# PHY 517 / AST 443:
# Observational Techniques in Astronomy

## Lecture:

## Proposals
## Time Allocation Committee

# Telescope time / data analysis proposals

- writing (successful) proposals is an essential part of being a researcher
- ... at the latest, when you need to apply for funding

- observational astronomers need to submit proposals for telescope time
- can also submit proposals for funding to analyze existing data

# Example: Hubble Space Telescope

- proposal deadline once per year (~April)
- typically ~1000 proposals: time, archival, theory
- ~20% success rate
- open to anyone

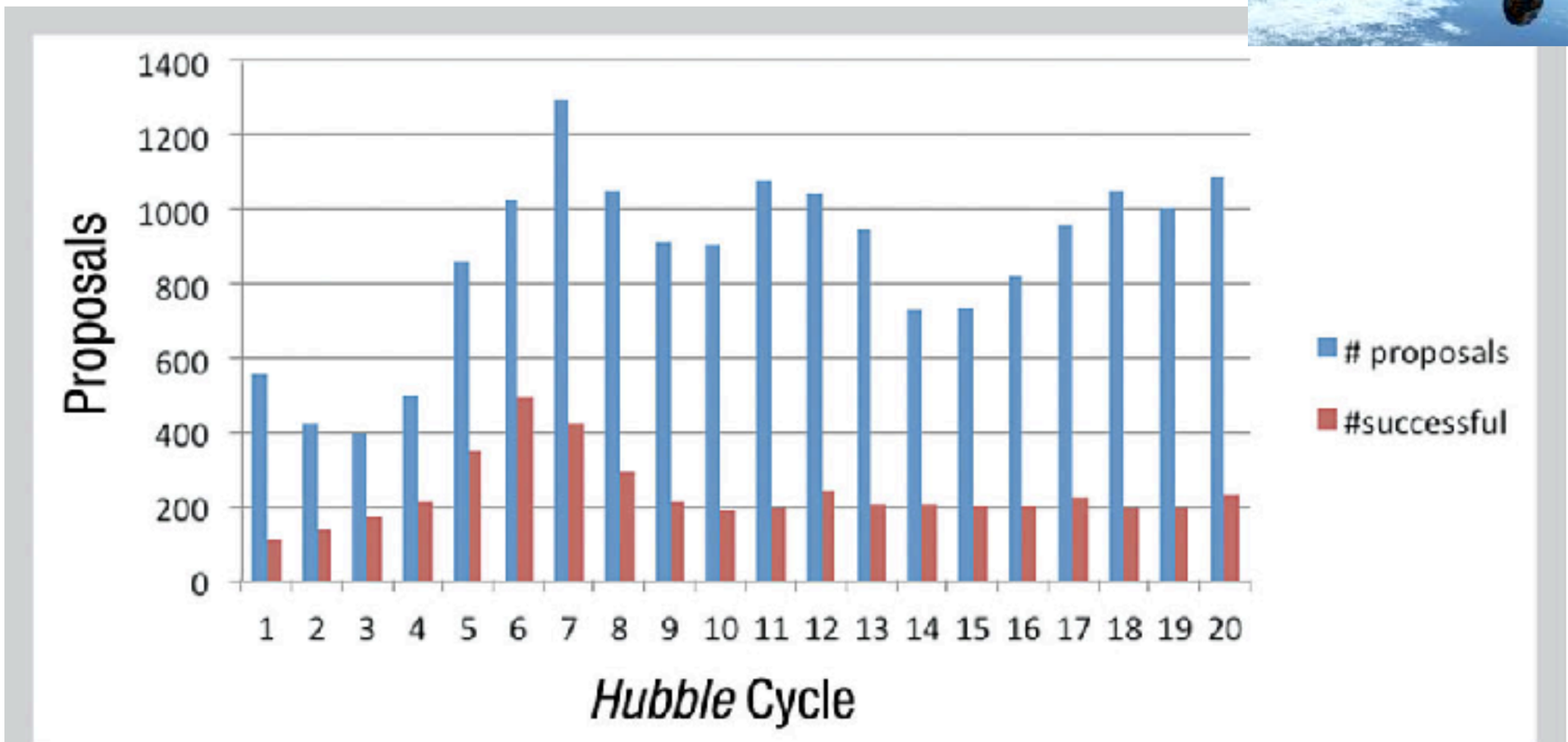
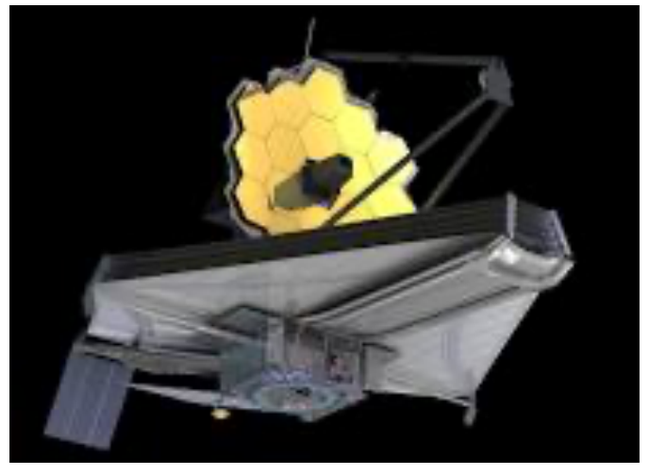




**Figure 1:** *Hubble* proposal pressure by number of proposals. The blue histogram shows the number of proposals submitted each cycle; the red shows the number accepted. The Cycle 7 statistics include the cycle 7N and 7AR proposals. The oversubscription ranges from 2:1 in Cycle 6 to more than 5:1 since SM4.

STScI

# JWST



- proposal deadline once per year
- next is Cycle 4 (Feb 12th 2025)
- Cycle 3: 1931 proposals: time, archival, theory
- ~10% success rate
- open to anyone
- proposals ~1x per year

| ID | Program Title | PI & Co-PIs | Exclusive Access Period (months) | Prime/ Parallel Time (hours) | Instrument/ Mode | Type |
|---|---|---|---|---|---|---|
| 2875 | Scrutinizing the Dirtiest Cepheids, a Test of the Hubble Tension | PI: Adam Riess | 12 | 15.97/7.26 | NIRCam/Imaging | GO |
| 2974 | The Hubble constant at 1.9% from spatially resolved kinematics of gravitational lens | PI: Tommaso Treu<br>Co-PI: Anowar J. Shajib | 12 | 36.3/0 | NIRSpec/IFU | GO |
| 3055 | A TRGB Calibration of Surface Brightness Fluctuations | PI: R. Tully | 12 | 46.83/22.06 | NIRCam/Imaging | GO |
| 3325 | Mapping the Most Extreme Protoclusters in the Epoch of Reionization | PI: Feige Wang<br>Co-PI: Jinyi Yang | 12 | 44.51/16.34 | NIRCam/WFSS<br>NIRSpec/IFU<br>NIRSpec/MOS | GO |
| 3950 | Unlocking the Early Universe for Weak Lensing with JWST: High-Precision Analysis of z=2 Galaxy Cluster XLSSC122 | PI: Kyle Finner | 12 | 4.99/0 | NIRCam/Imaging | GO |
| 4265 | Unveiling the interplay between the circumgalactic and interstellar media in a complex protocluster environment at z=4.5 | PI: Jorge Gonzalez Lopez<br>Co-PI: Manuel Aravena | 12 | 17.03/0 | NIRCam/Imaging<br>NIRSpec/IFU<br>NIRSpec/MOS | GO |

link to proposal guidelines: https://jwst-docs.stsci.edu/jwst-opportunities-and-policies/jwst-call-for-proposals-for-cycle-3#JWSTCallforProposalsforCycle3-TOC_anchor

# NOIRLab

- National Optical-Infrared Astronomy Research Laboratory
- formerly NOAO = National Optical Astronomical Observatories
- US national research & development center for ground-based night-time astronomy
- manages most telescopes with US-wide access
- own facilities:  Kitt Peak National Observatory (KPNO, Arizona), Cerro-Tololo Inter-American Observatory (CTIO, Chile)

- Calls for Proposals 2x per year; deadlines end of September and end of March

# ESO

- ESO = European Southern Observatory
- manages the Very Large Telescope (VLT; Chile)
- also open to anyone; preference for European projects only in direct conflicts

- Calls for Proposals 2x per year; deadlines end of September and end of March

# ALMA

- ALMA = Atacama Large Millimeter Array
- multi-national project
- proposals through respective managing facilities, e.g. for US: NRAO = National Radio Astronomy Observatory

- proposals ~1x per year

ALMA observatory

# Other telescopes

- some facilities are not open-access, but only available to researchers at the institutions / countries who built / finance them
- for example:
  - Keck telescopes (mostly CalTech, University of California + University of Hawaii)
  - Subaru telescope (mostly Japan + University of Hawaii)

# PHY517 / AST443 proposals

- each of you will write a *telescope proposal* for your Lab 3
- the telescope proposal has to be of the opposite observational technique (photometry/spectroscopy)

- you will then review the other students' proposals (~8 proposals to read, grade and evaluate)
- we will hold a Time Allocation Committee (TAC) meeting to discuss and rank the proposals

- each group will conduct their top-ranked project

# PHY517 / AST443 proposals

- Proposal deadline: **Friday, Mar. 08, 2pm (strict !)**
- Initial reviews deadline: **Friday, Mar. 15, 11:59pm**
- Time Allocation Committee: **Monday, Mar. 18**

# How to write a good proposal

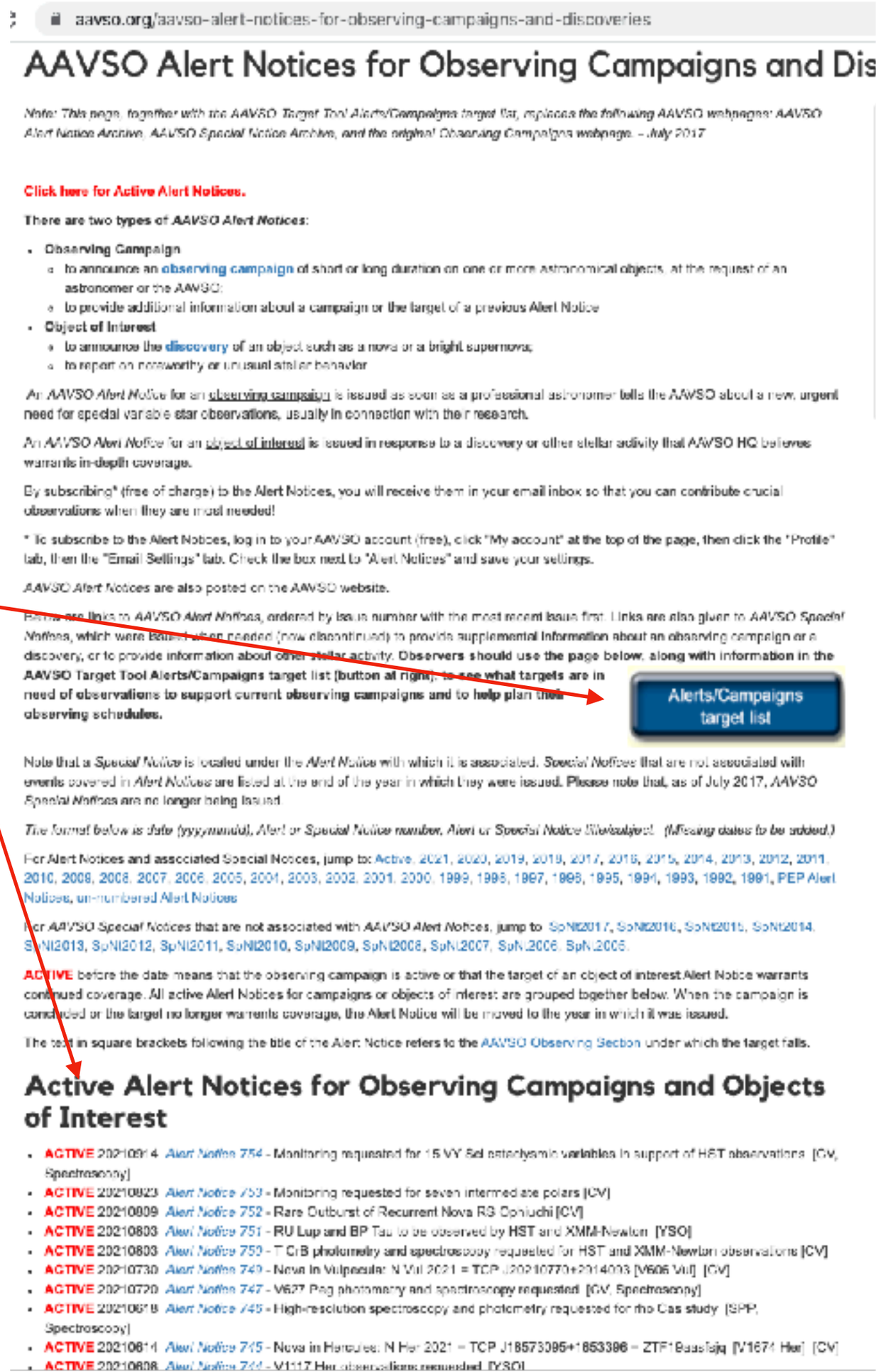
- come up with a good idea!
  - make sure that there is a *measurement* involved (i.e. not just plotting a lightcurve)

- figure out the technical details

# Possible resource: AAVSO

American Association of Variable Star Observers (AAVSO):

- "alert": call for observations by small telescopes, issued by scientists
- could pick one (or more) of these as basis for your proposal
- try to maximize science output
  (1 single 10-minute observations probably not very exciting)
- note: you will have to research the topic to write your science case



# More resources on transient events

- Zwicky Transient Facility:  https://www.ztf.caltech.edu/
- Latest supernovae:  https://www.rochesterastronomy.org/supernova.html
- Transient Name Server:  https://www.wis-tns.org/

# Your data + archival data

- your observing proposal will be to make measurements with our roof-top telescope

- for the scientific analysis, you can *add* data from other sources
- examples:
  - AAVSO database -> lightcurve
  - spectroscopic information (Simbad, NED)
  - Gaia parallaxes -> distances
- see wiki tab "Astronomical Data Archives" for a list of resources

# Possible project resource:  basic astronomy

- think back to your introductory astronomy class (e.g. AST203)
- there are some "classic" measurements, e.g. color-magnitude diagrams, period-luminosity relations, etc.
- you could choose one of these
- make sure that there is a measurement goal!

# Possible project resource:  astro-news

- check astronomy news (e.g. Sky & Telescope)
- also, what is currently visible (planets, comets, …)
- is there something that inspires you?
- research the scientific background

- make sure that there is a measurement goal!
- example: "*I want to make a pretty picture of this galaxy*" is not a quantitative measurement goal

# Deep (stacked) imaging

- in the exoplanet lab, we analyzed each exposure separately
- can also combine exposures to create a deeper image with higher signal-to-noise
- straightforward with `scamp` command (provided you have run astrometry.net on you images) - see wiki page

# Spectroscopy ?

- limited to bright targets that are easy to find

Possible resource: Astronomical Ring for Access to Spectroscopy (ARAS):

- observing campaigns and alerts, specific for spectroscopy
- could pick one of these as basis for your proposal
- note: you will have to research the topic to write your science case
- read the spectroscopic manual of Lab 2!

# Possible project resource:  your own idea!

- come up with your own idea!

# Time Request

- the target observing period is Mar. 19 - Apr. 5

- you might need one full night, or several partial nights, or …
- nights can be shared between groups
- try to be flexible in your time request
- I will assign observing time, based on proposal ranking and your (non-)availability

- examples of how to specify your time request:
  - 1 nights
  - 3x 2hours

- specify the nights you are *not* available (e.g. night before a mid-term / GRE)

# Time Request

- if targeting transient sources:  we cannot accommodate real Target-of-Opportunity requests (where your observations override somebody else's on a timescale of hours) - make sure you can do something with the nights you're given

# Proposal Structure

- Cover Sheet
  - title
  - abstract
  - ~~PI and CoI names~~
  - telescope / instrument / set-up request
  - time request
- Scientific Justification
  - limited to 1 page
- Figures, Tables, References (2 pages)
- Technical Justification / Experimental Design
  - limited to 1 page
- Analysis Plan
- Observing Run Details

# Proposal Structure

telescopes such as ours.
Your data might even contribute to a journal paper! However, make sure that there is a measurement aspect to your project (i.e. not just plotting a lightcurve).
You can choose to add archival data (e.g. lightcurve data from AAVSO) to your own data to facilitate this.

- Other resources for transient events include ZTF, the Transient Name Server, and this list of recent supernovae.
- For ideas specifically for spectroscopy, check this forum.
- Think back of the concepts taught in your basic astronomy course. There are "standard" labs such as constructing color-magnitude diagrams. Make sure you have a quantitative science goal!
- Imaging analyses often acquire deep exposures of targets. It is straightforward to combine a set of exposures with the {\tt scamp} program.
- For the data analysis, you can combine your data with external data. A list of resources can be found here.
- Browse the current astronomy news. Is there something unique happening in the sky where you can measure something interesting? (Again, make sure you have a quantitative science goal.)

Your proposal has to be distinct from your lab-mates, so be sure to check with them. They will automatically be Co-Investigators on your proposal.

Figure out the technical aspects of your project. When is your target observable? What filter or grating do you need? What should the exposure times be? Use your experience from the previous labs, and the manuals of the instruments as guides. Read the lab manual for Lab 2 of the same observation type.

Use the latex template provided below to write your proposal. Note that at most 1 page can be used for the scientific justification. The other pages may be used for figures, tables, and object list. You have to use an 11-pt font, 1-inch margins, and single spacing, otherwise your proposal will be disqualified!
Make sure to submit your proposal by the deadline - late submissions cannot be accepted!

The proposal review will be blinded - for the PI and CoIs, list only your SBU IDs, no names!

LaTeX template file
LaTeX style file
Reference file for template
Figure for template
PDF of template

- Lab 1: CCDs
- Lab 2.1: Exoplanet transit
- [illegible]
- Lab 3: Your own proposal
- [illegible]
- Astronomical Data Archives
- Weather
- End-of-night report

Computing

- Computing Resources
- Astro Software Overview
- Bash
- LaTeX
- Python
- Jupyter
- GitHub
- ds9
- SExtractor
- Topcat
- Astrometry.net
- Image arithmetic (+ftools)
- Stacking images

**Clone this wiki locally**

https://github.com/sibirrer/PH

**Mt. Stony Brook Observing Proposal**
*Date:* February 21, 2022

**Panel:** *For office use.*
**Category:** Star Clusters

# Catchy Title

**PI:** put your SBU ID here

**Abstract of Scientific Justification** *(will be made publicly available for accepted proposals)*:

Your abstract is the review panel's window into your proposal: the abstract provides an initial impression about your proposal and it is also what panel members refer to at the review meeting to remind themselves about the content of your proposal. Take advantage of the opportunity to give the panel members an understandable and concise summary of what you want to do, and why. Write your abstract so that non-specialists can quickly understand why the observations you want to make are important.

**Summary of observing runs requested for this project**

| Run | Telescope | Instrument | Time Request | Moon | Optimal months | Accept. months |
|---|---|---|---|---|---|---|
| 1 | 14-inch | imaging | 3x 2 hours | dark | Oct | Oct - Nov |
| 2 | 14-inch | spectrograph | 1 night | grey | Mar | Mar - Apr |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |

**Scheduling constraints and non-usable dates** *(up to six lines)*.

Run 1 needs to be scheduled to catch phase 0 of the eclipsing binary, on Oct. 20, Oct. 25, Oct. 30 or Nov. 4. Run 2: please avoid Apr. 1 (proposers have a mid-term the next morning).

**Scientific Justification** *Be sure to include overall significance to astronomy. For standard proposals limit text to one page with figures, captions and references on no more than two additional pages.*

The scientific justification should explain the overall goals of your program in the context of your field, as well as the importance of your program to astronomy. Writing a good scientific justification is an art. It takes skill and practice. And it requires a good scientific idea. This last you must supply but a few general guidelines about proposal writing might still be helpful...

- State succinctly and clearly the problem you are trying to solve and the progress that will be made toward doing so if the proposed observations are successful. If the review panel members have to work hard even to understand what you want to do, they are unlikely to be sympathetic to your proposal.
- Explain clearly why the project is important and how it relates to the broad context and important issues in your field. Many proposals focus too tightly on a specific observational goal (e.g. "measure the velocity dispersion of this cluster of galaxies") without explaining why it is important or how it relates to a significant question about the Universe.
- Be specific. If your observations will "constrain theoretical models," then discuss what will be constrained and why those constraints matter. Make sure the review panel understands exactly why the observations you propose will make a difference in your field, and exactly how the observations will refine or require changes in the theory.
- Keep it simple. Try to focus on the central idea of your proposal. Complex arguments are hard to explain and hard for the panel members to follow. Distracting tangential arguments obscure the theme of your proposal.
- Include a figure to help explain what you want to do. Sample data or model predictions shown in a figure often help clarify complex arguments for the panel members. A sample figure is included below with this proposal.
- Keep it short. Never exceed a page for the text of the scientific justification, and never reduce the font size. It may even help to be a little under a page, and increase the font size a little! Organize your presentation with paragraphs, headings, and bullets so it is easy to read.
- Include and check references as appropriate [Bell et al., 1996].
- Print out the proposal to be sure your LaTeX is correct. Proofread it. Make sure the proposal is correct scientifically, technically, and grammatically. Run a spellchecker.

Finally, when an opportunity arises, volunteer to serve on a TAC or review panel. The experience is a great help in learning how to write a good scientific justification.

## References

D. J. Bell, C. D. Biemesderfer, J. Barnes, and P. Massey. An Automated System for Receiving KPNO Proposals by Electronic Mail. In G. H. Jacoby and J. Barnes, editors, *Astronomical Data Analysis Software and Systems V*, volume 101 of *Astronomical Society of the Pacific Conference Series*, page 451, 1996.

Scientific Justification

1-page limit!

# Scientific Justification

- describe your project to a knowledgeable, but non-expert audience
- provide background information / motivation
- what is the goal of your measurement?

- make it exciting / important!
- polish the text - typos and carelessness are distracting

*This box blank.*

2 pages for figures, references, etc.

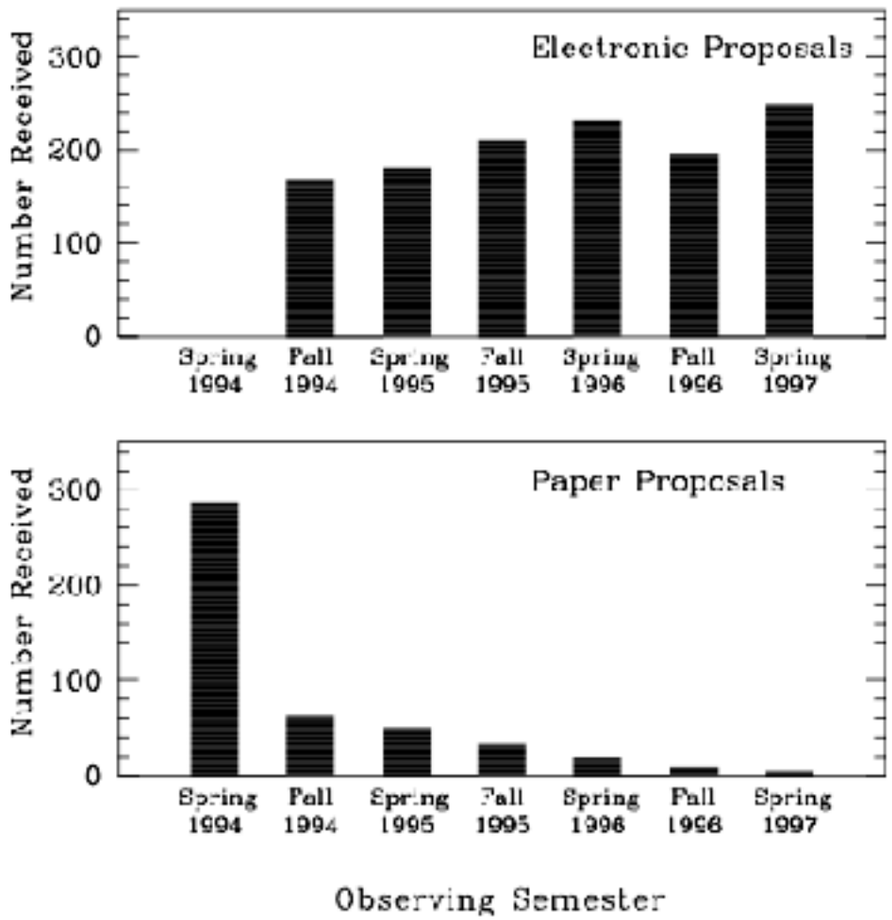



Figure 1: This sample figure shows how quickly electronic proposals for telescope time replaced paper ones.

# Experimental Design / Technical Justification



*This box blank.*

**Experimental Design** *Describe your overall observational program. How will these observations contribute toward the accomplishment of the goals outlined in the science justification? If you've requested long-term status, justify why this is necessary for successful completion of the science. (limit text to one page)*

The review panel looks to this section to find out about the overall strategy of your data analysis. You need to convince the panel that your strategy will be successful. If the strategy is found to be infeasible, the proposal will be outright rejected.

- What are the target objects and target datasets, and how were they selected?
- Comment on the observability of your targets.
- Provide a **detailed explanation of the exposure time estimate**. Where possible, scale from your existing data to calculate the required exposure time. Also provide an estimate of how long your total observing session will take (with multiple exposures, calibration, etc.).
- Provide an explanation of which filter(s) you will use.
- What calibration data will you require?
- Will you require external data? If so, describe the nature of that dataset, and how you will analyze it.
- What do you plan to measure, and how?

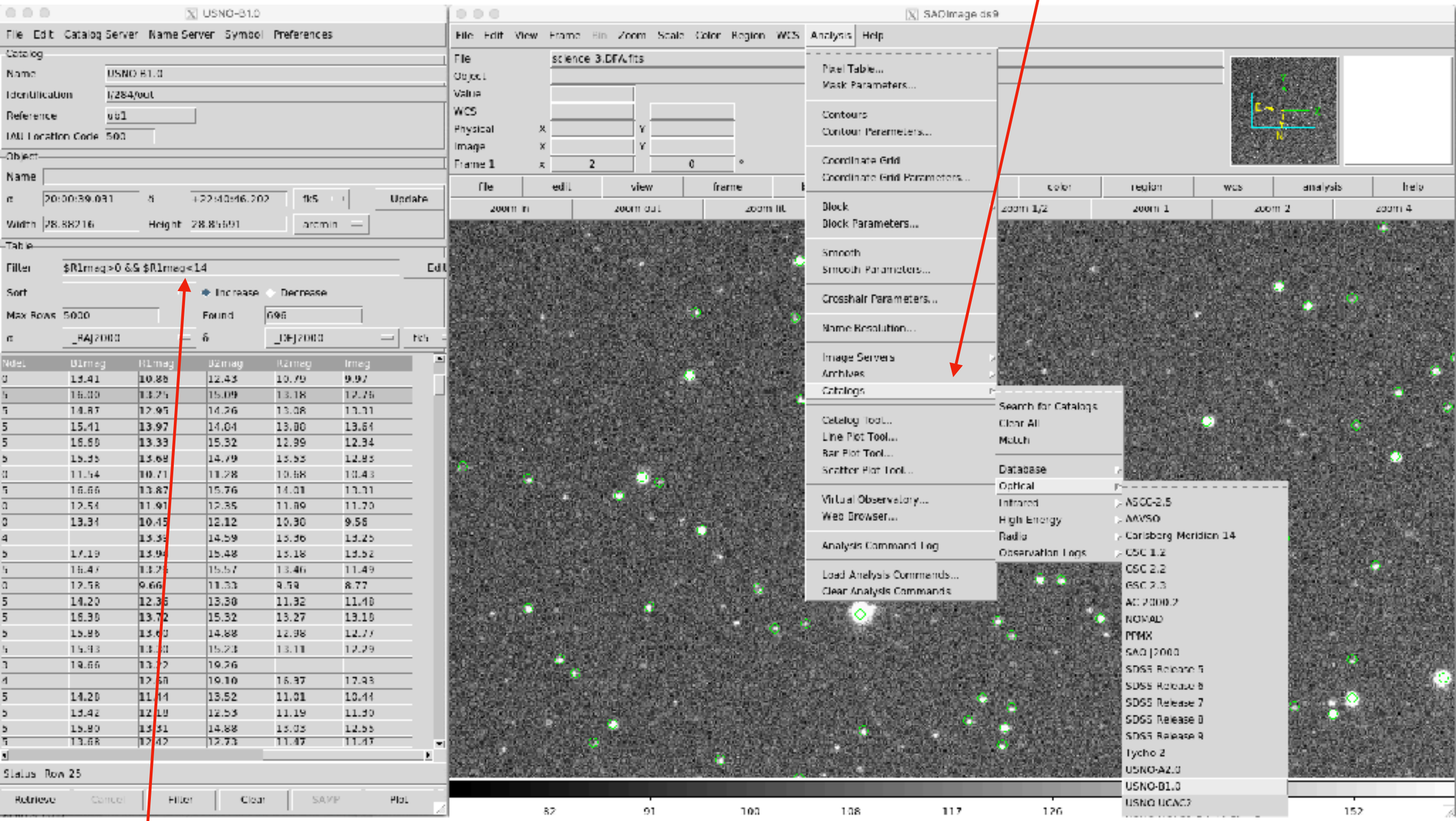
1-page limit

# Technical Justification

- as important as your scientific justification is the technical justification
- if your project is not feasible, it will be rejected

- from the exoplanet lab, you have an idea of what magnitude star requires what exposure time
  - can scale to other magnitudes with CCD signal-to-noise equation (recall that $mag \propto log[flux]$ )
  - make sure to justify choice of filter(s), too

# to overlay external catalogs:




might need to filter results

# Analysis Plan

**Analysis Plan** *Describe the steps that you will take to analyze the data. State which tasks will be due for the weekly check-ins (weeks 1, 2, 3). The week 4 task will be to complete the lab report. In case you have less than four weeks between taking the observations and the last day to submit lab reports, how will the analysis plan change?*

+1 week:
+2 weeks:
+3 weeks:
+4 weeks: Submit the lab report.

note: last day to submit lab reports: May. 3

## Observing Run Details for Run 1: 14-inch/STL-1001E

**Technical Description** *Describe the observations to be made during this observing run. Justify specific instrument choices such as the required filter, or the grating choice, as well as the requested lunar phase. List targets, coordinates, and magnitudes (or surface brightness, if appropriate) in the Target Tables section below.*

Create a separate "run" page for each telescope/instrument combination being used for your project.

### Instrument Configuration

Filters: B,V,R,I,IIa
Grating/grism: -
Order: -
Cross disperser: -

Slit: -
Multislit: -
$\lambda_{start}$: -
$\lambda_{end}$: -

Fiber cable: -
Corrector: -
Collimator: -
Atmos. disp. corr.: -

**R.A. range of principal targets (hours):** 12 to 13

**Dec. range of principal targets (degrees):** 10 to 15

**Special Instrument Requirements** *Describe briefly any special or non-standard usage of instrumentation.*

Target Table for Run 1: DECam

| Obj ID | Object | $\alpha$ | $\delta$ | Epoch | Mag. | Filter | Exp. time | # of exp. | Lunar days | Sky | Seeing | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 777 | NGC 7078 | 21:30:10 | 12:10:03 | 2000.0 | 18.6 | g | 1000 | 5 | 4 | | | globular cluster |
| 778 | NGC 7078 | 21:30:10 | 12:10:03 | 2000.0 | 18.6 | r | 1000 | 5 | 4 | | | same cluster |
| 779 | NGC 7078 | 21:30:10 | 12:10:03 | 2000.0 | 18.6 | i | 1000 | 5 | 4 | | | |

# AST 443 / PHY 517 proposals

proposal template available on GitHub:

https://github.com/sibirrer/PHY517_AST443/wiki/Your-own-telescope-proposal

**blind review**: list only your SBU ID as author!

GitHub page includes links to example telescope proposals

# Time Allocation Committee

# Time Allocation Committees

- proposals are reviewed by panels of researchers, chosen by the responsible agencies (e.g. HST - STScI)
- panels are assembled by topical groups (e.g. cosmology)
- every panelist has to read every proposal assigned to that panel, typically ~80
- preliminary grades submitted online
- 2-day meetings to discuss all proposals and finalize grades

# AST 443 / PHY 517  TAC

- you will be assigned a list of ~8 proposals to evaluate and grade
- you will have to send in grades and comments for all proposals on your list a few days before the TAC meeting

# AST 443 / PHY 517  TAC

- you will be primary reviewer for one proposal, and secondary reviewer for another proposal
- during the TAC meeting, the primary and secondary reviewers will lead to discussion of each proposal, but *everybody will be expected to take part*
- the PI of the proposal and their collaborators, as well as PIs of directly competing proposals, will leave the room

# AST 443 / PHY 517 TAC

- after each discussion, you will re-grade the proposal via secret ballot
- we will rank the proposals based on the final grade
- *each group will work on its top-ranked project*

- after the TAC meeting, the primary and secondary reviewer will collate the comments into a final evaluation of that proposal

# Blind reviews:
# avoiding unconscious bias

# Avoiding unconscious bias

- Unconscious / implicit bias:  our judgment is biased by stereotyped expectations
- has been well documented in much of society

Image: Texas Medical Center

# Example: Racial Bias in Job Applications

Are Emily and Greg More Employable than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination

Marianne Bertrand and Sendhil Mullainathan

NBER Working Paper No. 9873
July 2003
JEL No. J7, J71, J23, J24, J63, J82, C93

## ABSTRACT

We perform a field experiment to measure racial discrimination in the labor market. We respond with fictitious resumes to help-wanted ads in Boston and Chicago newspapers. To manipulate perception of race, each resume is assigned either a very African American sounding name or a very White sounding name. The results show significant discrimination against African-American names: White names receive 50 percent more callbacks for interviews. We also find that race affects the benefits of a better resume. For White names, a higher quality resume elicits 30 percent more callbacks whereas for African Americans, it elicits a far smaller increase. Applicants living in better neighborhoods receive more callbacks but, interestingly, this effect does not differ by race. The amount of discrimination is uniform across occupations and industries. Federal contractors and employers who list "Equal Opportunity Employer" in their ad discriminate as much as other employers. We find little evidence that our results are driven by employers inferring something other than race, such as social class, from the names. These results suggest that racial discrimination is still a prominent feature of the labor market.

**DOI** 10.3386/w9873

# Example: Gender Bias in Student Teaching Evaluations

This study analyzed differences in student ratings of their instructors[1] from an online course, independent of actual gender. The course professor randomly assigned students to one of six discussion groups, two of which the professor taught directly. The other four were taught by one of two assistant instructors—one male and one female. Each instructor was responsible for grading the work of students in their group and interacting with those students on course discussion boards. Each assistant instructor taught one of their groups under their own identity and the second group under the other assistant instructor's identity. Thus, of the two groups who believed they had the female assistant instructor, one actually had the male. Similarly, of the two groups who believed they had the male assistant instructor, one actually had the female (see Table 1). At the end of the course, the professor asked students to rate their instructor through the use of an online survey. This design created a controlled experiment that allowed us to isolate the effects of the gender identity of the assistant instructors, independent of their actual gender. If gender bias was present, than the students from the two groups who believed they had a female assistant instructor should have given their instructor significantly lower evaluations than the two groups who believed they had a male assistant instructor.

MacNell, Driscoll & Hunt 2015
DOI 10.1007/s10755-014-9313-4

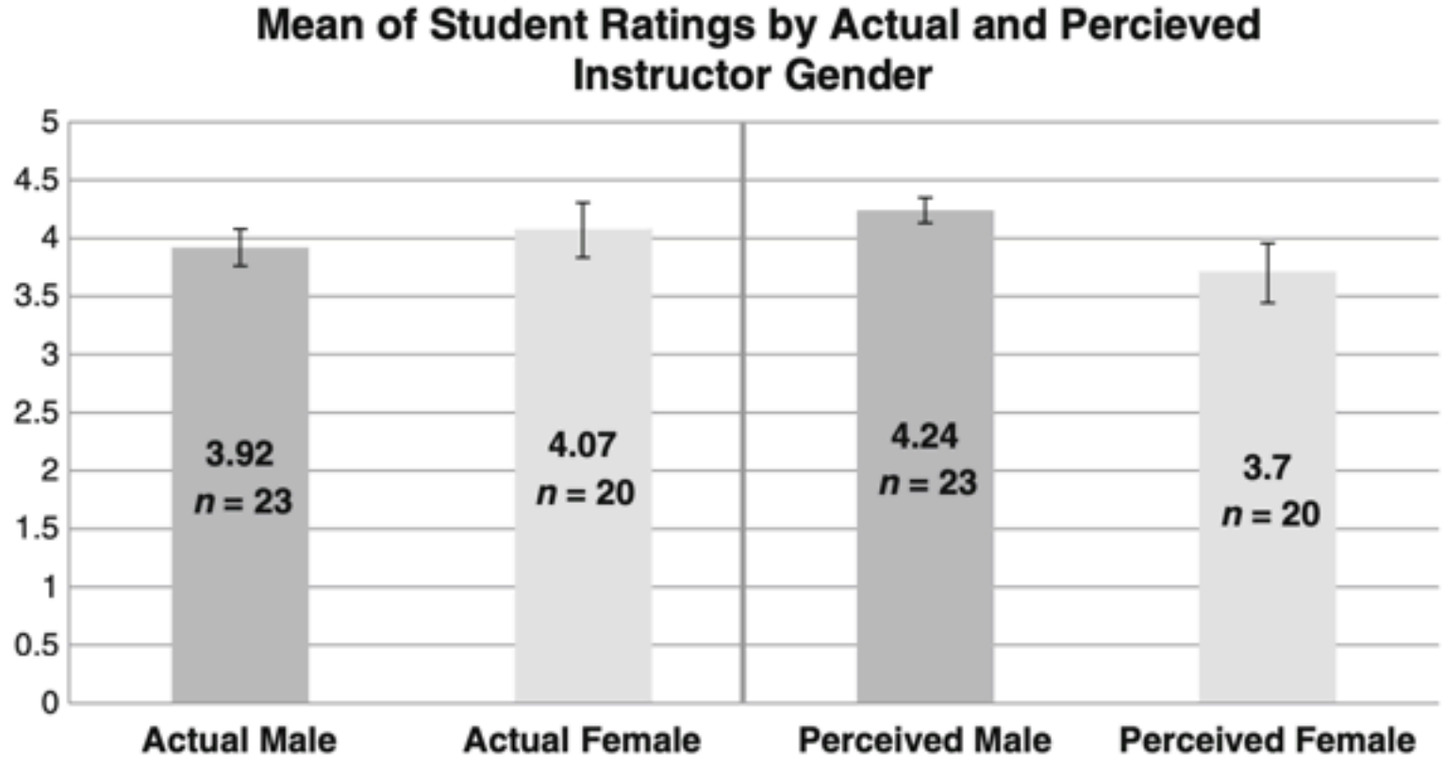



**Figure 1** Comparison of the mean of student ratings across actual instructor gender (left two columns) and perceived instructor gender (right two columns). The difference between the right two columns is significant to the p<=0.10 level.

# Avoiding unconscious bias

- Unconscious bias is "unconscious" - there is no malicious intent (unlike racism / sexism etc.)
- Result of how humans make decisions → difficult (but not impossible!) to avoid

**Affinity Bias**

Feeling a connection to those similar to us

**Perception Bias**

Stereotypes and assumptions about different groups

**Halo Effect**

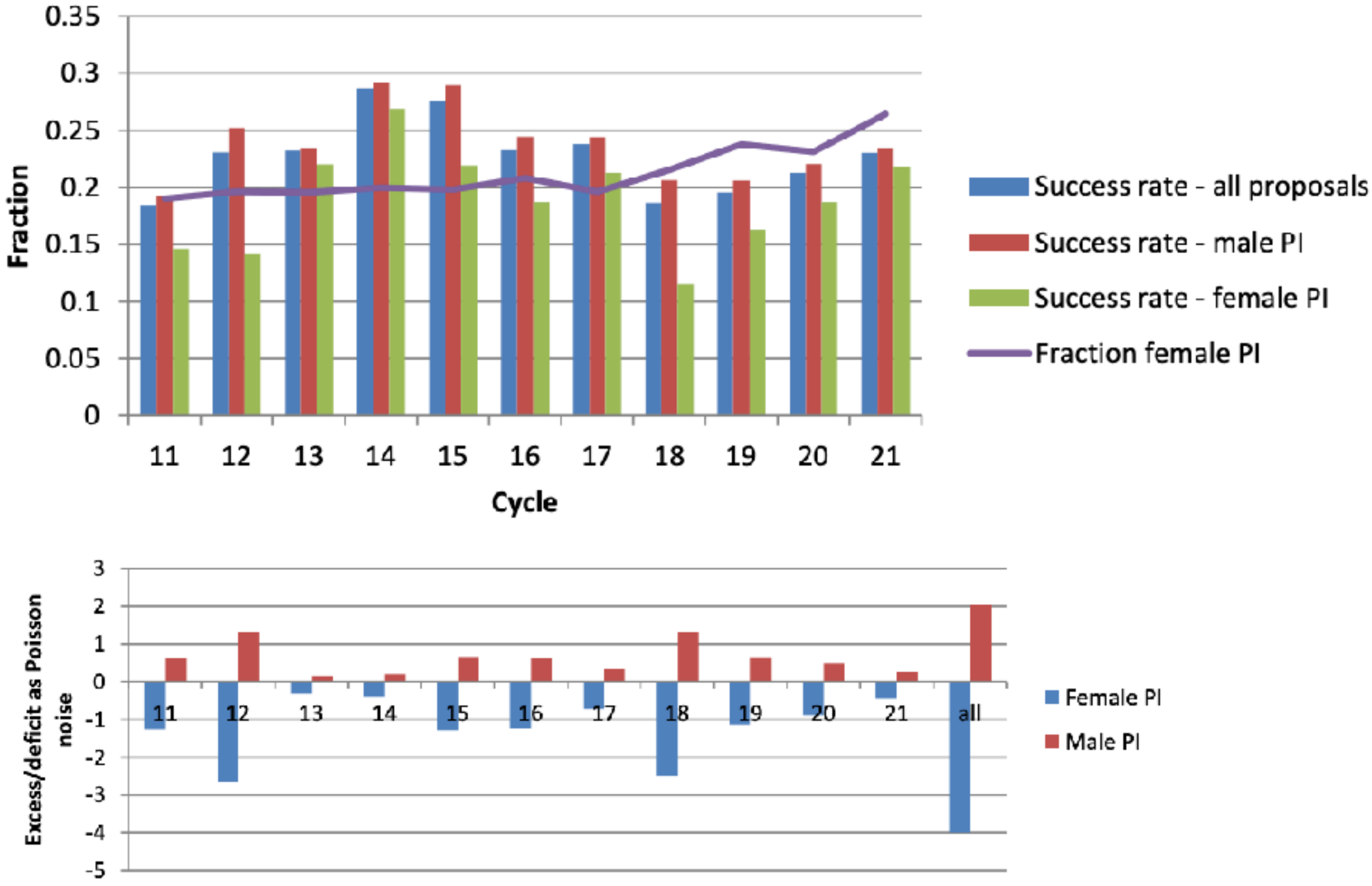
Projecting positive qualities onto people without actually knowing them

**Confirmation Bias**

Looking to confirm our own opinions and pre-existing ideas.

https://www.beapplied.com/post/unconscious-bias-explained-and-how-it-affects-hiring

# Gender bias in proposal success rates



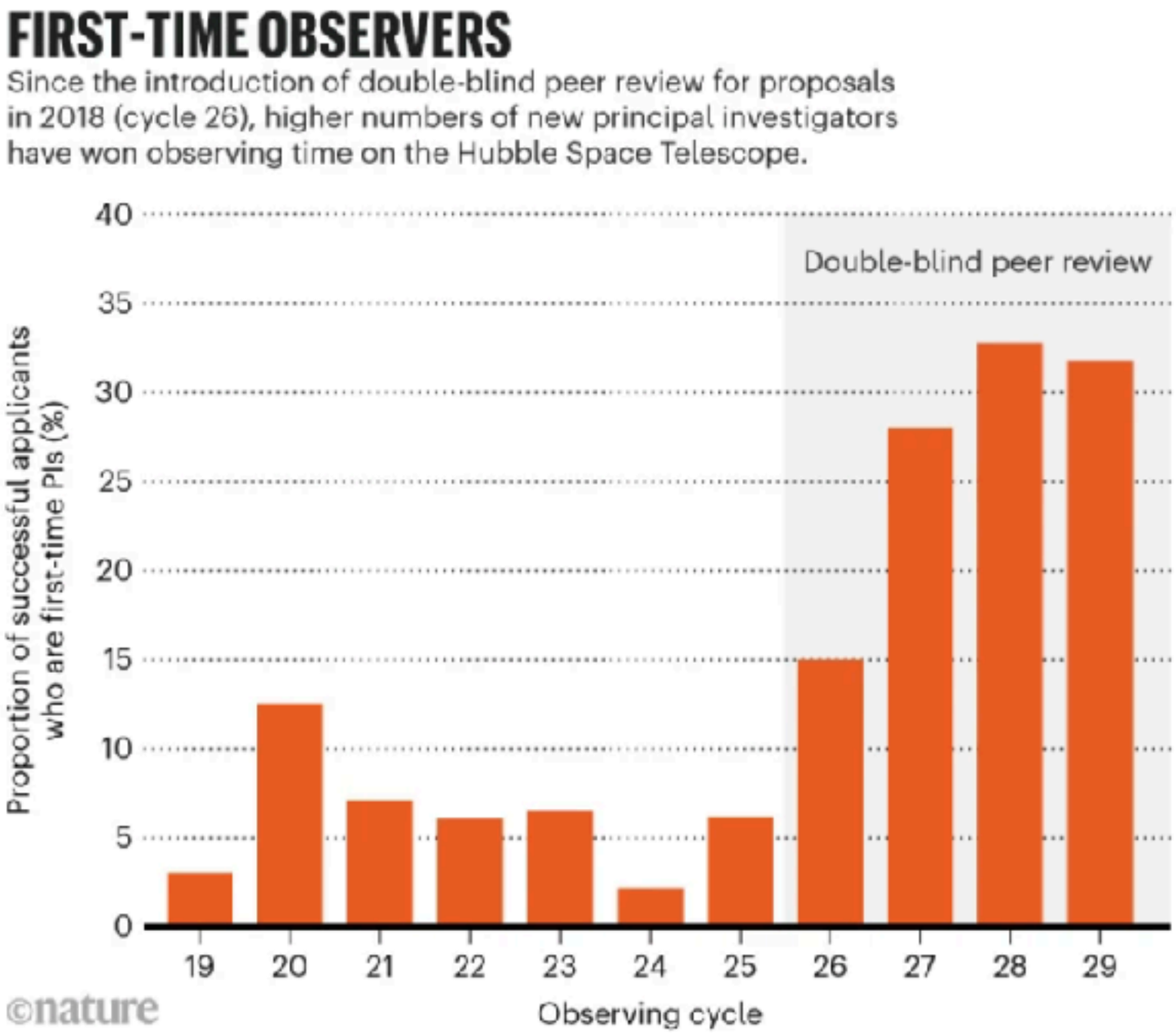

Reid 2014

# Avoiding unconscious bias

- In 2018, the Hubble TAC was conducted dual-anonymously
  - PIs were not identified; had to avoid identifying themselves in the narrative
  - Reviewers were told not to guess the proposers

# Avoiding unconscious bias

- In dual-anonymous review:  seniority bias could be overcome




Nature news, 2021

- Implemented also for several other review processes

# Therefore:

- class TAC:  double-blind
- class grading:  as blind as we can make it

- “we” are still trying to figure this out
- be conscious of biases when you get into advisorship / leadership roles

# Further Reading

- Reid 2014: Gender-based Systematics in HST Proposal Selection. https://ui.adsabs.harvard.edu/abs/2014PASP..126..923R/abstract
- Strolger & Natarajan 2019: Doling out Hubble time with dual-anonymous evaluation. https://physicstoday.scitation.org/do/10.1063/PT.6.3.20190301a/full/
- Nature news 2021: Record number of first-time observers get Hubble telescope time. https://www.nature.com/articles/d41586-021-03538-8
- Caplar, Tacchella, Birrer 2017: Quantitative evaluation of gender bias in astronomical publications from citation counts. https://ui.adsabs.harvard.edu/abs/2017NatAs...1E.141C/abstract