

# **AST1501 - Introduction to Research**

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# How to write a good research proposal

# How to write a good research proposal

- Main focus here: writing proposals for graduate funding
  - Domestic: CGS-M, CGS-D, Vanier, OGS, DSI, other university awards
  - Int'l: Vanier, DSI, OGS international, cognate competitions (e.g., OGS)
- Many of you applying to CGS-M by Dec. 1
  - Writing workshops for CGS-M: Wed, November 8, 10am-12pm, Instructor: Dan Newman
  - **Highly recommended**

# Typical proposal components

- Summary or abstract
- CV
- Research proposal
- Discussion of research contributions
- Letters







# CV

- Either standard form like Canadian Common CV (CCV —> why not CCCV????), online application form (most NSERC), other standard form (e.g., DSI), or free-form
  - Good to have a main version of your CV in, e.g., Word or LaTeX and use it to help populate other forms
  - Use version control for your CV —> can easily see changes to main version when updating other versions
- Should be complete and include all awards, papers, talks/posters/presentations, professional activities (leadership, outreach, etc.) that you have done
  - Free-form CV will have sections: Education, Awards, Publications, Professional Activities, Teaching, Outreach, etc.
  - In each section: order reverse chronologically, but if there's a lot, emphasize important contributions (e.g., first-author papers vs. N-th author; activities you've led vs. participated in)
  - Generally don't include pre-college items

# CV (cont'd)

- Publications
  - Include full citation info, stable links (DOI or arXiv)
  - Free-form: useful to bold your name
  - In collaboration: split first- or first-few author papers from collaboration papers
  - Generally frowned upon to include non-submitted papers, certainly no more than one (non-submitted papers ideally addressed in letters)
- Presentations:
  - Include full info on venue
  - Talks >> posters, so split if it makes sense

# CV (cont'd)

- Awards:
  - Will generally list dollar amount
  - For non-national awards (USRA, CGS-X, ...), can be useful to include a very brief explanation of what they are (CCV allows this)
- Other info:
  - Language skills: not generally that relevant
  - Computer skills: focus on non-obvious skills, it's assumed you have a basic working knowledge of a computer and standard programs





# Research Proposal Writing

# Research proposal

- Main purpose: convince reader that
  - Your research question is important
  - You have clear achievable objectives
  - You have a good plan to reach these objectives
  - This research will have impact

# Research proposal (cont'd)

- Most important question before starting: what is your audience
  - Generally readers will be in the sciences broadly defined, so need to be broadly accessible
  - Tricky to write: need to both
    - Write generally, avoid jargon
    - Demonstrate that you are an expert who knows what they are doing
- My general suggestion: start by connecting your research to very big questions in astro/cosmology, which are understandable to outsiders, then move towards being more specific/detailed
  - So start, e.g., by discussing “A big question in cosmology is how the Universe evolved from the hot primordial plasma into the stars and galaxies that populate it today” or “One of the biggest outstanding mysteries for humanity is whether there is life on other planets”
  - Then move to say how your specific research topic fits into the quest to answer these bigger questions
- Okay if a reader in, say, biochemistry gets lost in the specific details for a paragraph or two, as long as they can understand the overall proposal



# Research proposal structure

- Generally need:
  - Overall motivation
  - Intro to the specific research you are doing
  - Objectives and goals
  - Research plan / methodology / potentially a timeline
  - Significance and impact: more detailed discussion of how your research will impact the field / state of knowledge. Narrower than the connection in the overall motivation
- Explicitly labeling parts of your research proposal can be useful to guide the overworked reader
- If there is a scoring sheet for the competition, make sure to hit all the points they are looking for
- Generally good to use all/most of the available space, but keep the page airy

# EDI in research

- Very common now for EDI to have to be addressed in proposals

- E.g., CGS-D has

‘Have relevant equity, diversity and inclusion considerations been taken into account at any of the stages of the research process for your proposed research? The stages of the research process include: research questions, design of the study, methodology, data collection, analysis, interpretation and dissemination of results.

If you answer "yes" to the question above, please ensure that you include the relevant equity, diversity and inclusion considerations in your proposal and use the text box below to explain your answer. If you answer "no" to the question above, please use the text box below to explain why equity, diversity and inclusion considerations have not been taken into account.

- Generally understood that EDI has no direct bearing on the *research itself* in astrophysics
- So in astro can generally answer no and explain in the box that your research does not involve humans or topics that directly affect humans, but rather that it concerns objects in space. Keep any such statements neutral (no need to say things like “I don’t see how EDI considerations would be relevant here”, just say “EDI considerations are not relevant for my research on ...”)
- It can be helpful to briefly discuss EDI considerations in the *practice of doing research*, e.g., disseminating results on arXiv to avoid barriers for other researchers, generally acknowledging the benefits of EDI considerations in composition of research teams etc.

# Discussion of research contributions

- Some applications ask for explicit discussion of prior research contributions
- Great opportunity to show off your accomplishments
- Don't leave this space empty, use it for something!
- Good place to discuss your role in co-authored publications
- Also often includes discussion of leadership and other activities, so discuss those as well!



# Letters



# Reference letters

- Most applications will require two letters (postdoc apps —> three)
- Can't control what people write, but can help your letter writers by
  - Giving advance notice that you will need a letter
  - Sending them an up-to-date CV and a draft of your research proposal well before the deadline (i.e., not the day before, earlier rough draft more helpful than last-minute full draft), and nudges about things that would be good to highlight, especially in areas of your profile that they might not know that well (e.g., outreach, leadership)

# Reference letters: who?

- Will generally need a letter every year or so, so good to cultivate a good relation with your letter writers:
  - Best letters are from people very familiar with you (e.g., course instructor is not that useful)
  - Good to have a letter from someone who has known you for a while
  - But need a letter from supervisor to directly comment on your research proposal and that you are well suited to it
  - Vanier needs four letters, including two 'leadership' letters, so need to cultivate those relations if you want to apply for Vanier
- During grad school, good to cultivate a close relation with three faculty for postdoc letters. Good to have a letter writer from outside the department.
- Discuss letters from postdocs