



Reading and Writing Scientific Papers

Please Start with this Quick Survey



Last Meeting

We discussed the importance of **research products** that illustrate in some way what you accomplished (and listing these in your CV as part of the outcomes of each of your research experiences for grad school):

- Presentations (Conference Abstracts – add link to CV)
- Code (add Github repository link to CV)
- Some sort of write up □ Blog, Term Paper, Thesis, Poster, Research Note, Peer-Reviewed Journal Article

Research Products: AAS Research Notes

- <https://journals.aas.org/research-note-preparation-guidelines>

Short – 1500 words total

One Figure or Table (not both)

- “Negative” results – e.g. didn’t get a signal, test found null results
- Results adds a technical point that is important to methods utilized in the field
- “Small” results that are timely/relevant and so deserve attention from the community
- NOT peer-reviewed (but are moderated by editor) – so not completely novel ideas
- **Benefit:** Published usually within 72 hours (!!!)
- Much easier to get first-author. Much easier to publish.
- Still counts as a publication on your CV



RNAAS Structure

- Intro (motivation)
- Methods (what you did)
- Results (one plot. OR one table)
- Conclusions (summary & why it matters).
 - [this doesn't have to be a separate section]
- Acknowledgements/References

Mathieu Renzo et al. 2024,
RNAAS
(teaching ASTR400A)



Research Products: Peer-Reviewed Journal Article

- **“Peer-review”** : means another expert in the field read it over and gives comments. This process can take a very long time, delaying when the paper is published.
- **Journals**: Each discipline has standard peer-reviewed journals in which results are published. E.g. Astrophysics: ApJ, MNRAS, JCAP, etc.
- **Goal**: to communicate a scientific finding of *importance* to the scientific community. [Technical writing].
- **Cost**: 10 page paper ~\$1.5-2K (paid by advisor’s grants)
- **Benefit**: because you go through the peer-review process, the work can be novel, and it has more impact on the field – this can weigh more strongly in your grad school application.

(co) Authorship on a peer-review journal

How is it decided whether you are first author or a co-author?

- First author □ the person who wrote the paper and did the bulk of the work
- Second author □ usually advisor (in biology this would be the last author)
- Other authors □ people who contributed to the work (provided data, analysis, figures, code, funding, ideas)

First Authorship: If you didn't write the majority of the final draft, it's unlikely that you will be the first author. It's easier to get a first author Research Notes.

Co-Authorship : This is a great way to complete a project and move onwards. It counts similarly in grad applications.

When should or shouldn't you pursue a first-author publication?

Getting a publication takes time (~2 years) – working towards a publication means you are giving up other learning opportunities (other letter writers) and investing a lot of time (and it still might not pan out).

- But go for it IF:
 - you love the project/subject matter and are learning a diverse range of skills
 - you feel supported by your research advisor/team - is this a healthy working environment for you?
 - It is realistic that the paper will happen before winter of your final year.
 - You have a plan for other letter writers (maybe two of your instructors)
 - You have a novel project (that can't be a RNAAS)
- Personally, I think it is better to do enough to merit co-authorship/RNAAS and then jump to another project. Co-authorship can still take a year.

How to read/write journal articles

How to Find Journal Articles:

- NASA ADS <https://ui.adsabs.harvard.edu/>
 - Also a great way to learn about the research done by folks here.
 - bibstem:RNAAS author:"renzo"
- Importance of review papers (e.g. annual reviews ARA&A) : <https://www.annualreviews.org/content/journals/astro>
 - bibstem:ARA&A, abs:"quasars"
- For recent (& unpublished) work : <https://arxiv.org/> (but these are searchable in NASA ADS)

Astrobites

- Written by graduate students
- Summarizing peer-reviewed journal article. With lots of links to complicated terms.
- <https://astrobites.org/>



Structure of a Journal Article

- Abstract
- Intro – Context, Introduce the Problem and the Aims
- Methods – with plots
- Results – with plots
- Discussion – some plots
- Conclusions
- Acknowledgements (collaborators, code)
- References

How to go about reading a journal article (first time)

- Abstract
- Figures in the Results section & Captions
- Conclusion
- Intro for context

NOTE: It takes a long time to read a paper . It could take a week.
There is A LOT of jargon in science.

What is an abstract?

- Summary of findings/of the paper structure (journal)
- Advertisement (a talk)
- Stand-alone application for a competitive spot (for a conference!)
- Summary of proposed usage of resources (proposal)

Abstract Outline

Context - introduce the topic or what you are presenting

Aims – what is the goal of the work/problem being solved

Methods

Results – “We find” , “We demonstrate”

Conclusions & Big Picture



[Go back to Renzo+2024](#)

Progenitor Stars Calculated with Small Reaction Networks should not be Used as Initial Conditions for Core Collapse

Show affiliations

Renzo, M.  ; Goldberg, J. A.  ; Grichener, A.  ; Gottlieb, O.  ; Cantiello, M. 

Core collapse initial conditions are a bottleneck in understanding the explosion mechanism(s) of massive stars. Stellar evolution codes struggle after carbon burning, and either stop or adopt numerical simplifications missing crucial physics. The use of small nuclear reaction networks (NRN) that account for energy production but bypass weak reactions is typical, but insufficient to study the dynamics of the collapse. We advise against the use of progenitors computed with small NRN in expensive multidimensional simulations of core collapse, bounce, (jet formation), and explosion.

Context

Aims: Problem and Goal

Methods

Results

Big Picture

How to go about writing a journal article

AS YOU DO YOUR PROJECT

- **Methods**
- **Intro** – add citations here (one line summary) to keep track of what you are reading.
- **Figures & Captions.** (don't write the outline of a paper until you know your results!)
Keep a research journal/slide deck

Once figures are complete and you know your results:

- **Conclusion** (bullet points! – add one per results figure)
- **Abstract** (this informs your intro)
- **Results** (start with bullets, flush out the description of your figures)
- **Introduction** (start with bullets, provide context for your findings)

(caveat: this is my advice)

Paper Writing: LaTeX

- Overleaf - has journal Templates to match formatting
- <https://www.overleaf.com/>

Practice !! Try writing research notes/summaries in LaTeX!

While you do a research project – write up your methods in latex!

Citations

- “quotes” are not common in scientific writing.
- Instead, paraphrase and add a citation to the paper to which you are referring.
- You cannot copy text from another paper verbatim and use it. Even if that paper is YOUR OWN (self-plagiarism is a thing – you don’t own the paper, the journal does)
- “BibTex” is commonly used to support citations in LaTeX
 - NASA ADS provides citations that can be imported for bibtex

Panelists

- How did you find your research project?
- Did you know at the beginning that the work could result in a publication? When did you have a conversation about publication?
- How did you know your results were ready for publication?
- Are you writing a first-author or co-author paper – how did that get decided?
- Where are you going to publish? How did you decide this?
- What was/is the writing process like for you?

Research Products: Term Paper

- E.g. TIMESTEP Internship requires students to complete a ~3 page document that summarizes what the intern did.
- You can decide to do this even if your advisor doesn't require it.

Intro (What is the motivation for the study. What is the study itself)

Methods (How did you conduct the project)

Results (What did you find? Usually with a plot or two)

Conclusion (Summarize what you did and provide context for what the results mean)

Research Products: Blogs

- Research Documentation. (Virtual Lab Note Book)
- Ways to share methods related to data analysis, codes

Examples:

Dr. Evan Scheider (UA PhD, Professor at U. Pitt)

<https://evaneschneider.github.io/site/>

Down sides to pursuing a first-author peer-review journal article as an undergrad:

- Writing a journal article during undergrad is hard and hardly achievable. Some research areas are easier than others.
- If you want to write a 1st author paper, express this to your mentor upfront. Ask for a project that can be published and develop a clearly structured work plan with your mentor. **Expect to work overtime... lots**
- Ask to have a PD or senior PhD student as an additional mentor. Meet once a week.
- You'll have to focus on one area if you want 1st author paper; you can't have multiple projects if you are going for a paper; **expect 2 years of work in one group.**
- A 10 page paper costs ~\$2K. (usually advisor covers)
- Takes a long time to publish (referee process and editing process)

What is the goal of an abstract?

- To summarize an argument for a particular point of view
- Summary of findings (journal) □ arguing that your science is correct to a referee / audience
- Advertisement (a talk) □ arguing why one should come to listen to you
- Stand-alone application for a competitive spot (for a conference) □ arguing for why you should be given a spot to speak
- Preview of an argument (proposal) □ arguing for why you should get resources allocated

SIMULATIONS OF THE MAGELLANIC STREAM IN A FIRST INFALL SCENARIO

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ABSTRACT

Recent high-precision proper motions from the *Hubble Space Telescope* suggest that the Large and Small Magellanic Clouds (LMC and SMC, respectively) are either on their first passage or on an eccentric long period (>6 Gyr) orbit about the Milky Way (MW). This differs markedly from the canonical picture in which the Clouds travel on a quasi-periodic orbit about the MW (period of ~ 2 Gyr). Without a short-period orbit about the MW, the origin of the Magellanic Stream, a young (1–2 Gyr old) coherent stream of H I gas that trails the Clouds $\sim 150^\circ$ across the sky, can no longer be attributed to stripping by MW tides and/or ram pressure stripping by MW halo gas. We propose an alternative formation mechanism in which material is removed by LMC tides acting on the SMC before the system is accreted by the MW. We demonstrate the feasibility and generality of this scenario using an N -body/smoothed particle hydrodynamics simulation with cosmologically motivated initial conditions constrained by the observations. Under these conditions, we demonstrate that it is possible to explain the origin of the Magellanic Stream in a first infall scenario. This picture is generically applicable to any gas-rich dwarf galaxy pair infalling toward a massive host or interacting in isolation.

Context

Aims: Problem and Goal

Methods

Results

Big Picture

Final Survey

- Please fill this out !

