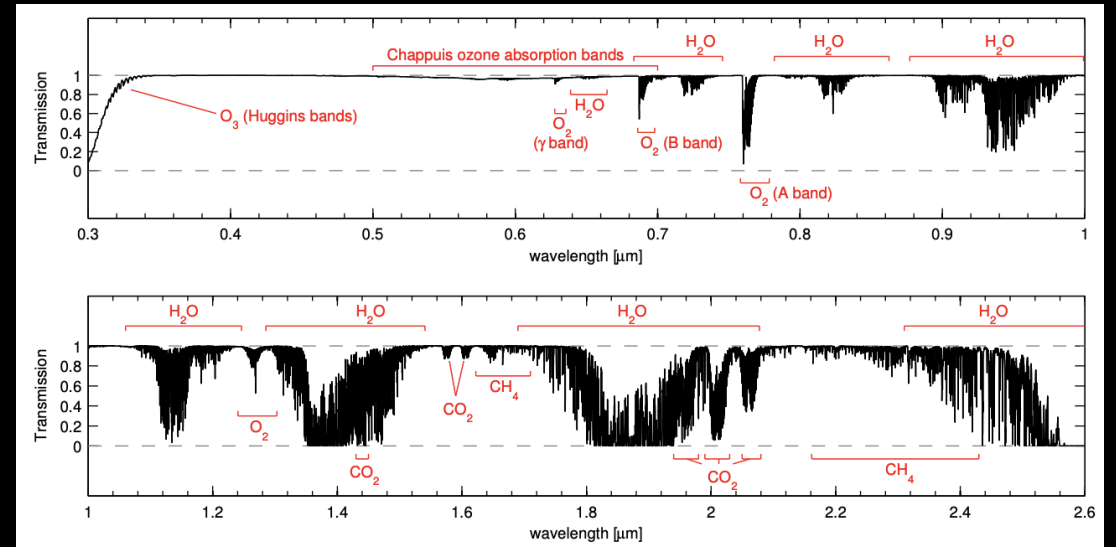


NASA, M. Giavalisco, L. Moustakas, P. Capak, L. Cowie and the GOODS Team

Astronomical Observations - the reality check

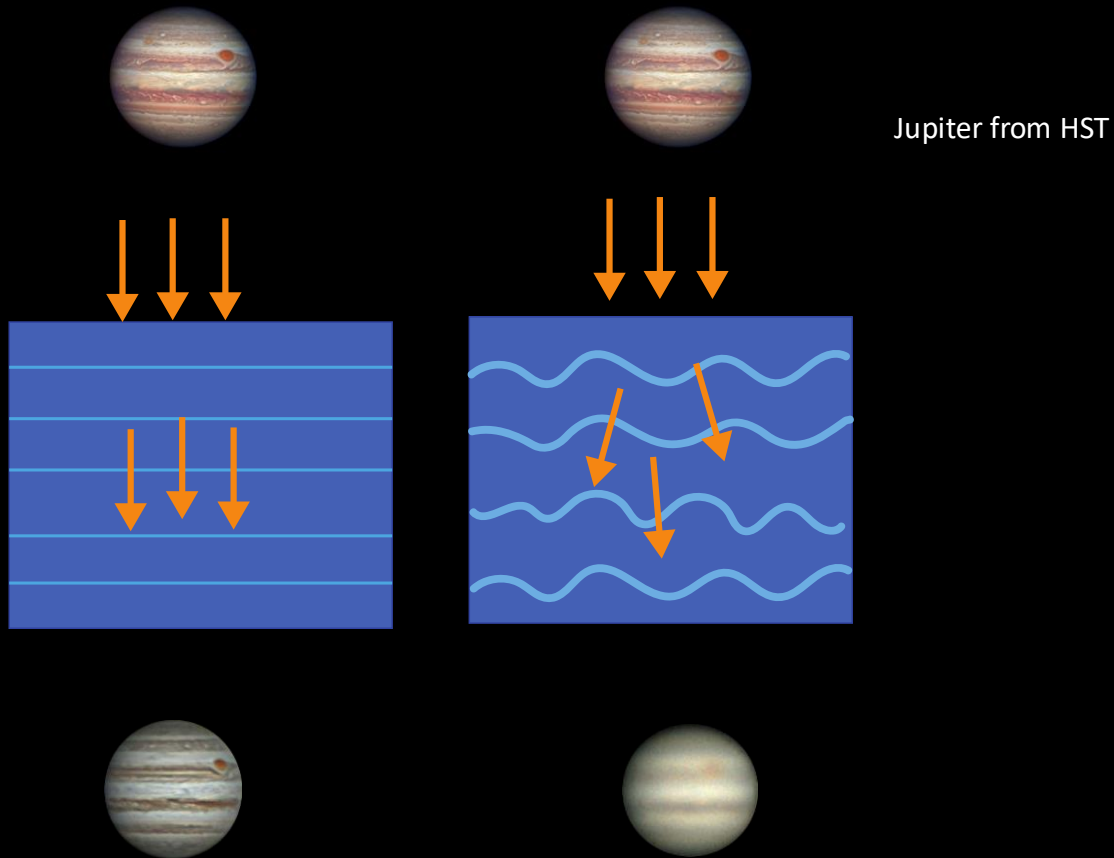


<http://salzgeber.at/astro/moon/seeing.html>



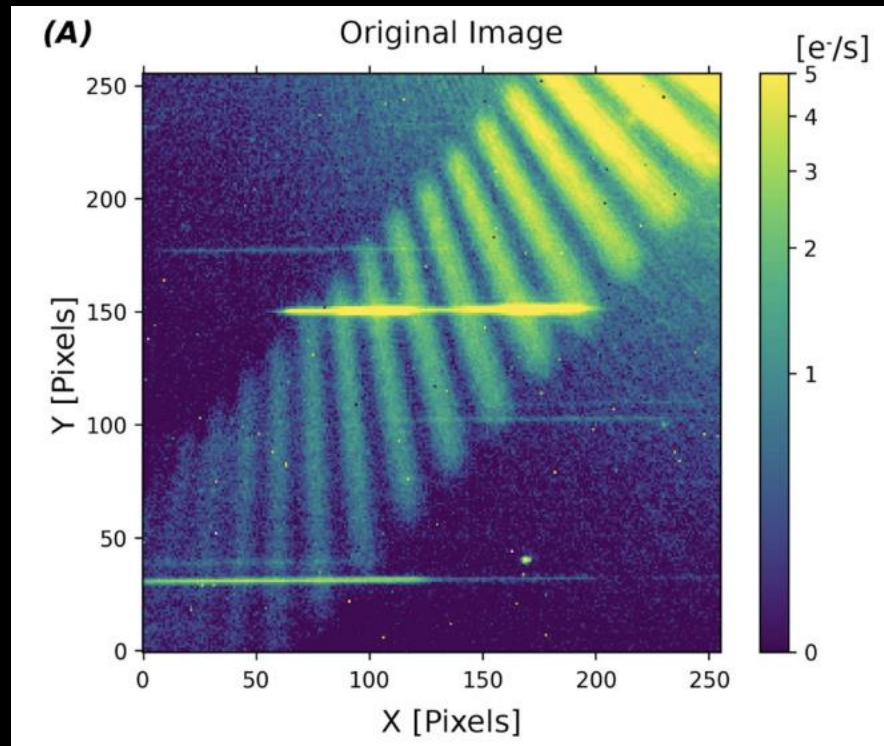
Smette+2015

Astronomical Observations - the reality check

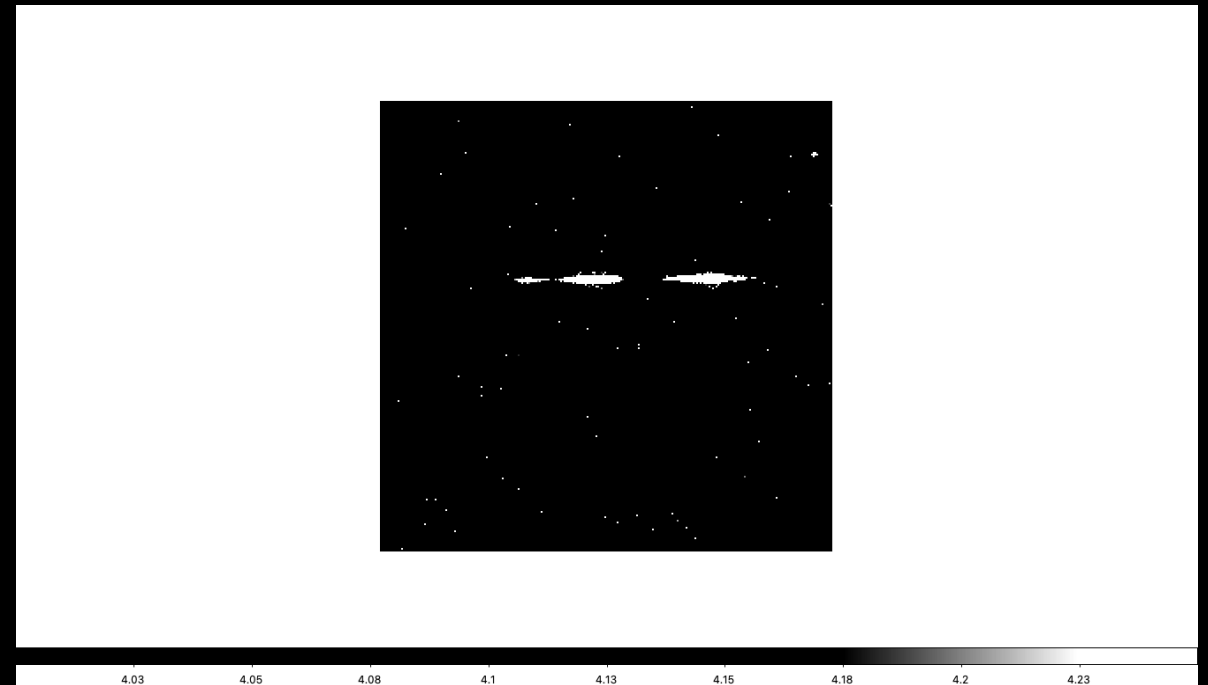


Jupiter from:
<https://britastro.org/wp-content/uploads/2018/11/128-6-AbsBegis-fig2.jpg>

Astronomical Observations - the reality check

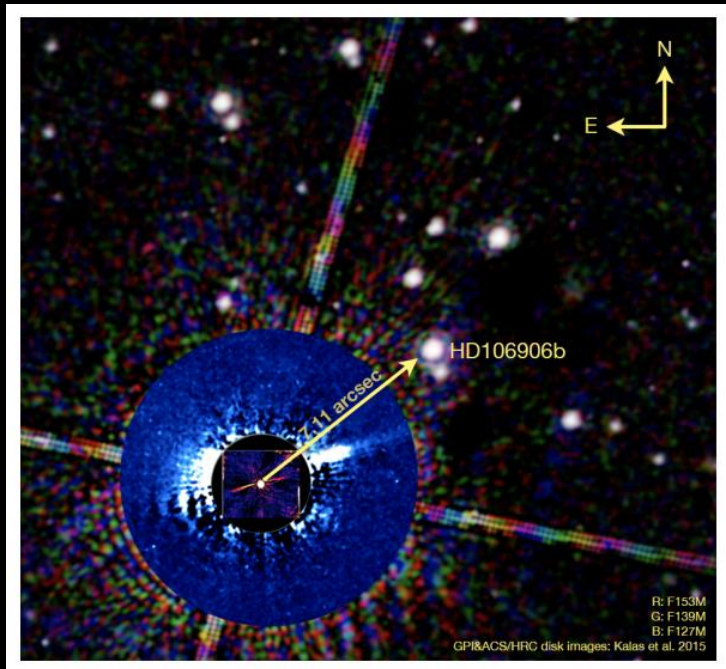


Zhou+2018

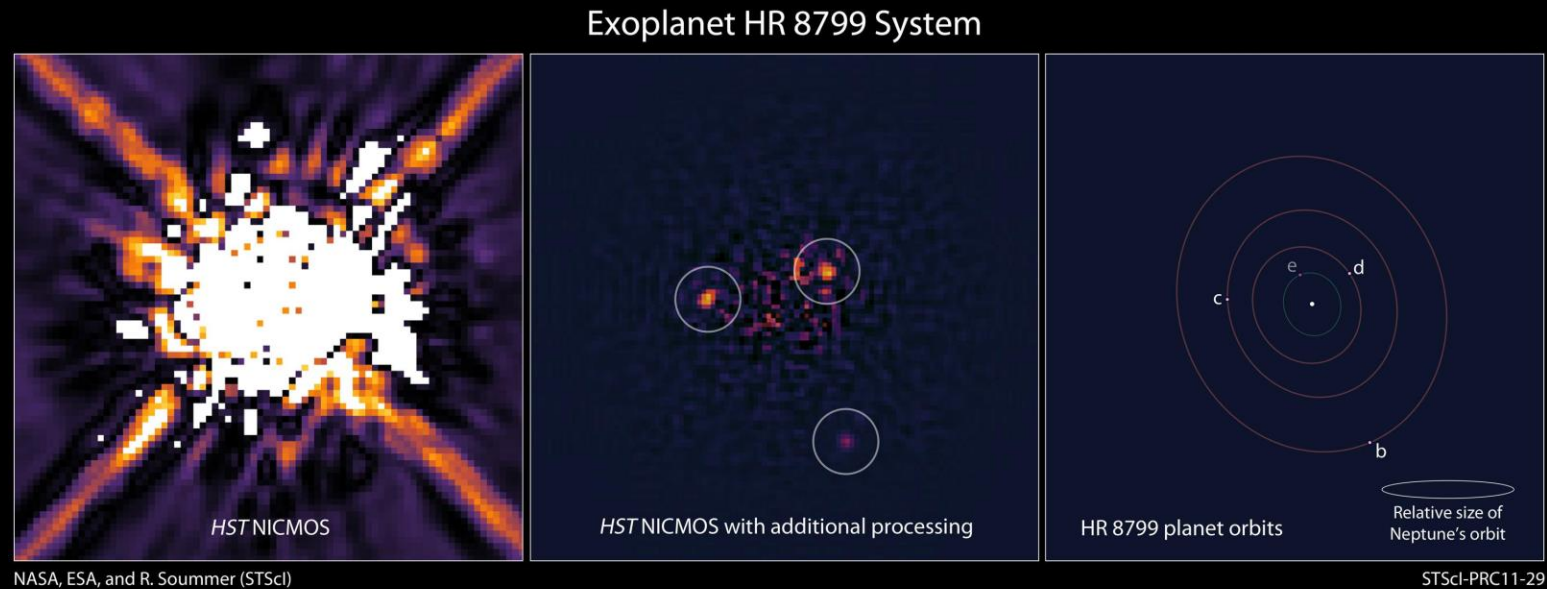


Credit: Ben Lew (NASA Ames/ BAERI)

Astronomical Observations - the reality check



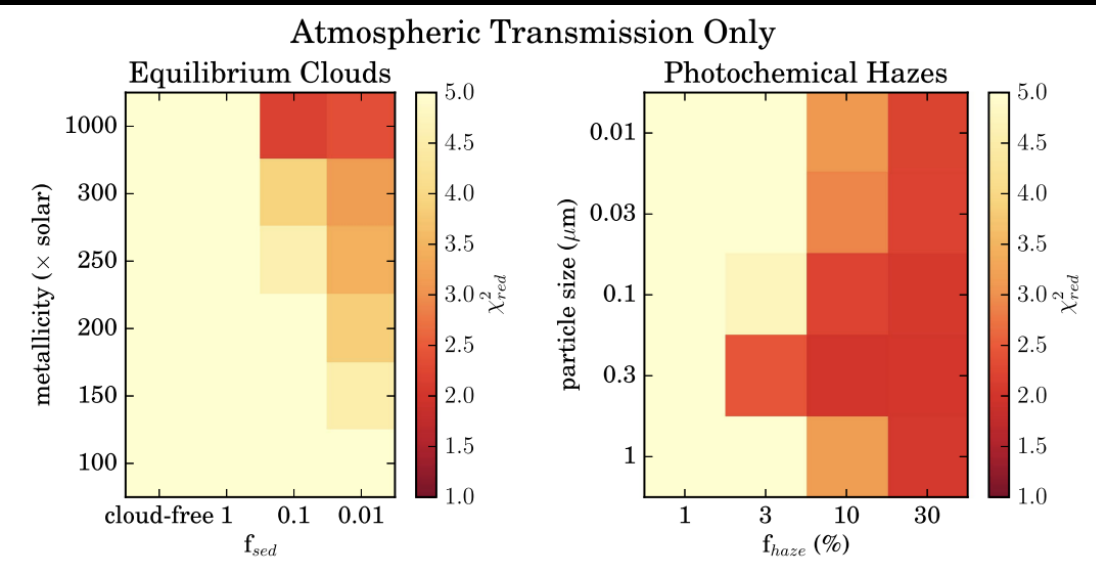
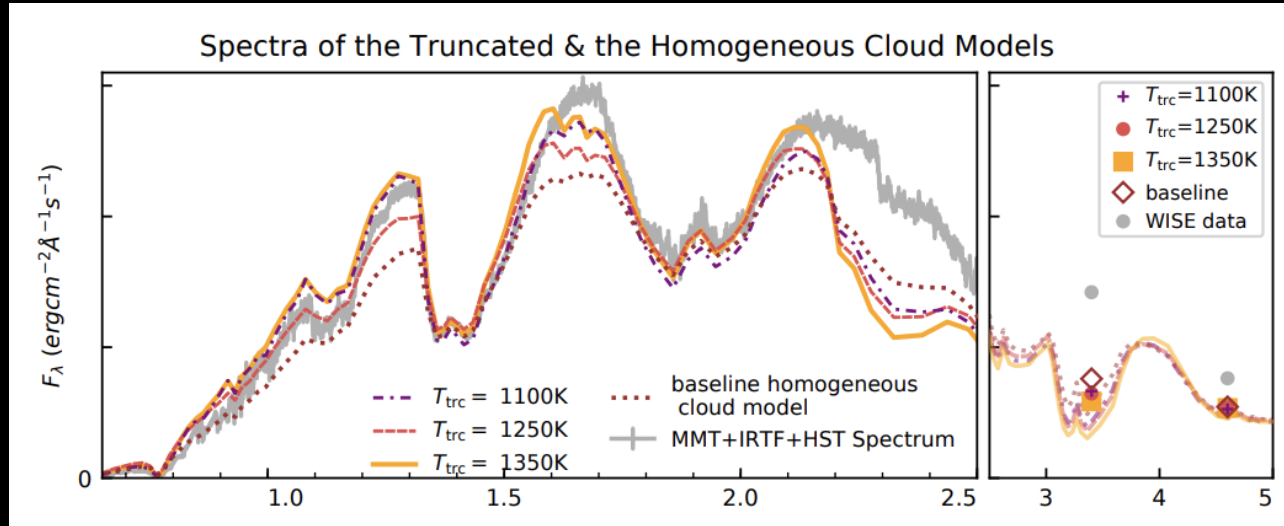
Zhou+2020



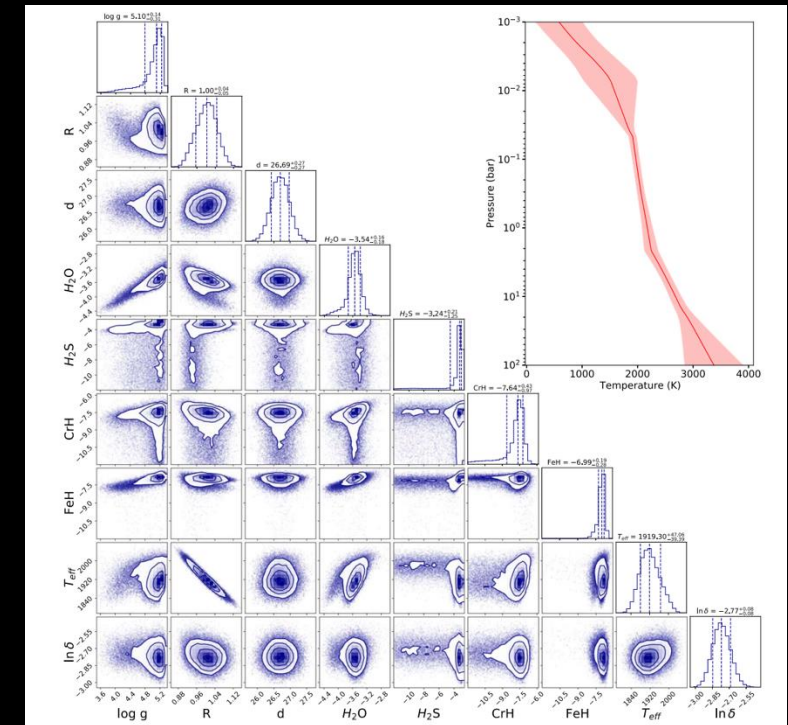
And then....what does it mean?

- You got your images, photometry/spectroscopy
- How do you figure out what it means for the physical processes of star formation/ galaxy evolution/ planetary atmosphere/ galaxy and black hole mass/ etc....?

And then...what does it mean?



Lew+2021



Lueber+2022

Rackham+2017

Why this class?

“Advanced astronomical data formation and acquisition, detector physics, measurement extraction, error analysis, modeling, computer programming, statistics <and> interpretation”

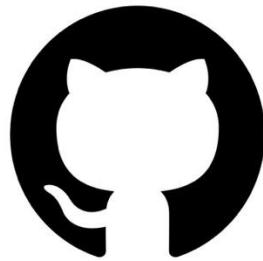
Why this class?

- Learn to use your laptop for research
- Get a better understanding of issues research data have
 - Understand basic statistics and error analysis as used in the physical sciences,
 - Extract physical measurements and error estimates from raw data,
 - Fit a theoretical model to the measurements, including uncertainties and signal-to-noise ratios,
 - Draw scientifically-valid conclusions from the measurements,
 - Manage and carry out online work with large amounts of data
- Present scientific results.

What will we cover in this class?

1. Computers, programming, online management.
2. Fitting
3. Introductory statistics and modeling.
4. Array detectors and corrections, image analysis.
5. Photometry and intro to spectroscopy.
6. Project

What will we use in this class?



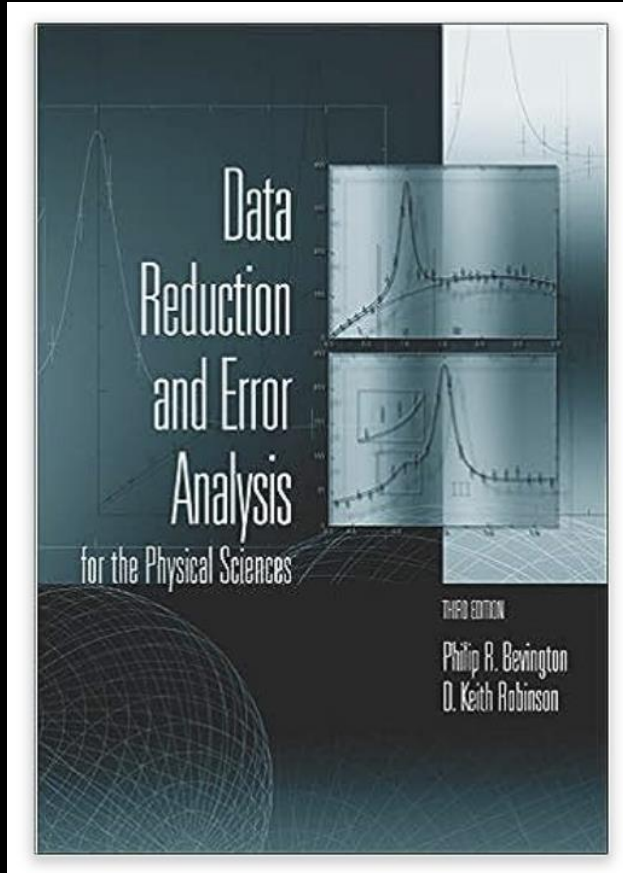
GitHub



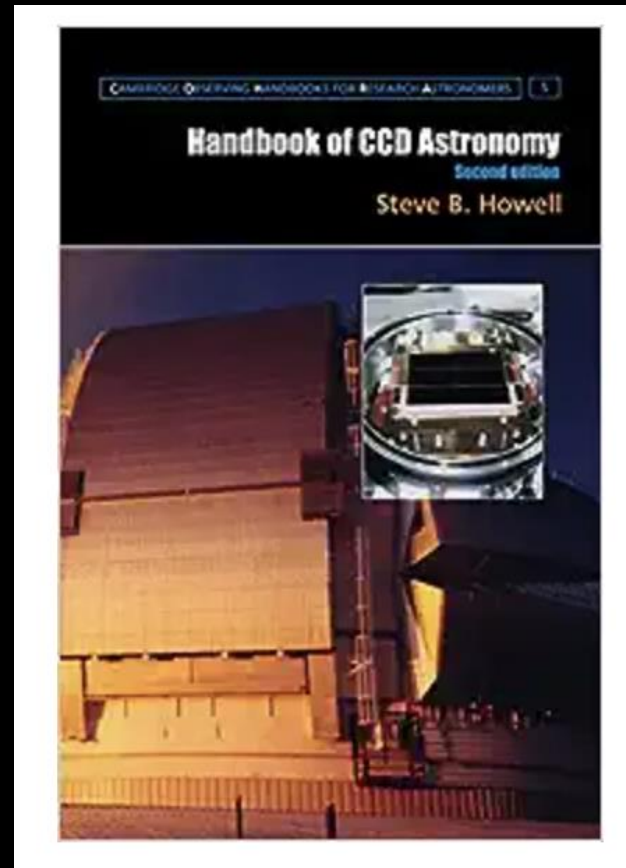
GitHub



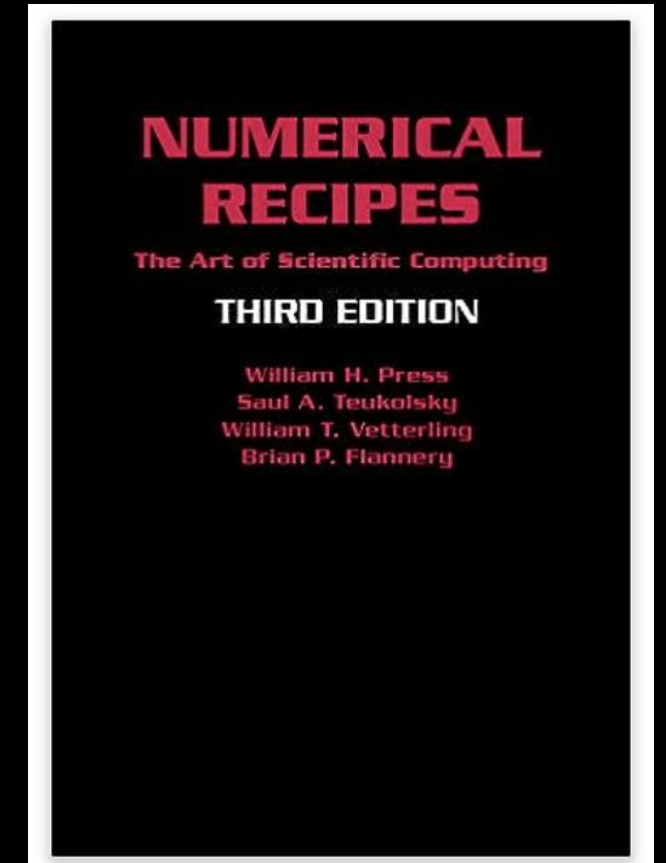
The books



Not printed anymore



Available through the library for free!



Few reads; no *need* to buy:
<http://numerical.recipes/book.html>

What about AI?

- See syllabus



Syllabus

- Check Webcourses

See you all Wednesday!