

# Writing proposals in astronomy

- Observing proposals
- Supercomputing proposals
- Funding proposals
- Fellowship proposals

All proposals: requests to a group of people to provide resources for your work.

## Why are your ideas important?

Why are your ideas important to the people evaluating your ideas?

Faculty recruitment: do other people in your field take your ideas seriously? Have you been able to get resources to support yourself (and others)? **PI proposals demonstrate that evaluation.**

# Peer review for competitive proposals

- Committee of 6-12 people
    - 100 proposals to read, triage (=ignore) lowest ~30%.
    - Oversubscriptions can be 10:1 or more; 4:1 is common
    - Primary/secondary reviewer gives careful read
    - Sometimes include an outside expert review
  - Who are those people?
    - Experts in astronomy? (Fellowship proposals)
    - Experts in extragalactic/galactic astronomy (observing proposals)
- (Avoid jargon and acronyms!!! Sell your ideas to non-experts)**

# Results of proposal applications

- Fellowship: Yes/No
- Observing Time: A/B/C/rejection (or something like that) or Yes/No
- Comments

# Peer review comments

- Often written quickly, may not reflect the discussion that was in the room
- If triaged, random comments from the primary (with limited input from others)
- Learn from the comments, but don't take them too personally
- Identified weaknesses
  - Sometimes real problem the proposal failed to address
  - Most often: failure to communicate clearly
  - Unusual: mistaken reasons or biases

# Science

- What science do you want to do?
- Do you have the resources to do it?
  - For observers, do you have sufficient modeling on the team?
  - Co-Is provide resources, technical expertise, and eyes for a critical read of your proposal
- Feasibility – can you do your science?
  - Write the feasibility first
  - Sample?
- Quality of proposal proportional to resources
  - 10 nights of VLT vs 1 hr of LCO photometry
  - Is this the right resources for the science?

# Can you use less expensive resources?

- JWST: mid-IR is unique, but are there other ways to do the same science?
  - Same with HST and UV or high-resolution+wide-field optical imaging
- ALMA: Morita (ACA) array – less powerful, but oversubscription is lower
- Smaller telescopes
- Filler time for bad weather

# Why should I care about your work?

(literally, me)

I'm on the SMA TAC this semester. I have now learnt my lesson the hard way. Always consider "Why should Greg care" when writing a proposal! Always, always, always. No excuses.

It's incredible how many proposals dive right into how we should observe a specific phenomenon in a specific target without any link to the bigger picture and without even trying to convince me that it needs doing, as if that is self-evident. It isn't! It doesn't help that I've been given all the high-mass star formation and AGB stars, neither of which I know much about...

# Don't tell me that your science is important, show me why your science is important

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# Figures and illustrations: critical

- What's missing in literature?

- Sample selection?

- Unbiased?
- Sufficient but not too much?

- **SHOW ME!**

- Case studies

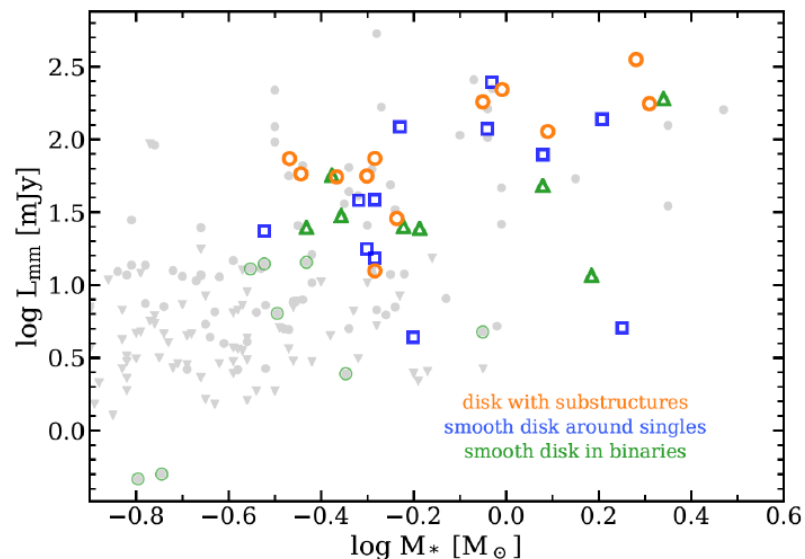
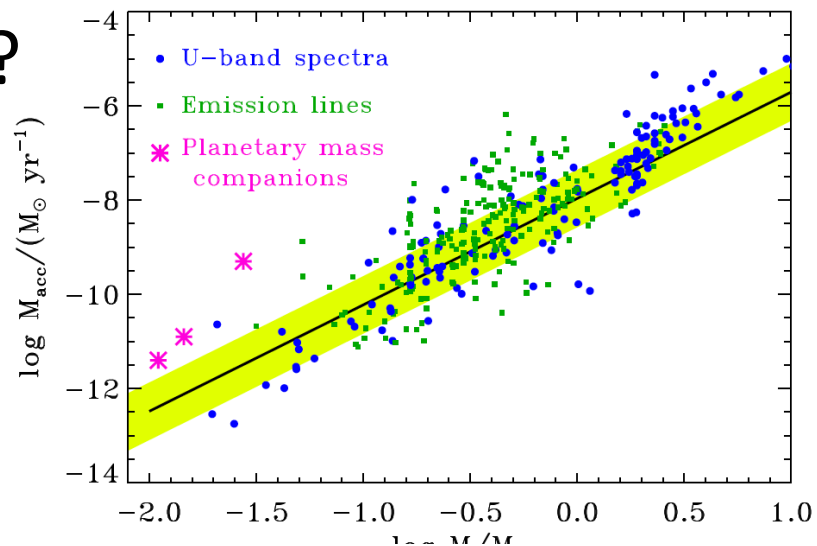
- Is your object weird?

- **SHOW ME**
- Generalizable?

- Is your object normal?

- SHOW ME!

- Cartoons are good



# Format

- Length? Forms? Phase IIs or just initial proposal?
  - Never, ever play games with font size, length, margins, and the rest
  - Play games by writing concisely
    - Non-native English speakers are at a disadvantage in ability to maximize information/line
  - Keep the text+figures readable and legible
- Science Justification? Technical Justification?

# A proposal is like a condensed introduction

## Science Justification

- First paragraph: Big Picture
  - perhaps **thesis sentence** at end, or perhaps elsewhere
- Second paragraph: flow big picture down to problem
- Third paragraph: explain problem, what has been done in the past, **limitations** of past studies
- Fourth paragraph: How will you solve this problem?

Ideally, problem has two possible solutions, your observation will discriminate between those solutions

Citations: be broad! Cite your own work, but minimally – make sure that you cite literature from wide range of groups!

# The thesis sentence

The thesis sentence is a single sentence that concisely describes:

- 1) What problem you will solve
- 2) What resources you are asking for to solve
- 3) How you will use requested resources to solve the problem

**Boldface this sentence!** The entire proposal is then built around this sentence:

- before this sentence, why is the problem important?
- after this sentence, how you will solve the problem

The thesis sentence is usually written early. However, revisions occur until submission. Each revision may require adjustments in the proposal logic.

Sometimes the thesis sentence comes at the end of the first paragraph, sometimes later – depends on how the proposal was written

Thesis sentence must be on first page; similar version in abstract

# Tips for successful proposals

- A compelling proposal must be **clearly, persuasively, and concisely written** and must demonstrate:
  1. That the questions you are asking are **important and interesting**;
  2. That the program is technically **feasible**;
  3. That you are **competent** to execute it; and
  4. That it will provide a **definitive answer** to the questions posed.
- Put key points up front
  - (don't make it hard on the reader)
- Be direct, straightforward, and clear
- Use illustrations/cartoons to describe your points
- Abstract: captures all key points

# Editing

- Where are weaknesses?
  - Figure out how to address them!
  - Are they minor details that nobody else would see?
- For a 2-page proposal, write 2.5-3 pages at first
  - Text can always become more concise
  - Let others (Co-Is) edit!
  - Finish draft \*early\* (not 24 hrs early, but 1-2 weeks)  
(and earlier for JWST/galactic ALMA!)

# Technical Justification/Feasibility

- What is your general goal?
  - Tie back to big picture
- What is your specific observable?
  - Tie back to general goal
  - What S/N is required to measure that specific observable to answer your science question?
  - What tools will you use to analyze the observable to reach your general goal?
- Can you do your science?
  - If you do your feasibility after the science justification, sometimes you realize your science goals are not possible
  - Usually iterative: adjust feasibility => adjust science => adjust feasibility...

The technical justification is insufficient for funding/support,  
but a bad technical justification kills many proposals

# Exposure time: why?

- Telescope/instrument: right choice?
  - HST/JWST: why can science not be done from ground?
- Sample size and selection
  - Minimum required to answer science goal
  - Sufficient to answer science goal
  - How were they selected? Biases?
  - What other data exists or will be obtained?
- If upper limit is likely, describe why it will be useful
- Specify all relevant parameters
  - Include seeing requirements/assumptions, instrument resolution, etc
- Remember overheads!



# Proposals are fun!

- Imagine what you will do!
- Evaluate feasibility
- Focus future efforts
- Data is always perfect in your proposal mind
  - Paper is often very different than proposal
  - Data are flawed (try to avoid)
- Deadline!

# Fellowship proposals are not fun!

(imposter syndrome+long-term planning)

- What do you want to do for the next three years?
- Sell your ideas and yourself!
- CV is built in
- Research statement must be strong, easy to read, and concise
  - 3-page research plan (plus past research)
  - Cartoons and Figures: at least one on every page
- Also important for PI positions

<https://www.astrobetter.com/blog/2014/08/20/honing-your-hubble-application/>