ASTR21200

Observational Techniques in Astrophysics
Lecture 8

Bradford Benson

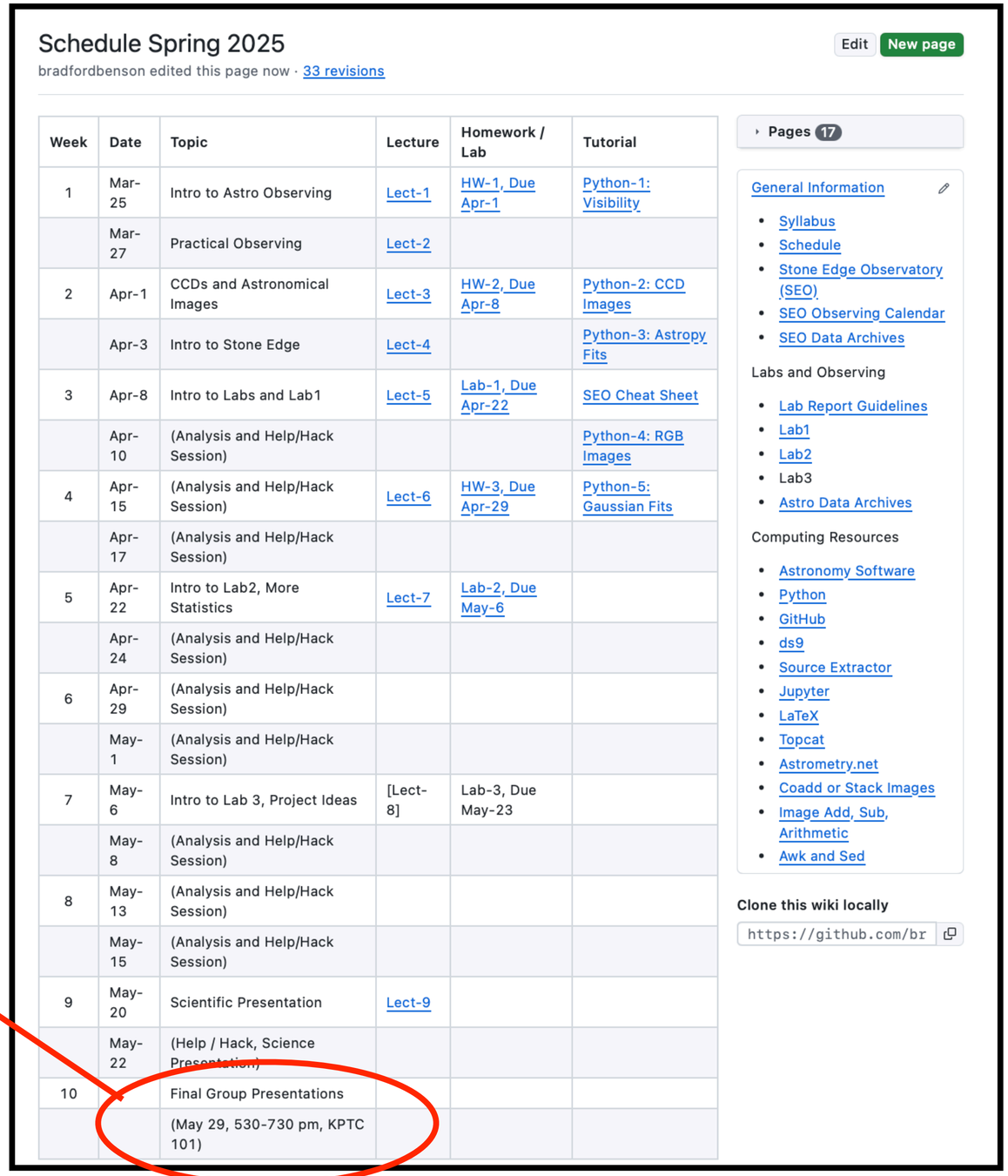
Lab-3: Design your own observing project

- For Lab-3, you're going to pick your own project!
- Feel free to think outside the box, but I might suggest some projects (see later slides which suggest starting point ideas)
- ***Final lab report*** can be in style of Jupyter notebook or Latex-style paper, with each group member submitting their own lab report!
    - **Note**: In either case, you will need to add more text than previous labs explaining the project with a reasonable paper/section structure that mirrors a scientific paper:
        - 1) Intro, 2) Data and Observations, 3) Data Analysis, 4) Discussion, 5) Conclusions
    - **Final Lab Report will be due by 5pm on Friday May 23**
- ***Group "Presentation"*** about your Lab-3 results
    - Intended to mimic the type of presentation that you might give at a scientific conference, and share what you came up with to the rest of the class.
    - I will give you more suggestions / instructions / advice about this during lecture in 2-weeks
    - Plan for 15-min presentation plus 5-min for questions, trading off sections across your group members.
    - **Group presentations will take place Thursday May 29 from 530-730pm in KPTC 101 (during "Finals week")**
        - Let me know now, if this time doesnt work, and we can discuss accommodations!

Class Schedule

Final Group Presentations

May 29 (Thursday)
530-730pm
KPTC 101



Schedule Spring 2025

Edit | New page

bradfordbenson edited this page now · 33 revisions

Week	Date	Topic	Lecture	Homework / Lab	Tutorial
1	Mar-25	Intro to Astro Observing	Lect-1	HW-1, Due Apr-1	Python-1: Visibility
	Mar-27	Practical Observing	Lect-2		
2	Apr-1	CCDs and Astronomical Images	Lect-3	HW-2, Due Apr-8	Python-2: CCD Images
	Apr-3	Intro to Stone Edge	Lect-4		Python-3: Astropy Fits
3	Apr-8	Intro to Labs and Lab1	Lect-5	Lab-1, Due Apr-22	SEO Cheat Sheet
	Apr-10	(Analysis and Help/Hack Session)			Python-4: RGB Images
4	Apr-15	(Analysis and Help/Hack Session)	Lect-6	HW-3, Due Apr-29	Python-5: Gaussian Fits
	Apr-17	(Analysis and Help/Hack Session)			
5	Apr-22	Intro to Lab2, More Statistics	Lect-7	Lab-2, Due May-6	
	Apr-24	(Analysis and Help/Hack Session)			
6	Apr-29	(Analysis and Help/Hack Session)			
	May-1	(Analysis and Help/Hack Session)			
7	May-6	Intro to Lab 3, Project Ideas	[Lect-8]	Lab-3, Due May-23	
	May-8	(Analysis and Help/Hack Session)			
8	May-13	(Analysis and Help/Hack Session)			
	May-15	(Analysis and Help/Hack Session)			
9	May-20	Scientific Presentation	Lect-9		
	May-22	(Help / Hack, Science Presentation)			
10		Final Group Presentations			
		(May 29, 530-730 pm, KPTC 101)			

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General Information

- Syllabus
- Schedule
- Stone Edge Observatory (SEO)
- SEO Observing Calendar
- SEO Data Archives

Labs and Observing

- Lab Report Guidelines
- Lab1
- Lab2
- Lab3
- Astro Data Archives

Computing Resources

- Astronomy Software
- Python
- GitHub
- ds9
- Source Extractor
- Jupyter
- LaTeX
- Topcat
- Astrometry.net
- Coadd or Stack Images
- Image Add, Sub, Arithmetic
- Awk and Sed

Clone this wiki locally

https://github.com/br

Lab-3: Design your own observing project

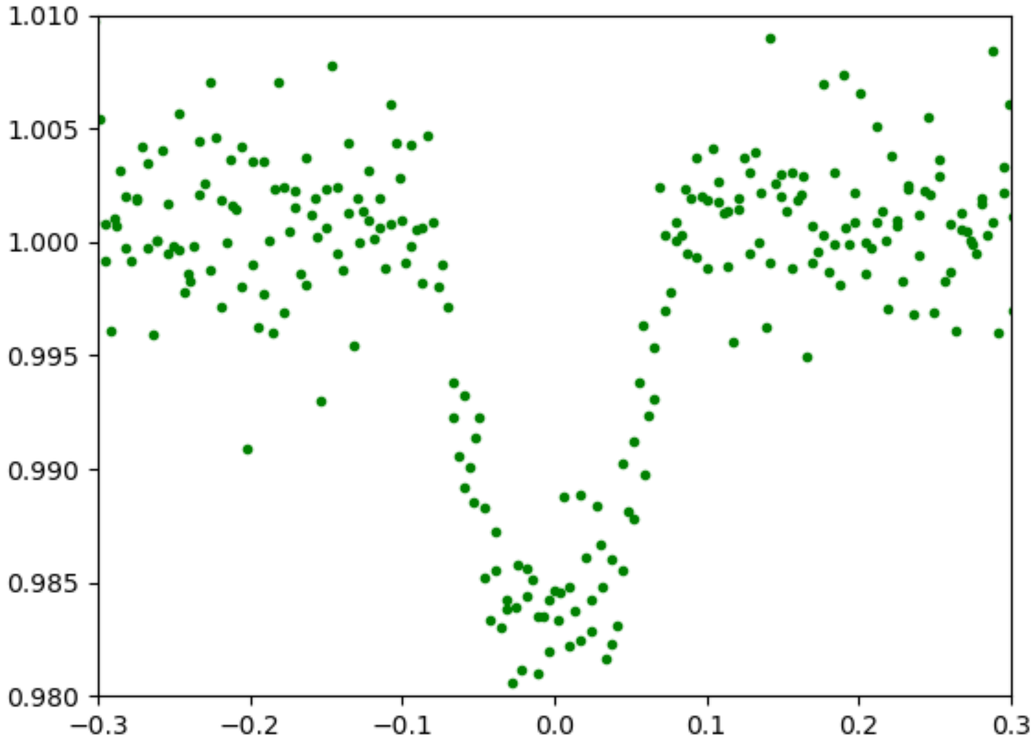
- Basic workflow for Lab-3:
  - Think about what project / science questions you're interested in
  - Decide what objects that you want to observe
  - Schedule observations
  - Do basic reductions of observations
  - Do "analysis" - How do you go from observable to some physical property of the object you want to measure? (e.g., mass, distance, etc.)
    - Figure out how to measure that in software / code, etc.
    - ***Please reach out to us for suggestions, we might be able to suggest useful resources or code repositories!***
  - Write up results and put them in report / paper

Lab-3 Ideas!

1) Measuring an exoplanet transit!

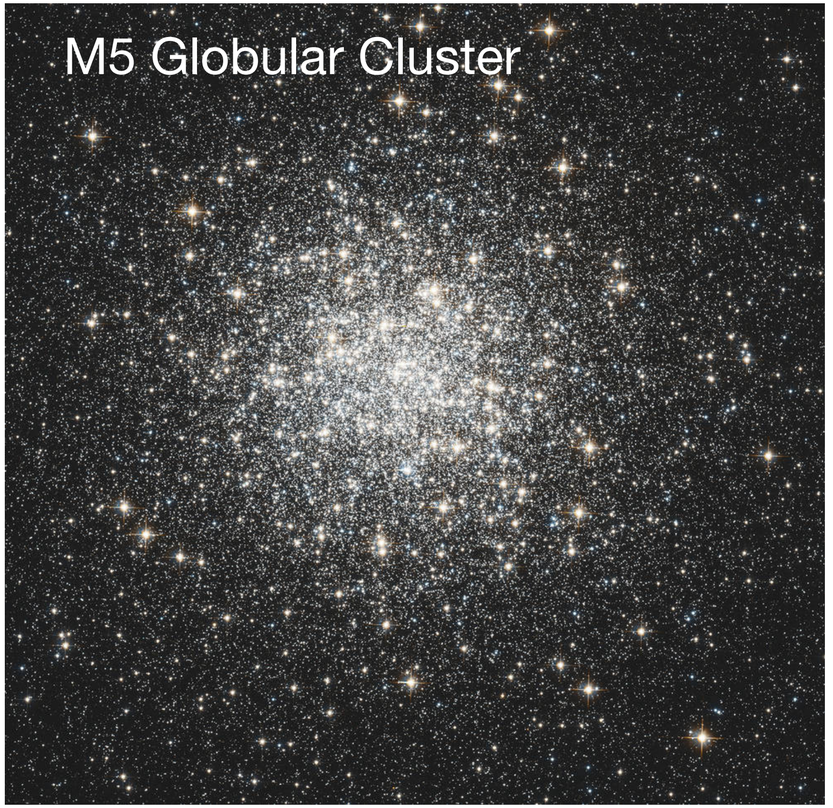
- Find an exoplanet(s) that is transiting and observable
    - https://astro.swarthmore.edu/transits/
- **Data:** Observe an exoplanet at a high enough cadence so that you can detect the dimming of the star when the planet transits.
- **Result**: Determine properties of the planet, including its mass or density

Exoplanet light curve from SEO for TOI-2591 (Fabrycky)

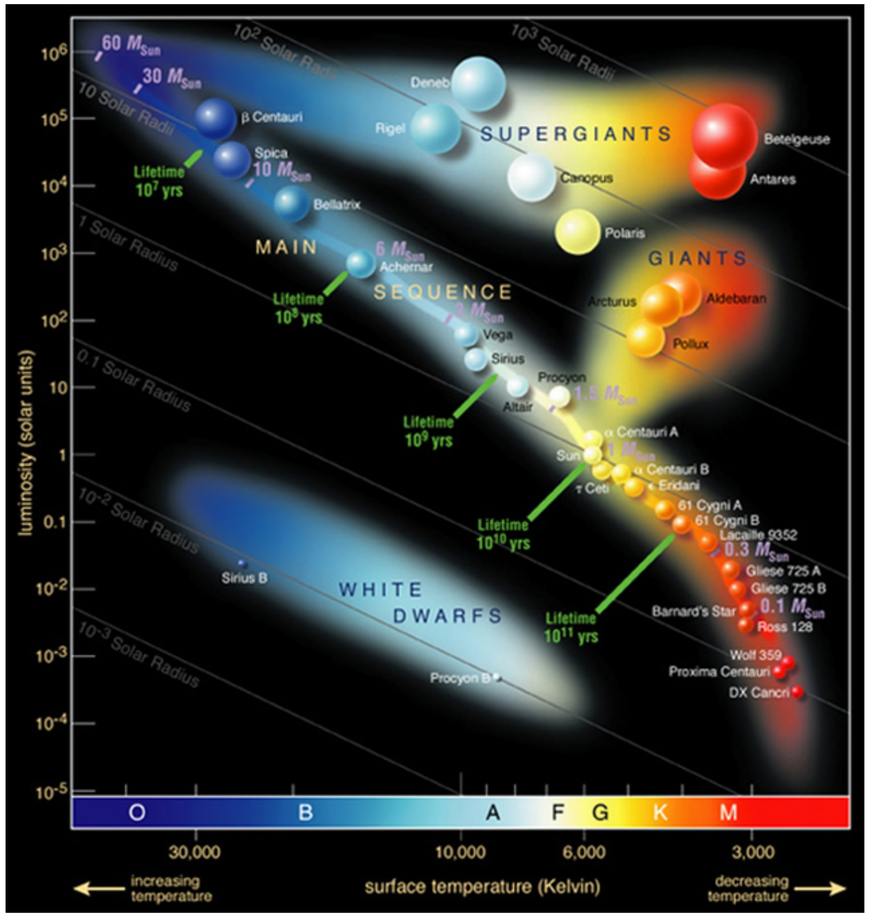


2) Measuring a Hertzsprung-Russell (HR) Diagram

- **Data**: Observe a nearby “globular cluster” and measured luminosity-temperature (or brightness-color) relation for the cluster
- **Result**: Fit “isochrone” to infer properties of the cluster, including its “age”

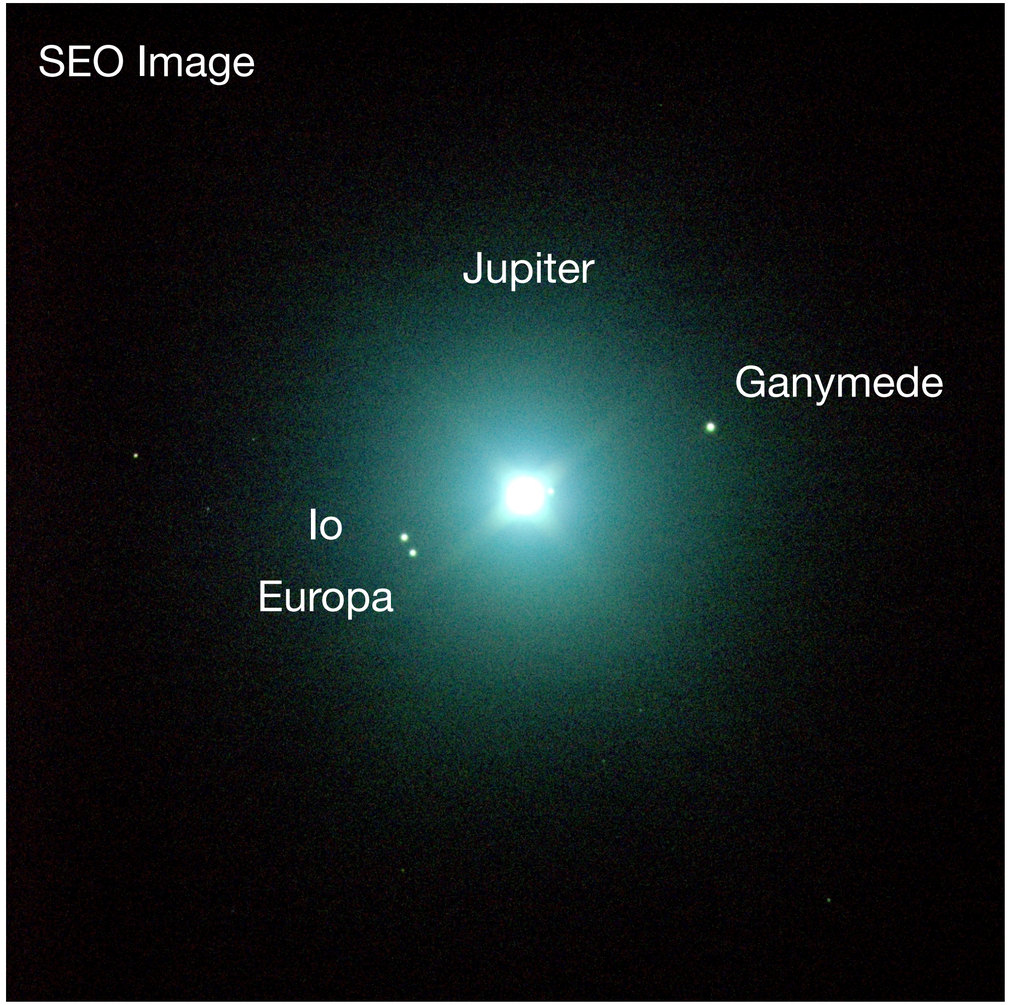


HR Diagram



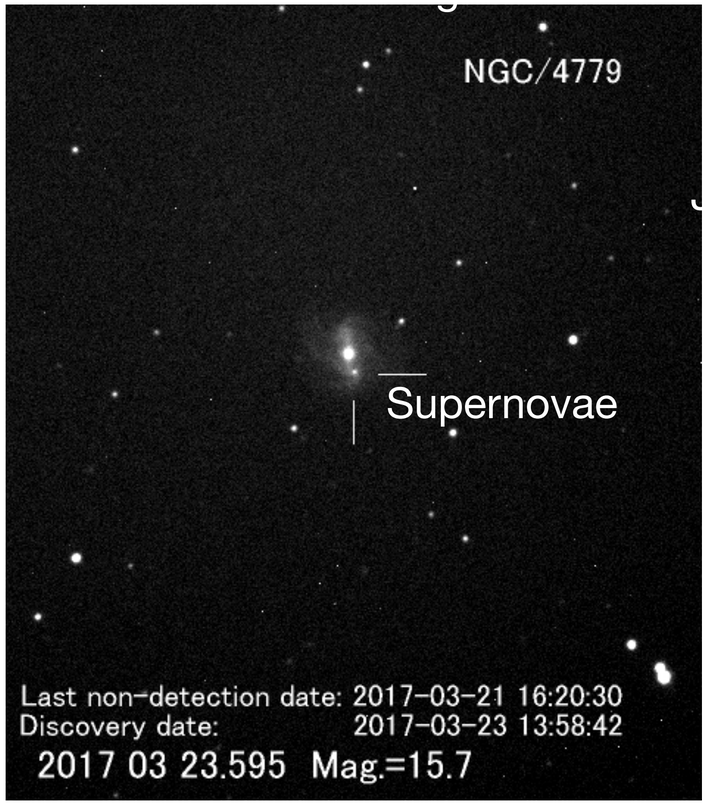
3) Measure Jupiter's Mass

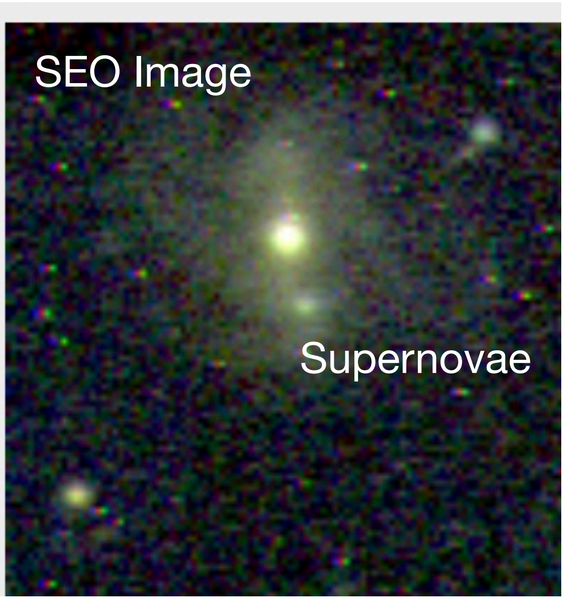
- Use SEO observations of Galilean moons to determine their orbital period and calculate the mass and density of Jupiter
- **Data**: Observe Jupiter over the course of ~5-10 days, measure location of moons
- **Result**: Fit an orbital period and phase to estimate the mass of Jupiter



4) Measure a Supernovae (SNe) Lightcurve

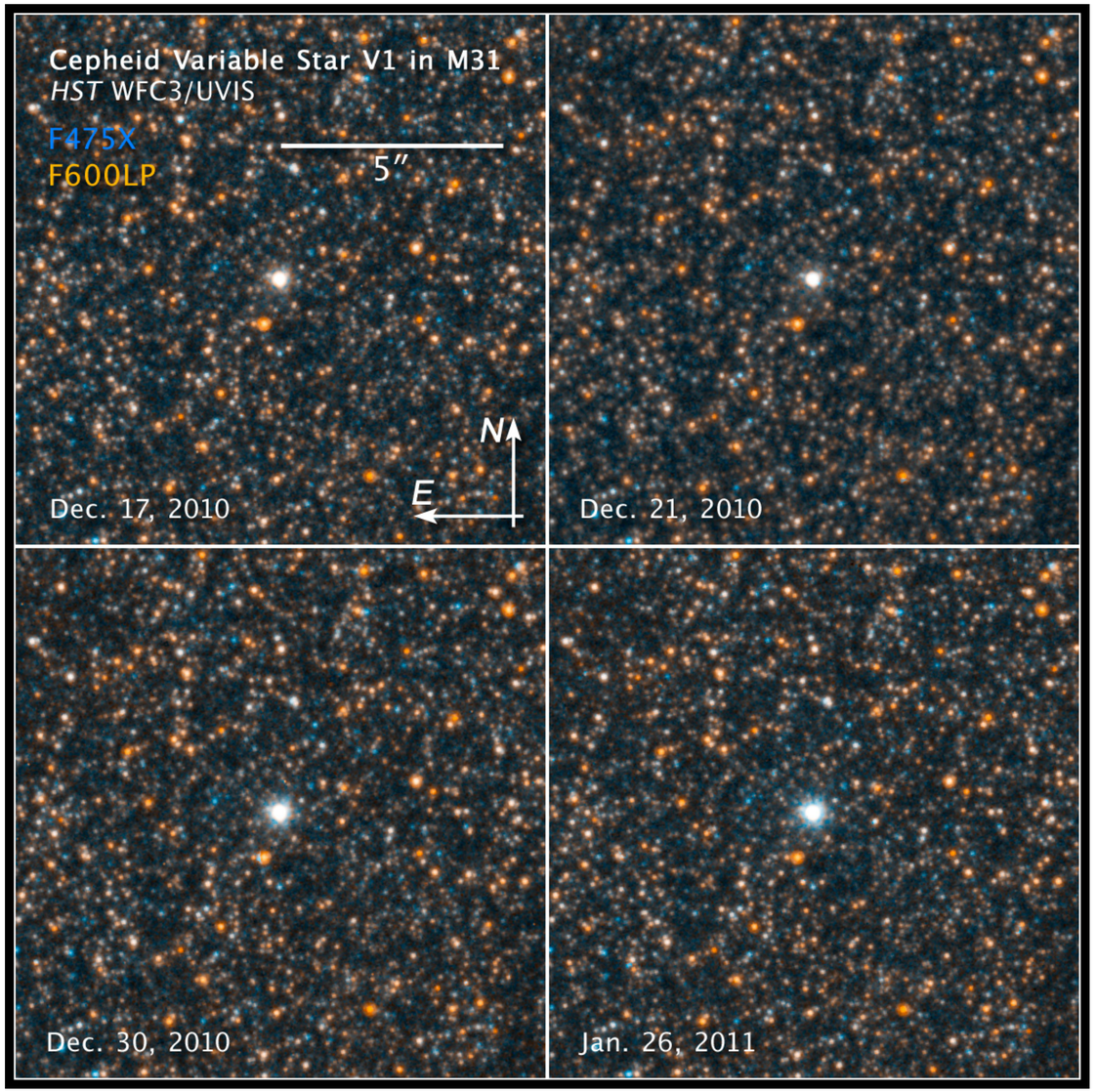
- Use SEO to observe a recently exploded Supernove:
  - https://www.rochesterastronomy.org/supernova.html
- **Data**: Find and observe a recent Supernovae, observe it over several days, and measure its dimming in several colors.
- **Result**: Estimate the distance to the galaxy using the SNe as a “standard candle”, or other properties of the SNe





5) Measuring a Cepheid Variable

- **Data**: Using archival data, measure the period and brightness of a Cepheid variable.
- **Result**:
  - The Cepheid Variable Star V1 in M31 is one of the “famous” variable stars used as the first rung in the Hubble diagram to measure the cosmic expansion rate. How would we do that with SEO?



6) Measuring a Variable Object

- **Data**: Observe a nearby variable object, and measure its brightness over time.
- **Result**:
  - Find and classify the variability, compare it to historical measurements.

7) Feel free to think of your own project!

- These are just suggestions, feel free to think outside the box and think about other projects that might be possible with SEO!

Next steps

- Think about some of these projects (and other possibilities) ahead of Thursday's class! (i.e., nothing to do today necessarily)
- On Thursday, come ready with some questions about projects you might want to learn more about, ask for suggestions, etc.
- Start thinking about if you want to schedule observations, and proactively start scheduling time. Its ok to take "test" observations, to help you learn / plan for later observations.

Extras