CAASTRO
ALL-SKY ASTROPHYSICS

Paper Writing Workshop

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Session 1: Structure

How to get started…

Why write a paper?

Why write a paper?

- Formalise your science and results
- Practise communicating your work
- Provide your results to the community
- Receive useful feedback and make new connections
- Improve your CV!

What’s stopping you?

Thoughts you might have…

- “Writing a whole paper seems really daunting…”
- “I don’t know how to start…”
- “Nothing I write sounds good…”
- “What do you mean I can’t include everything??”
- “How do I get people to read it??”

Good news!

Writing can be rewarding!

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(depending how you approach it…)

The stages of writing

Writing can be broken down into:

- Outline
- First Draft
- Revision

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How long should you spend on each?

The stages of writing

Writing can be broken down into:

- Outline 70%
- First Draft 10%
- Revision 20%

How long should you spend on each?

Tasks for each stage

- Outline — Collect facts and organise your ideas (include figures, tables & references)
- First Draft — Turn your thoughts into full sentences
- Revision — Edit your sentences to make your thoughts clear to the reader

The detailed outline

- Think of this as the roadmap of your paper
- It's a collection of all of the information, results and conclusions that might end up in your paper

Why do it this way?

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Research and revision interrupts your writing!

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- Have you ever stopped mid-sentence to look up a value you need?
- Have you ever spent ten minutes trying to find the perfect way to phrase a single sentence?

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Both tasks distract you from the bigger picture!

The detailed outline

- Think of this as the roadmap of your paper
- It's a collection of all of the information, results and conclusions that might end up in your paper
- Several ways to approach
  - start with a broad structure and allocate info
  - collect information and rearrange into sections
  - whatever suits you!

Traditional structure

- Abstract
- Introduction
- Data
- Methods
- Results
- Discussion
- Conclusion
- Appendix

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What order should you roadmap in?

Order of roadmapping

- Results (define the scope)
- Data and Methods (set up the results)
- Introduction (provide context)
- Discussion and Conclusion (interpret results)
- Abstract (sum up)

Figures

- Figures should define the structure of your paper
- Use captions and clear legends to make them self-explanatory
- Be wary of colour-blindness, particularly red-green
- Try to keep figures clear — too many colours or lines can confuse the reader

Figures — Exercise

- In groups of 2-3, look over the 10 figures
- Identify which figure is the best and which is the worst — give your reasons!
- Do you understand the figure without the paper?
- List what could be improved in each figure

Figures — Exercise

Best figure?

What was effective?

What was ineffective?

How much does the caption matter?

Results

- Aim for clarity! Readers often go here first

- Consider:
  - how can I present my results in the fewest figures?
  - what's the most appropriate format?

- The text should be a high level summary

- Remember to talk about negative or control results

Data and methods

- Give a clear overview of
  - where the data come from
  - how the data were analysed

- Give enough information to replicate the study

- Make life easy for the reader by
  - using subsections
  - using flow diagrams and tables in place of text

Introduction

- Usually 2-5 paragraphs
- Shape it around what you'll address in the paper
- Write for a general audience as much as possible
- Highlight the gaps in the literature
- Be specific about your aim/hypothesis and how you'll achieve it

Discussion and conclusion

- Gives the interpretation of results

- Should cover
  - your findings and how they relate to your aim
  - how your results compare to the literature
  - the strengths and any limitations of your study
  - big-picture take-home messages and future work

- Focus on what your results prove, not what you hoped they would prove!

Abstract

- Most people use the title and abstract to decide if they'll read further

- Keep it concise — people can be turned off by long abstracts

- Convey the main finding and why it's important!

- Give highlights from each section of the paper and emphasise what is novel in your work

- Should be able to stand on its own

Abstract — Exercise

- In groups of 2-3, look over the abstracts
- Which paper you would be most likely to read based only on the abstract?
- Can you identify any general strengths or weaknesses?

The first draft

- Just write!
- Take your roadmap and turn it into full sentences
- If you find that your roadmap doesn't contain the information you need, go back and fill it in!

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Session 2: Grammar & Style

How to edit…

Writing in the Sciences

- Much of the following content was adapted from the free online course
  “Writing in the Sciences”
  offered by Stanford University

- Visit
  https://lagunita.stanford.edu/courses/Medicine/SciWrite-SP/SelfPaced/about
  to learn more

The value of editing

- Writing papers is how we communicate our findings

- Writing clearly and concisely is the best way to do this

- Keeping style in mind means you can share your ideas with the reader without the text getting in the way!

Language is made up of…

- Verb: describes an action (is, write, listen…)
- Noun: names a thing (friends, author, school…)
- Adjective: modifies a noun (happy, clear, accurate…)
- Adverb: modifies a verb/adjective (very, only, quite…)

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- Verb: describes an action (is, write, listen…)
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We will now cover some common style tips

Active voice

- Active voice: subject, verb, object
- Passive voice: object, verb, subject

Cutting clutter

- Clutter is everything that might distract the reader from the point you're trying to make

- If you can replace a phrase with a single word… do!

a majority of ⟶ most

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- If you can replace a phrase with a single word… do!

a majority of	→	most
less frequently occurring	→	
give rise to	→	
due to the fact that	→	

Cutting clutter

- Clutter is everything that might distract the reader from the point you're trying to make

- If you can replace a phrase with a single word… do!

a majority of	→	most
less frequently occurring	→	rare
give rise to	→	cause
due to the fact that	→	because

Cutting clutter

- It is an extra step to understand a negative phrase within a sentence, so try to eliminate these

does not have ⟶ lacks

Cutting clutter

- It is an extra step to understand a negative phrase within a sentence, so try to eliminate these

does not have	→	lacks
not important	→	
not harmful	→	
did not pay attention to	→	
not clear	→	
did not succeed	→	

Cutting clutter

- It is an extra step to understand a negative phrase within a sentence, so try to eliminate these

does not have	→	lacks
not important	→	unimportant
not harmful	→	safe
did not pay attention to	→	ignored
not clear	→	unclear
did not succeed	→	failed

Writing with verbs

- Verbs make sentences go!
- Coupled with the active voice, they help the reader grasp the action
- Use descriptive verbs instead of nouns
- This is a common problem in academic prose and can lead to hollow and pretentious sentences!

undergoes expansion ⟶ expands

Writing with verbs

- Examples of weak nouns and their strong verbs

undergoes expansion	→	expands
provides emphasis	→	
offers confirmation	→	
provides a review	→	
makes a decision	→	
gives a description	→	

Writing with verbs

- Examples of weak nouns and their strong verbs

undergoes expansion	→	expands
provides emphasis	→	emphasises
offers confirmation	→	confirms
provides a review	→	reviews
makes a decision	→	decides
gives a description	→	describes

That vs. which

- The painting that was hanging in the foyer was stolen.

vs.

- The painting, which was hanging in the foyer, was stolen.

That vs. which

- The painting that was hanging in the foyer was stolen.

vs.

- The painting, which was hanging in the foyer, was stolen.

- “that” is restrictive (defines the subject):
  there is only one painting in the foyer, it was stolen

- “which” is non-restrictive (extra information):
  there are possibly other paintings in the foyer, but only one was stolen

Punctuation

- Punctuation allows you to vary your sentence structure, which keeps the reader's attention

- Order in terms of their power to separate clauses
  - a clause is a group of words with a subject and a verb

colon :

parentheses ()

comma ,

period .

semicolon ;

dash —

Punctuation

- Punctuation allows you to vary your sentence structure, which keeps the reader's attention

- Order in terms of their power to separate clauses:

period > semicolon > parentheses > dash > colon > comma

Semicolon

- Used to connect two independent clauses
- Separates two ideas and lends emphasis to the second
- Adds variety and connects short, related clauses
- “The new spectrograph will have a higher resolution; it will observe one million new targets.”

Parentheses

- Used to insert an afterthought or explanation
- Indicates that it's fine to skip over the information
- The sentence should make sense if you remove it

- "The simulation (completed in 2008) provides a clear picture of gas flow in galaxies."

Colon

- Used to introduce lists, quotes, explanations…
- It must follow a clause!
- Used to join two clauses if the second extends the first

- “I have visited three telescopes: the AAT, the UK Schmidt, and SkyMapper.”
- “We see similar results to the literature: changing the model influences multiple aspects of the analysis.”

Dash

- Used to add emphasis or insert an abrupt definition or description

- Very versatile, but will lose its impact if overused!

- More relaxed than parentheses, but adds emphasis

- “I would be happy to help — I just need to finish this application!”

Paragraphs

- Should contain a single main idea
- Get to the point early!
- Should have a logical flow
  - sequential in time
  - general to specific
  - logical arguments
- Keep the paragraph short and the sentences varied!

Editing — Exercise

ABSTRACT

We present a study of the links between star formation history and structural disturbance for a large mass-selected galaxy sample taken from the STAGES survey. Our sample contains galaxies of all morphologies inhabiting a very broad range of environments, from field galaxies to galaxies living in dense cluster regions. The galaxies' structure is quantified using Hubble Space Telescsope (HST) images (Thisisme et al. 2012), allowing us to divide the sample into undisturbed galaxies, disturbed but non-merging galaxies, and disturbed galaxies which are mergers. Moreover, a quantitative measurement of the degree of disturbance is calculated for each galaxy. As expected, we find that the vast majority of Elliptical and S0 galaxies in all environments probed have relaxed structure and show no signs of ongoing or recent star formation. We also find that structurally-disturbed galaxies have higher star-formation activity and younger stellar populations than their relaxed counterparts. These galaxies tend to avoid the lowest density regions. Conversely, cluster spiral galaxies with reduced/quenched star formation have significantly less disturbed (smoother) morphologies than spirals with "normal" star-formation activity. This is independent on whether these spirals are experiencing mergers or not. This finding suggests that these "passive" spirals have started their morphological transformation towards becoming lenticulars. Surprisingly, we also find that merging galaxies and equally-disturbed (but non-merging) galaxies have very similar specific star-formation rates and stellar ages. The degree of enhanced star formation in galaxies is thus linked to the degree of structural disturbance, regardless on its physical cause. Specifically, galaxies with equivalent degrees of "roughness" (i.e., equivalent deviations from a smooth profile) will have equivalent degrees of enhanced star formation, whether they are merging or not. This indicates that merging galaxies are not special in terms of their higher-than-normal star-formation activity. Any other physical process that produces "roughness", or, in other words, regions of enhanced density, will increase the star-formation activity in the galaxy with similar efficiency.

Editing — Exercise

Unsurprising — worth being in the abstract?

Essential info — parentheses are a poor choice of separation

Consider active voice?

ABSTRACT

We present a study of the links between star formation history and structural disturbance for a large mass-selected galaxy sample taken from the STAGES survey. Our sample contains galaxies of all morphologies inhabiting a very broad range of environments, from field galaxies to galaxies living in dense cluster regions. The galaxies' structure is quantified using Hubble Space Telescsope (HST) images (Thisisme et al. 2012), allowing us to divide the sample into undisturbed galaxies, disturbed but non-merging galaxies, and disturbed galaxies which are mergers. Moreover, a ~~quantitative~~ measure~~ment of~~ the degree of disturbance ~~is calculated~~ we for each galaxy. [As expected, we find that the vast majority of Elliptical and S0 galaxies in all environments probed have relaxed structure and show no signs of ongoing or recent star formation.] We ~~also~~ find that structurally-disturbed galaxies have higher star-formation activity and younger stellar populations than their relaxed counterparts. These galaxies tend to avoid the lowest density regions. Conversely, cluster spiral galaxies with reduced/quenched star formation have significantly less disturbed (smoother) morphologies than spirals with "normal" star-formation activity. This is independent on whether these spirals are experiencing mergers or not. This finding suggests that these "passive" spirals have started their morphological transformation towards becoming lenticulars. Surprisingly, we also find that merging galaxies and equally-disturbed (but non-merging) galaxies have very similar specific star-formation rates and stellar ages. The degree of enhanced star formation in galaxies is thus linked to the degree of structural disturbance, regardless on its physical cause. Specifically, galaxies with equivalent degrees of "roughness" (i.e., equivalent deviations from a smooth profile) will have equivalent degrees of enhanced star formation, whether they are merging or not. This indicates that merging galaxies are not special in terms of their higher-than-normal star-formation activity. Any other physical process that produces "roughness", or, in other words, regions of enhanced density, will increase the star-formation activity in the galaxy with similar efficiency.

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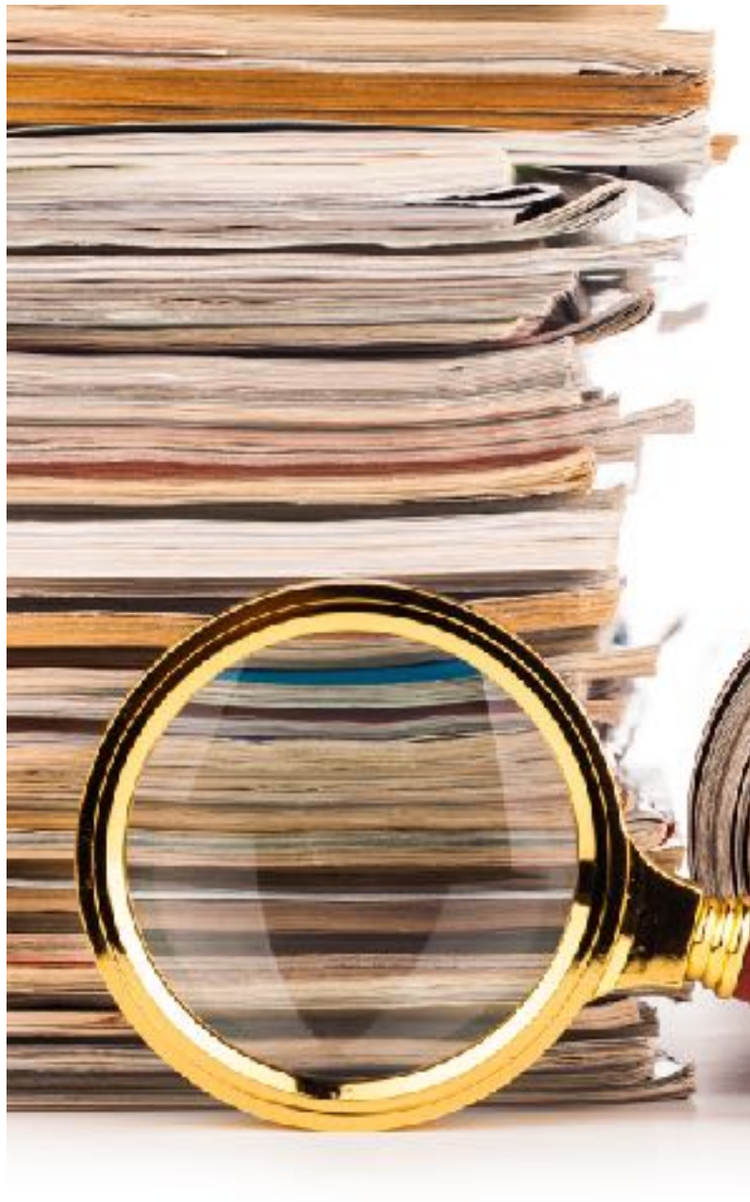
Session 3: Peer Review

What to expect…



The submission process

- Now that you've written and edited your work, it's time to submit! But…
- Where should I submit it to?
- What is the referee's job?
- How should I respond when I get feedback?

Authorship

Authorship

- First author
  - did most of the work
  - wrote the paper

- Co-authors
  - contributed to the work or the broader project
  - e.g. provided data or analysis

- Acknowledgements
  - older collaborations responsible for your data
  - those who helped shape your paper

Picking a journal

- Consider the audience and scope of the journal

Picking a journal

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- The impact factor:
  - average citations/paper for the past two years

$$\mathrm{IF}_y = \frac{\mathrm{Citations}_{y-1} + \mathrm{Citations}_{y-2}}{\mathrm{Publications}_{y-1} + \mathrm{Publications}_{y-2}}$$

Source: https://en.wikipedia.org/wiki/Impact_factor

Picking a journal

Journal	2016 IF	Free?
Nature	40.137	No
Science	37.205	No
The Astrophysical Journal (ApJ)	5.533	No
Astronomy and Astrophysics (A&A)	5.014	Yes
Monthly Notices of the Royal Astronomical Society (MNRAS)	4.961	Yes
Physical Review D (PRD)	4.568	Yes
Publications of the Astronomical Society of Australia (PASA)	4.095	Yes

Types of papers

- First exploration
- Mid-way contribution
- Definitive answer
- Review paper
- Letters

First exploration

- Emphasis on new phenomenon or new problem
- Not much to cite from before except context
- Example:

A bright millisecond radio burst of extragalactic origin
Lorimer, D. R. et al. (arXiv: 0709.4301)

Mid-way contribution

- Emphasis on the main step moving the field forward
- Existing literature needs to be discussed
- Example:

The Parkes multibeam pulsar survey - VII.
Lorimer, D. R. et al (arXiv: 1501.05516)

Definitive answer

- Emphasis on legacy left by new precision, completeness, or final measurements

- Lots of literature to take into account

- Example:

  Nine-year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Final Maps and Results
  Bennett, C. L. et al. (arXiv: 1212.5225)

Review paper

- Almost short textbook style
- Stratospheric overview, attention to detail, full list of open questions
- Doing full justice listing and evaluating in context all existing literature
- Example:

  A Universal Stellar Initial Mass Function? A Critical Look at Variations
  Bastian, N. et al. (arXiv: 1001.2965)

Letter

- Short paper (~5 pages), intended to be published quickly.

- Fast-track review and acceptance — good for discoveries.

- Example:

  The Highly Unusual Chemical Composition of the Hercules Dwarf Spheroidal Galaxy
  Koch, A. et al. (arXiv: 0810.0710)

Formatting

- Journals have specific instructions for authors and LaTeX templates for you to use

- They often have style guides, which can help with language and grammar choices

Spelling and grammar
Please use British English spellings – e.g. centre not center, labelled not labeled. For words ending in -ise/yse or -ize follow this style: use -ise/yse for devise, surprise, comprise, revise, exercise, analyse; use -ize for recognize, criticize, minimize, emphasize, organize, ionize, polarize, parametrize (note the spelling of this word in particular).

'None' is a singular word (none of the stars is a white dwarf), whilst 'data' is a plural word (these data show...).

Miscellaneous journal spellings: acknowledgements, artefact, best-fitting (not best-fit), disc (except computer disk), haloes (not halos), hotspot, none the less, non-linear, on to, time-scale.

For any other spellings, use whichever version is listed first in the Oxford English Dictionary.

Source: MNRAS instructions page

Submitting online

- You will likely need:
  - LaTeX source files (including figures)
  - a compiled pdf/ps for the editor and reviewer
  - any information you'd like the editor to know

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- Check for:
  - any final spelling mistakes
  - any mismatched references (figures and tables)
  - any incomplete citations

Submitting to arXiv

- Entirely your (and your co-author's) choice about when to submit to arXiv

- There are pros and cons for submitting either before or after acceptance of the journal

- Seek advice from many and use your best judgement!

The referee

The referee

- The referee has two major aims:
  - help you improve your scientific contribution
  - reject your work if it is irrelevant or incorrect
- Their job is not to rewrite your work!

The referee

- While reading your paper, they will wonder:
  - what does your paper contribute to the field?
  - have you made any major methodical mistakes?
  - are your results are believable?
  - are your ideas clearly presented?
  - have you made fair comparisons to the literature?

Some criteria

Is the subject appropriate for the journal?	Yes	No	Unsure
Is the content sufficiently significant to warrant publication in MNRAS?	Yes	No	Unsure
Are the methods and results set out clearly?	Yes	No	Unsure
Are all the necessary references given?	Yes	No	Unsure
Is the summary sufficiently informative?	Yes	No	Unsure
Can the paper be shortened without loss of clarity?	Yes	No	Unsure
Are all the figures and tables necessary?	Yes	No	Unsure
Are the figures and tables adequate?	Yes	No	Unsure
If there are colour figures, is colour reproduction essential? If so for which figures? Please leave details in the comments box below.	Yes	No	Unsure
Is the paper in reasonable English?	Yes	No	Unsure
If the paper contains long tables, finding charts etc., can these be published in electronic form only?	Yes	No	Unsure
req Do you want your name revealed to the authors?	Yes	No	Unsure

Receiving the outcome

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- Accepted with no changes (rare)

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- Accepted pending minor revisions

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  - this is a positive outcome!
  - you're just being advised to improve your work

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- Accepted pending minor revisions
- Moderate/Major revision requested (most common)
  - this is a positive outcome!
  - you're just being advised to improve your work
- Rejected (no resubmission possible)
  - maybe your paper is not a good fit for this journal

One paper, two reports - Exercise

- Reviewers may vary!
- Read over the two reports provided
- In this instance, the editor passed the paper to a new referee after initial revision
- What are some of the main differences between reports?

Referee report - Exercise

- Reports from referees are often quite varied!
- Read the provided referee reports and note:
  - what are common features of the different reports?
  - how do the reports differ?
  - how broad or specific do the comments get?
  - how do referees structure their comments?

Revision and resubmission

- Take some time away from the referee's comments so you can address them fairly!

- Resubmit with a response to the referee
  - start by thanking the referee for their feedback
  - state the comment and how you addressed it
  - if you don't want to change something explain why
  - be polite — being defensive won't help you!