

How to not make your PhD your entire life... and actually finish it!

DR. ADAM BATTEN

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ASTRO 3D Student Retreat 20/11/2022

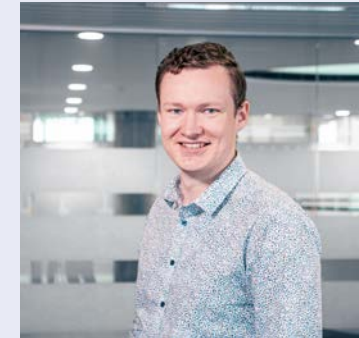
You can find the slides for this talk here:

<https://adambatten.com/talks/>

The logo for ASTRO 3D, featuring the text 'ASTRO 3D' in a bold, pink, sans-serif font. The background of the entire slide is a complex network of blue and black dots connected by thin lines, resembling a molecular or data network structure.

Who am I?

I studied the intergalactic medium and galaxy evolution using simulations and fast radio bursts.

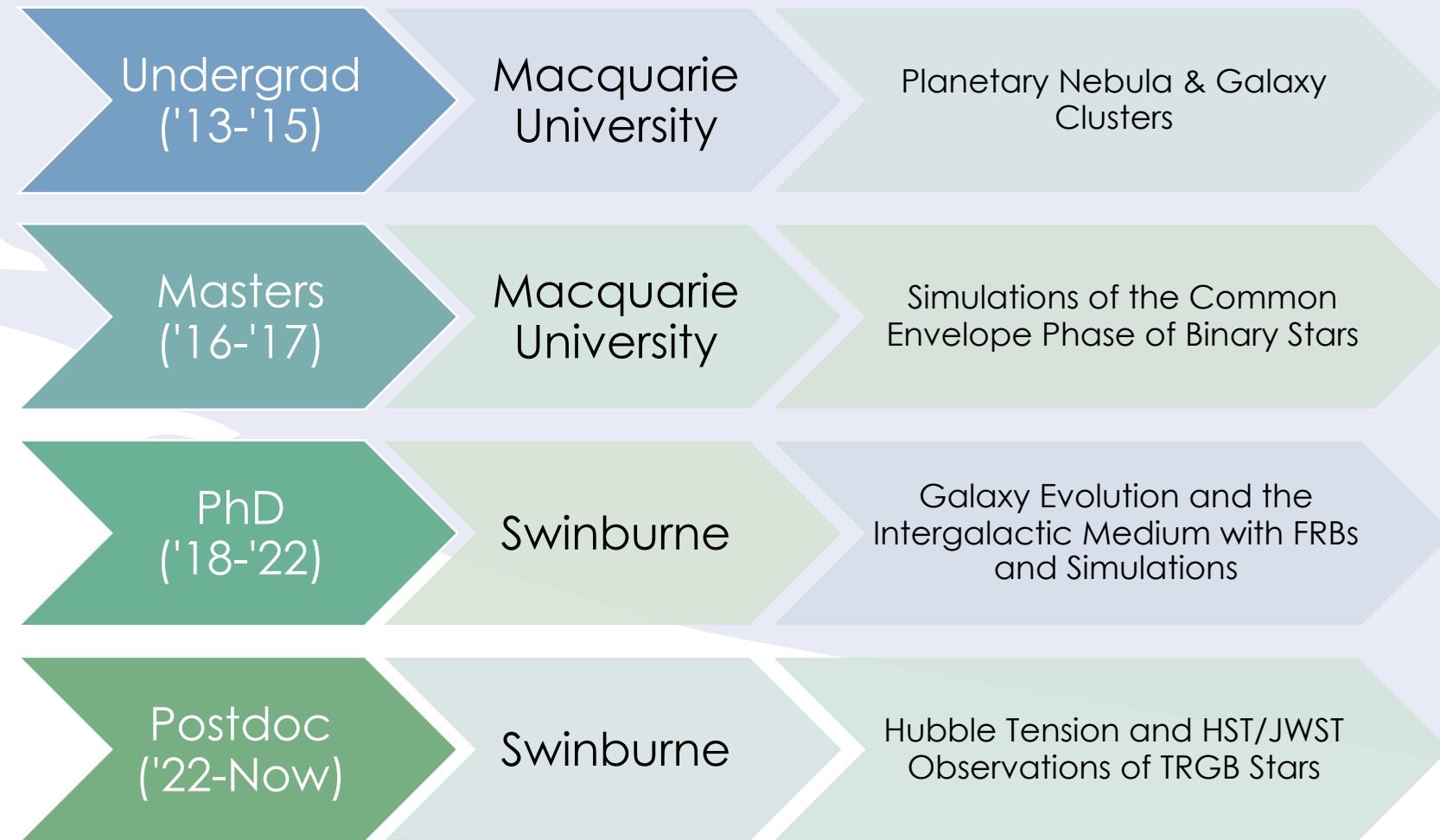


The first ASTRO 3D student retreat, 2019.



Performing outreach for ASTRO 3D at Uluru.

20/11/22



Why this talk?

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Why this talk?

Adam! I want to know how to stop my PhD from taking over my life!!!



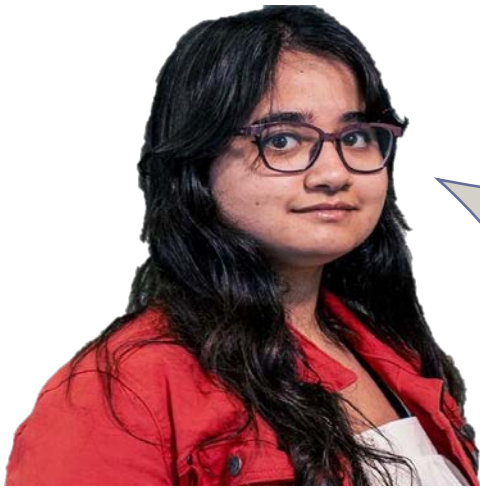
Why this talk?

Adam! I want to know how to stop my PhD from taking over my life!!!

Hmmmm...



Why this talk?



Adam! I want to know how to stop my PhD from taking over my life!!!

Hmmmm...

But I also want to finish my PhD eventually!



Outline

How to not make your PhD your entire life... and actually finish it!

- How I managed my life during my PhD (take what you want).
- Things to do during your PhD
- Tips for writing your thesis
- Random Tips Lightning Round

A silhouette of a roller coaster track and cars against a light blue sky background. The roller coaster is on the left side of the slide, curving upwards and then downwards. The cars are visible on the track. The background is a light blue gradient with a white, torn-paper-like edge on the right side.

Why is important to maintain your work life balance?

- Everyone experiences stress and down times during their PhD.



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- If your PhD is your entire life, then bad research times can bleed into the rest of your life.



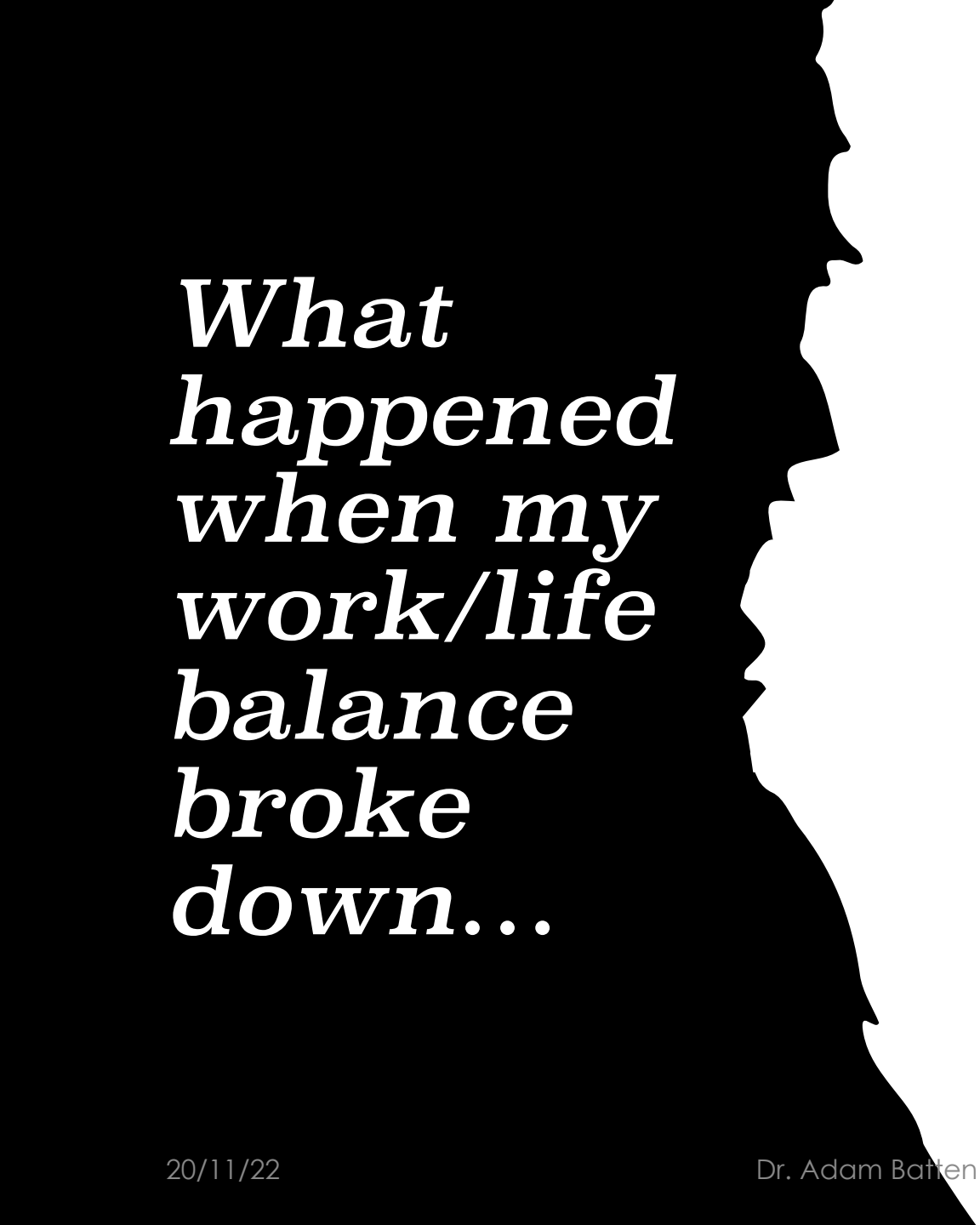
Why is important to maintain your work life balance?

- Everyone experiences stress and down times during their PhD.
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- It will prevent you getting burnt out.



Why is important to maintain your work life balance?

- Everyone experiences stress and down times during their PhD.
- If your PhD is your entire life, then bad research times can bleed into the rest of your life.
- It will prevent you getting burnt out.
- You'll enjoy your PhD experience more and be generally happier.



*What
happened
when my
work/life
balance
broke
down...*

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I felt like I was working hard all the time and achieving nothing. A failure.

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I've sat in my supervisors office crying about being a failure, being stressed, being burnout, etc..

What happened when my work/life balance broke down...



I felt like I was working hard all the time and achieving nothing. A failure.



I've sat in my supervisors office crying about being a failure, being stressed, being burnout, etc..



At the beginning of the Pandemic, the only thing I could do was work. But this was during the time where my research wasn't working. The darkest point in my PhD.

How I managed my life during my PhD

My techniques for managing my life

- I basically put all the stuff that I need to do in my calendar.
 - Personal Events
 - Work Meetings
 - Important Deadlines

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- I don't work longer hours unless I absolutely need to.
 - I specifically schedule my social activities on weekdays after work so I can't stay too long in the office.

My techniques for managing my life

- I basically put all the stuff that I need to do in my calendar.
 - Personal Events
 - Work Meetings
 - Important Deadlines
- I don't work longer hours unless I absolutely need to.
 - I specifically schedule my social activities on weekdays after work so I can't stay too long in the office.
- If I'm not working, *I'm not working*.
 - I'll leave the office if my brain has decided its done for the day.

Hobbies and activities that make me happy

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Partner Time

Board Games

Reading

Hiking/Walking

Running

Cooking/Baking

Video Games

D&D

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Life Critical Activities

Take my mind off things

Productive Activities

Meditative Activities

Hobbies and activities that make me happy

WITH OTHERS

Partner Time

Board Games

D&D

VARIABLE

Hiking/Walking

Video Games

ON MY OWN

Running

Reading

Cooking/Baking

Schedule time for these activities each week

Replace 'unintentional time' with these activities instead

Life Critical Activities

Take my mind off things

Productive Activities

Meditative Activities

Breakout Group Discussion 1

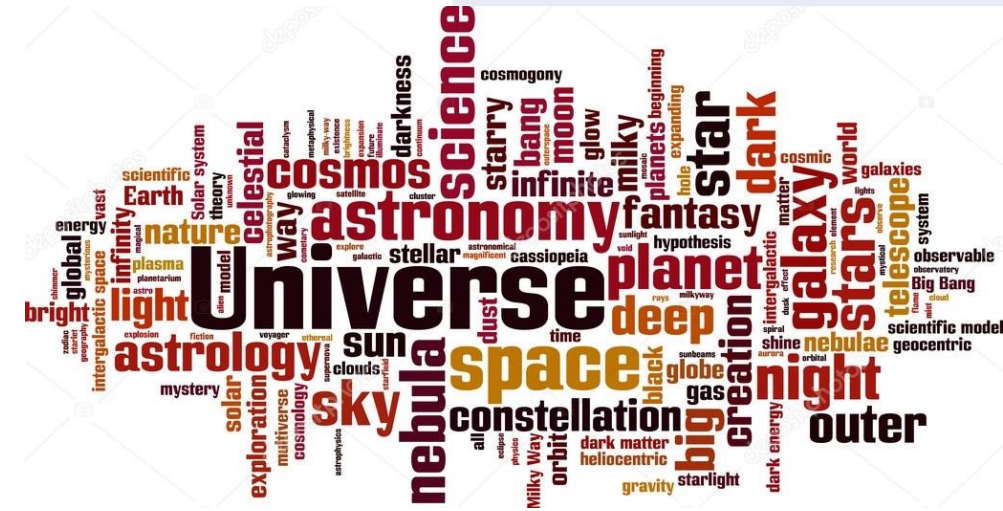
- In groups discuss the following:
- **What hobbies and activities do you enjoy?**
- **What strategies do you employ for maintaining ‘work/life balance’?**
- Choose one person to give a quick summary of the group discussion.

Additional Hobbies and Activities

Additional Strategies for work/life balance

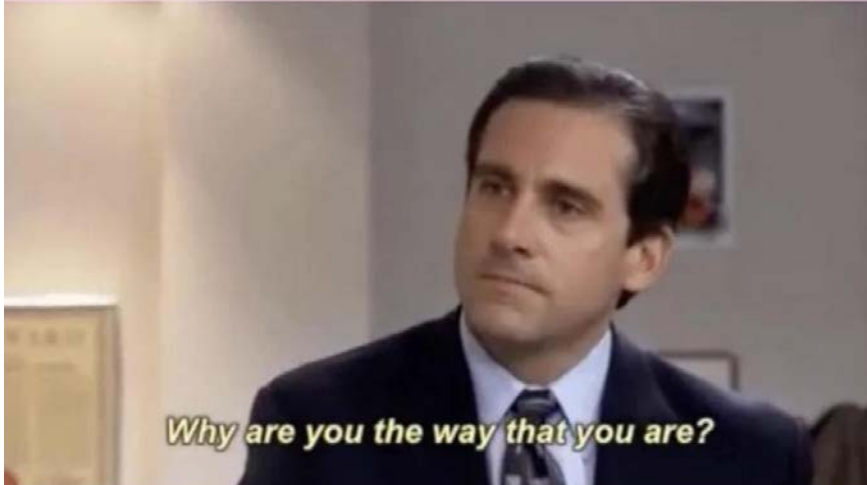
Things to Do During Your PhD

1) *Learn about areas outside your field!*



- Learn about areas of astronomy outside your field.
- Attend talks on topics not in your research area.
- Find the similarities between your field and theirs.
 - Techniques, data sets, core concepts, etc.
- If you are an observer, learn what simulators can and can't simulate, and why? Learn how simulations are constructed.
- If you are a simulator, learn what parameters are and are not observable? Which quantities do observers care more about, and what needs better models.

When the meeting's almost over, but someone keeps asking questions...



2) Ask questions during talks and presentations!

- Try to think of a questions during other people talks.
- It's an excellent way to set up networking opportunities!
- Needing to think of a questions helps me focus on talks.
- If you struggle to ask questions try:
 - First aim for 1 question per day of a conference.
 - Then try for 1 question per session.
 - Eventually you'll be thinking of questions for each talk.
- You don't have to ask them in front of everyone, you can also go up to people and ask them later.

3) Take Leadership Opportunities!



- Take leadership opportunities when you are given them.
 - Organizing a conferences or student retreat.
 - Running the journal club, colloquium series or other meeting at your institute.
 - Being a representative on a committee.
- Try doing different leadership roles throughout your PhD. Try to avoid taking on a lot of roles and responsibility at the same time.
- Academics higher up in the chain will start to learn who you are!

4) *Learn to give great talks!*



- If you give good talks, people will come talk to you about your research!
- People will remember good talks, even if they don't remember everything you said.
- My PhD mentor told me:
“The words you write, and the words that you say will determine how everyone in astronomy will view your work.”

5) *Make yourself known!*



- Make yourself known amongst your peers!
- If people know who you are, they are more likely to think of you for jobs and collaborations.
- Networking is actually kinda fun, and people are normally interested in talk about your work.
- Talk to people. Suggest ideas.
- Be visible!



6) *Learn Important Industry Tools and Software*

- If you plan to move into industry after your PhD, take some time to learn some skills and tools that are frequent in industry.
- Learn some standard coding practices
 - i.e. classes, documentation, testing, machine learning, etc...
- Learn how to use Amazon Web Services (AWS).
- Learn how to use infrastructure for code platforms like Terraform.
- Learn how to continuous integration (CI) and continuous deployment (CD)
- Data Visualization Tools: Tableau, Power BI

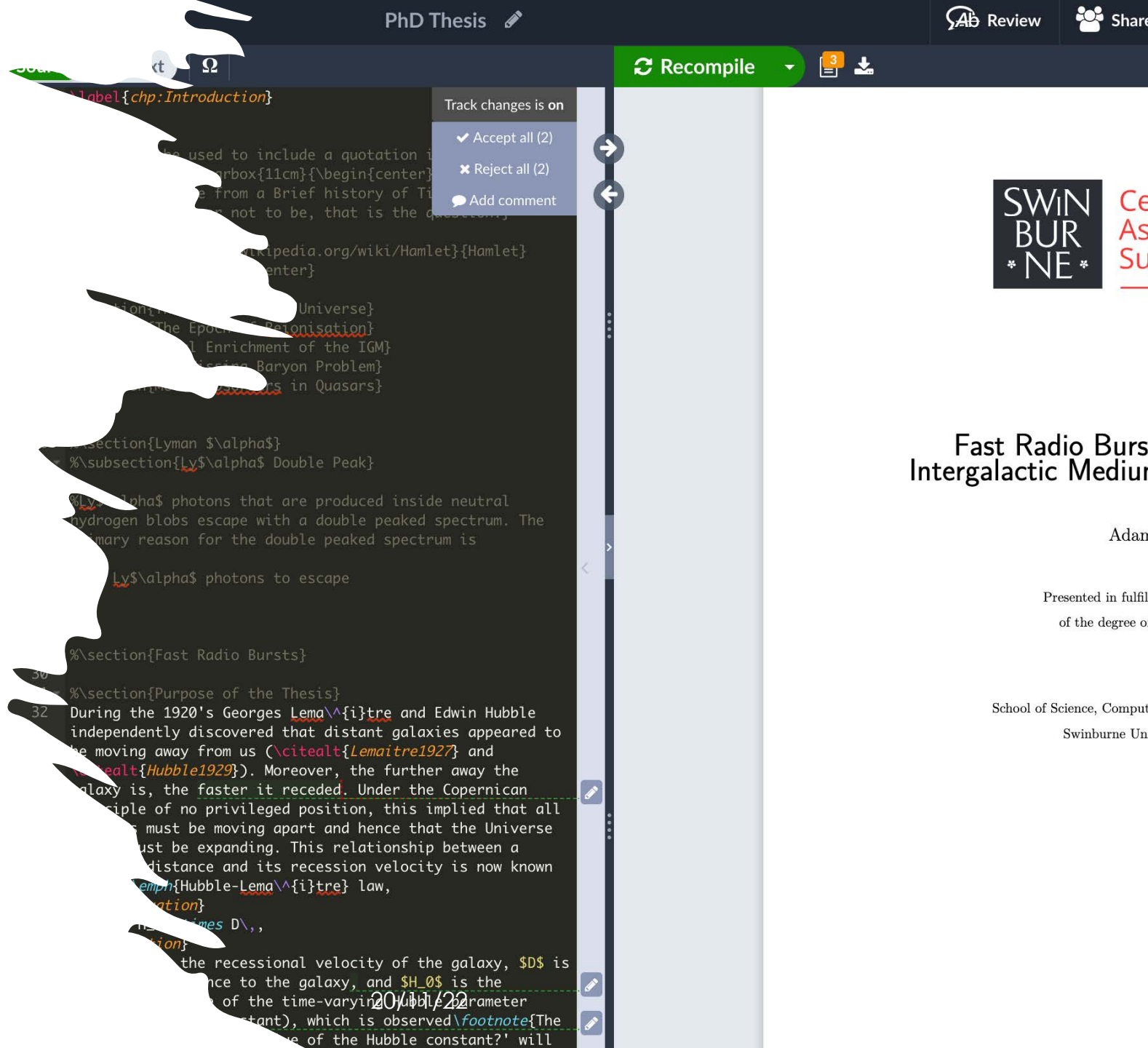


❖ Based on the recommendation of a previous ASTRO 3D astronomer working in Industry.

Writing Your Thesis

1) *Start your thesis earlier than you think*

- If you haven't already created an overleaf document for your thesis, find your Universities preferred LaTeX template make one today (or this week)!
- By starting earlier you'll find out which stuff you are going to need to redo.
- Often the hardest part of writing the thesis is writing the first page or so. You can leave that until much later.



The Brief History of the Universe

- Big Bang (13.6 Gyr)
- Nucleosynthesis first 20 minutes
- Recombination at redshift $z = 1100$ (CMB)
- First stars at redshift $z \sim 13-16$ (EDGES)
- Epoch of Reionisation finished redshift 6
- Intergalactic medium is polluted with elements by redshift 3
- Peak Star formation at redshift 2
- The Intergalactic Medium
 - The Edge of Galaxies
 - The IGM is defined as being outside the Virial radius of a Galaxy and Galaxy clusters.
 - Equation for Virial Radius
 - Large figure defining the virial radius as the boundary between CGM and IGM.
 - Typical temperature and densities of the IGM
 - Densities of about 1 atom per cubic meter
 - Temperatures of about $T = 1e6$ K
 - Metal enriched by redshift $z = 3$.
- Why is the Intergalactic Medium Important?
 - Most of the Matter in the Universe is in the IGM.
 - Simulations predict that 80% of all matter is in the IGM.
 - Understanding the distribution of matter in the Universe requires understanding the evolution of the IGM.
 - The Intergalactic Medium Effects Galaxy Evolution
 - Outflows and Inflows.
- Probes of the Intergalactic Medium
 - Using Emission and Absorption Lines
 - Quasar Sightlines
 - Absorption vs Emission
 - Fast Radio Bursts
 - what is a fast radio burst
 - dispersion measure
 - FRBs as cosmological probes
 - They can measure the ionised baryons in the IGM that do not have favourable transition lines.
- Current things not understood about the IGM
 - Missing Baryon Problem
 - Metal Enrichment History of the IGM.
 - The IGM appears to be enriched to a level of $1e-3$ solar by redshift $z=3$ (Schaye)
 - What types of galaxies pollute the IGM?
 - When do galaxies pollute the IGM?
 - Does metal enrichment relate to star formation history?
- What does this thesis attempt to solve?

2) *Sketch out what your thesis is going to look like, early.*

- Make a dot point plan what your thesis will look like.
 - What is going to be in your introduction.
 - What is going to be in each chapter?
 - How many chapters?
 - Is there any appendices?
- Write down headings and subheadings of your introduction.

This was my original thesis introduction plan. The final version changed a bit from the plan, but its largely similar.

3) Write reports like the content will be in your thesis.

- If you must write reports during your PhD (i.e. literature reviews, yearly work summaries, etc.), write sections like they can be copy and pasted into your thesis.
- This will make writing up your thesis a lot faster and easier if you already have a much of content to just edit, than writing from scratch again.
- For example:
During my 1st year review, I had to write a couple paragraphs about the Epoch of Reionisation. I was then able to just copy and paste that into my thesis and edit it slightly and add a couple more references and I was done.



4) Consider going somewhere else to write your thesis

- Allocate time for specifically just writing! No analysing data. No checking emails. No reading papers. Just writing.
- Going some place else prevents people coming to your office and distracting you and letting you get tempted with analysis.



5) If you have trouble starting, try starting to write 'in the middle'.

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This gas will eventually radiatively cool to form stars.

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Hot gas from the IGM can fall into a dark matter halo and accrete onto a galaxy.

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Some of these stars will undergo a supernova explosion which will pollute their environment with newly formed metals and potentially drive outflows that enriches the IGM with metals.

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These mechanisms mean that the history of the IGM is tightly linked to the evolution of galaxies. Hence studying the IGM provides essential insights into the mechanisms behind galaxy evolution.

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- Then write a summary sentence at the end that summaries the paragraph.

Galaxies do not exist in isolation from their environment; instead, a cycle of inflows and outflows is driven through feedback processes (Putnam et al., 2012). Hot gas from the IGM can fall into a dark matter halo and accrete onto a galaxy, and this gas will eventually radiatively cool to form stars. Some of these stars will undergo a supernova explosion which will pollute their environment with newly formed metals and potentially drive outflows that enriches the IGM with metals. These mechanisms mean that the history of the IGM is tightly linked to the evolution of galaxies. Hence studying the IGM provides essential insights into the mechanisms behind galaxy evolution.

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- Then after a few sentences, I determine if anything needs to be said before the first line (often nothing needs to be added).
- Then write a summary sentence at the end that summaries the paragraph.
- Then in a future draft I do any edits needed.

6) *General Writing Tips and Suggestions*

- Look at successful papers and thesis in your area and see what they do.
- Try writing the methods section first. It's the most linear section that you probably know the best.
- Tips from a non-native English speaker:

“I am not a native English speaker, so I rely on collaborators that are [native English speakers] and they can help me improve my style. Unfortunately, becoming better at it is simply a matter of experience. Reading papers by yourself and highlighting the words you need help understanding helps too.”



SINCE

VERSUS

BECAUSE

Indicates cause and time

Indicates the cause

Implies that information given by the subordinate clause is already known

Implies that information given by the subordinate clause is more important than the rest of the sentence

Sometimes result in ambiguity

Does not result in ambiguity

Pediaa.com

7) Use “because” instead of “since”

- A lot of the time whenever I wrote the word ‘since’, I intended to mean ‘because’. So, I learnt to replace almost every ‘since’ with because.
- Example:
 - However, the EAGLE boxes do not overlap *because* the redshift spacing between the snapshots is larger than the box size.
 - However, *because* the smaller simulations are required to perform convergence tests, we have opted for a new method.

Breakout Group Discussion 2

- In groups discuss the following:
- **What do you do to help you focus on writing?**
- **What other writing tips do you have?**
- Choose one person (different from the previous discussion) to give a quick summary of the group discussion.

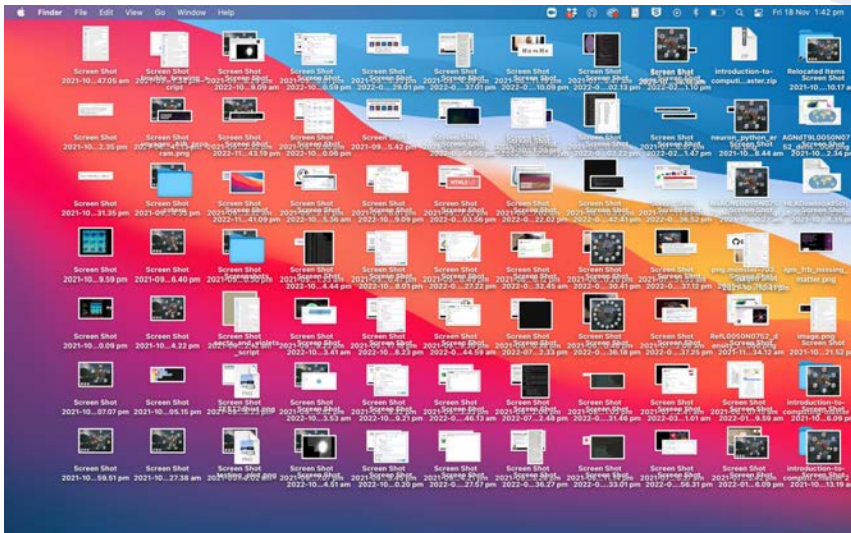
Tips for focusing on writing

More Writing Tips

Lightning Round

Hiding Desktop Icons during Presentations

- If you have a messy desktop like me and don't want to let everyone else know about it. You can hide all the icons without deleting them.
- I add these to my .bashrc (MacOS) and whenever I have a presentation I use “hidedesktop”. Then I can restore them using “showdesktop”.



```
alias hidedesktop="defaults write com.apple.finder CreateDesktop -bool false; killall Finder;"
```

```
alias showdesktop="defaults write com.apple.finder CreateDesktop -bool true; killall Finder;"
```




MathPix

Screenshot from paper

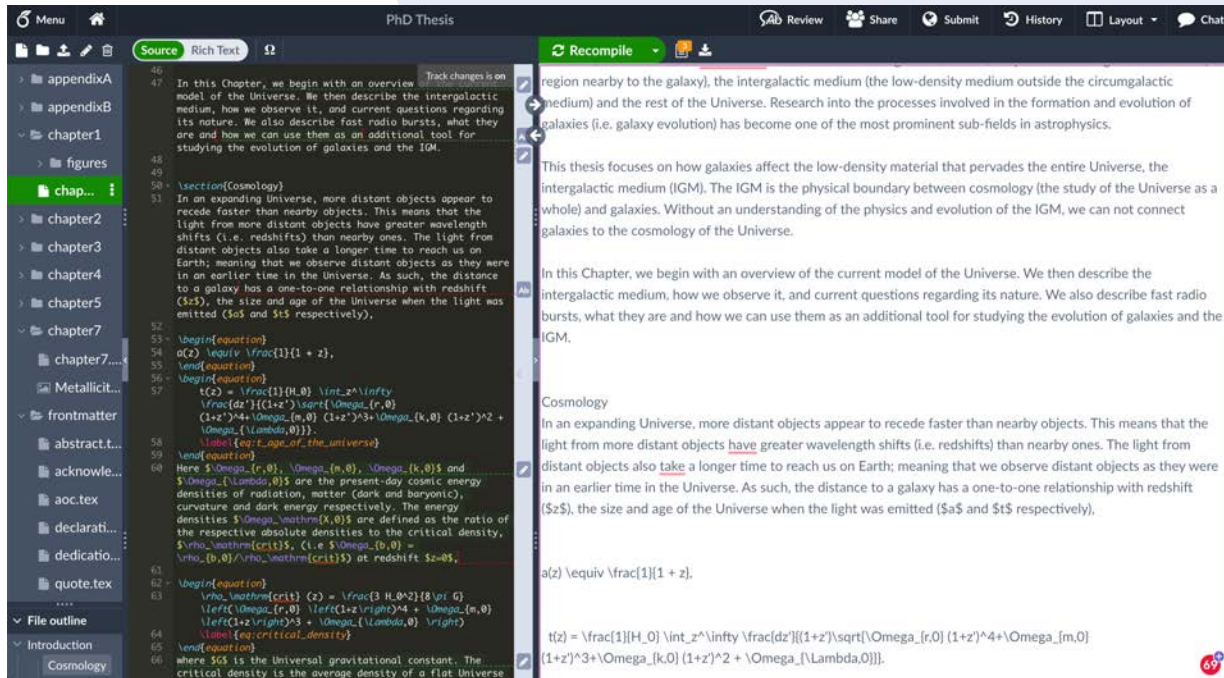
cosmological distances, the appropriate comoving distance element is $dl = c|dt/dz|dz$, where $|dt/dz| = (1+z)^{-1}H(z)^{-1}$ and $H(z) = (\Omega_m(1+z)^3 + \Omega_\Lambda)^{1/2}$ for a flat cosmology.² One must also account

LaTeX code it generates

```
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and  $H(z) = (\Omega_m(1+z)^3 + \Omega_\Lambda)^{1/2}$  for a flat cosmology.
```

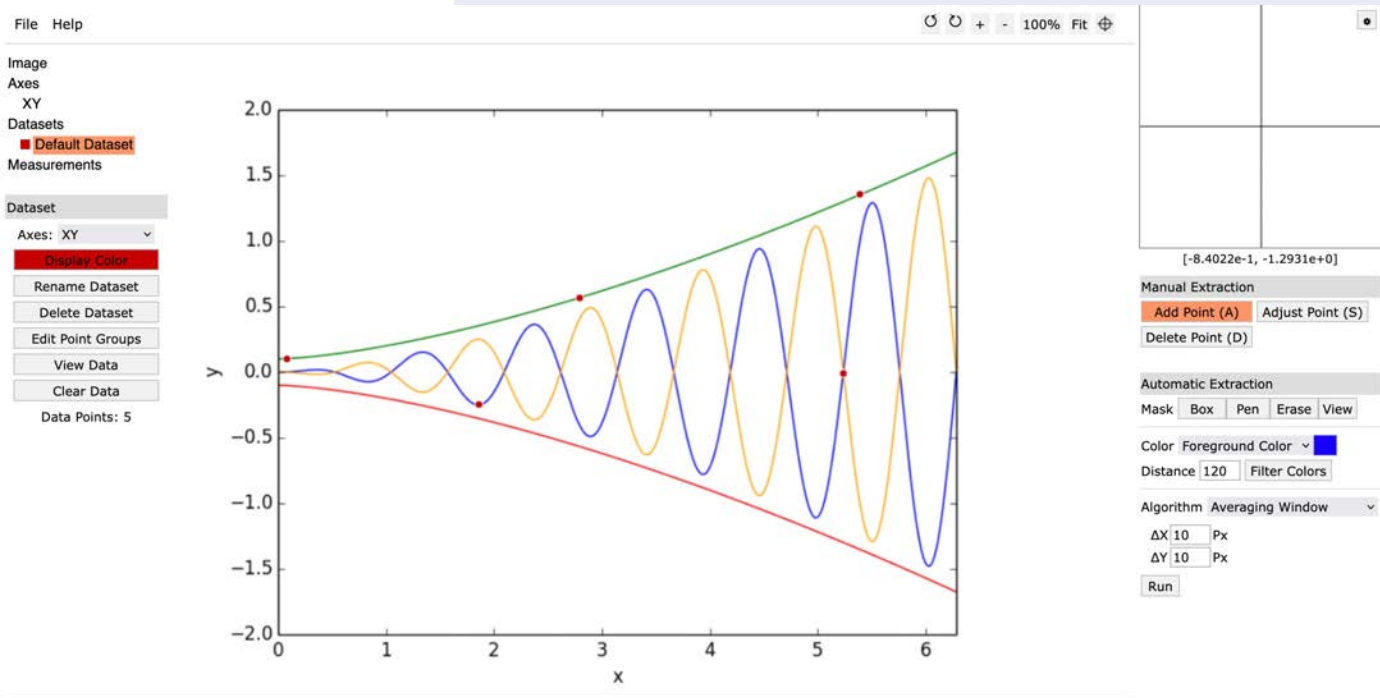
- Math Pix is great for getting equations from papers!
- It converts a screen shot from part of a paper and converts that image into LaTeX code.
- It can also convert handwritten notes into LaTeX (with some accuracy).
- Chrome:
<https://chrome.google.com/webstore/detail/mathpix-snip/acjfbklbdkhaamiiehfmmpaiddbnido>

Grammarly Plugin for Overleaf



- There is a plugin that lets you use Grammarly (and any other similar software for overleaf!
- Overleaf TextArea!
- It turns your compiled PDF into a text area for Grammarly to modify.
- Chrome Extension: <https://chrome.google.com/webstore/detail/overleaf-textarea/iejmieihafhjmjpboblehbpdgchbckil>

Webplot Digitizer



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- It turns your compiled PDF into a text area for Grammarly to modify.
- <https://apps.automeris.io/wpd/>

Wikipedia Error Propagation

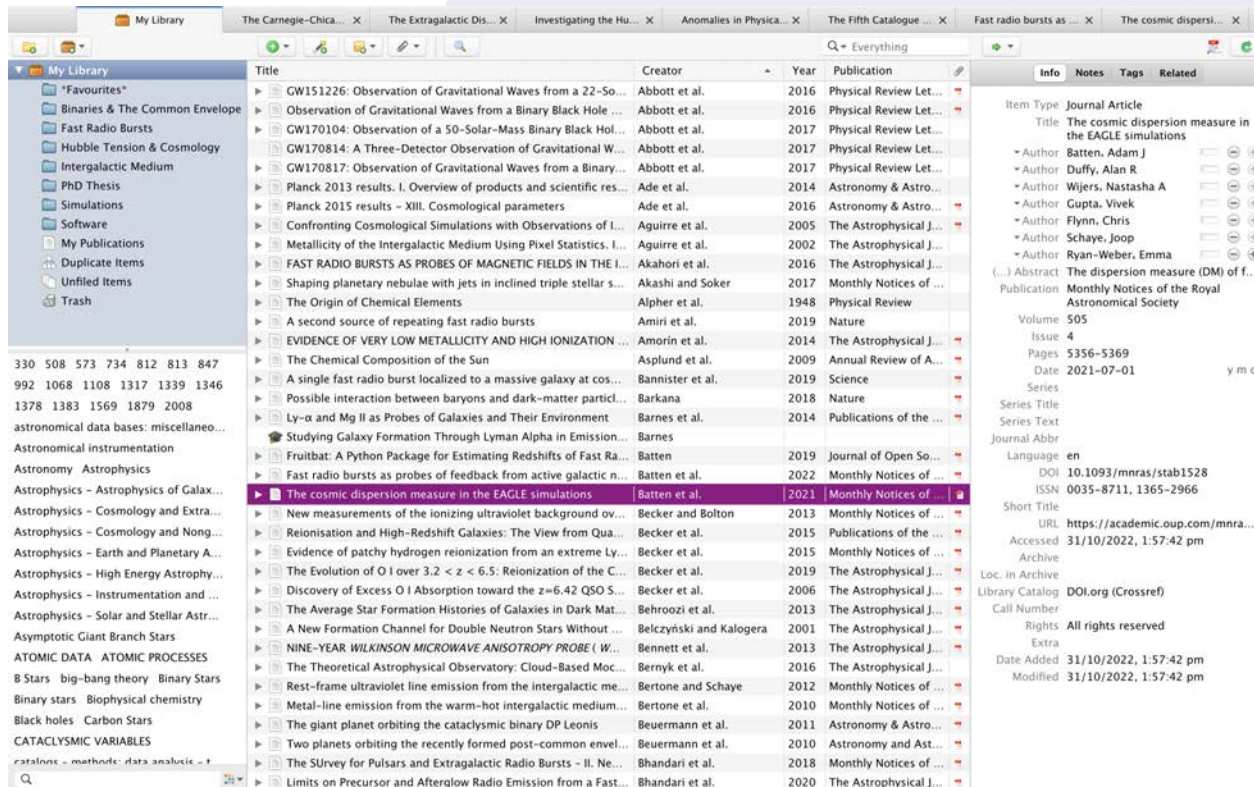
Function	Variance	Standard Deviation
$f = aA$	$\sigma_f^2 = a^2 \sigma_A^2$	$\sigma_f = a \sigma_A$
$f = aA + bB$	$\sigma_f^2 = a^2 \sigma_A^2 + b^2 \sigma_B^2 + 2ab \sigma_{AB}$	$\sigma_f = \sqrt{a^2 \sigma_A^2 + b^2 \sigma_B^2 + 2ab \sigma_{AB}}$
$f = aA - bB$	$\sigma_f^2 = a^2 \sigma_A^2 + b^2 \sigma_B^2 - 2ab \sigma_{AB}$	$\sigma_f = \sqrt{a^2 \sigma_A^2 + b^2 \sigma_B^2 - 2ab \sigma_{AB}}$
$f = A - B,$	$\sigma_f^2 = \sigma_A^2 + \sigma_B^2 - 2\sigma_{AB}$	$\sigma_f = \sqrt{\sigma_A^2 + \sigma_B^2 - 2\sigma_{AB}}$
$f = aA - aA,$	$\sigma_f^2 = 2a^2 \sigma_A^2 (1 - \rho_A)$	$\sigma_f = \sqrt{2} a \sigma_A (1 - \rho_A)^{1/2}$
$f = AB$	$\sigma_f^2 \approx f^2 \left[\left(\frac{\sigma_A}{A}\right)^2 + \left(\frac{\sigma_B}{B}\right)^2 + 2\frac{\sigma_{AB}}{AB} \right]$ [11][12]	$\sigma_f \approx f \sqrt{\left(\frac{\sigma_A}{A}\right)^2 + \left(\frac{\sigma_B}{B}\right)^2 + 2\frac{\sigma_{AB}}{AB}}$
$f = \frac{A}{B}$	$\sigma_f^2 \approx f^2 \left[\left(\frac{\sigma_A}{A}\right)^2 + \left(\frac{\sigma_B}{B}\right)^2 - 2\frac{\sigma_{AB}}{AB} \right]$ [13]	$\sigma_f \approx f \sqrt{\left(\frac{\sigma_A}{A}\right)^2 + \left(\frac{\sigma_B}{B}\right)^2 - 2\frac{\sigma_{AB}}{AB}}$
$f = aA^b$	$\sigma_f^2 \approx (abA^{b-1} \sigma_A)^2 = \left(\frac{fb\sigma_A}{A}\right)^2$	$\sigma_f \approx abA^{b-1} \sigma_A = \left \frac{fb\sigma_A}{A}\right $
$f = a \ln(bA)$	$\sigma_f^2 \approx \left(a \frac{\sigma_A}{A}\right)^2$ [14]	$\sigma_f \approx \left a \frac{\sigma_A}{A}\right $
$f = a \log_{10}(bA)$	$\sigma_f^2 \approx \left(a \frac{\sigma_A}{A \ln(10)}\right)^2$ [14]	$\sigma_f \approx \left a \frac{\sigma_A}{A \ln(10)}\right $
$f = ae^{bA}$	$\sigma_f^2 \approx f^2 (b\sigma_A)^2$ [15]	$\sigma_f \approx f b\sigma_A $
$f = a^{bA}$	$\sigma_f^2 \approx f^2 (b \ln(a) \sigma_A)^2$	$\sigma_f \approx f b \ln(a) \sigma_A $
$f = a \sin(bA)$	$\sigma_f^2 \approx [ab \cos(bA) \sigma_A]^2$	$\sigma_f \approx ab \cos(bA) \sigma_A $
$f = a \cos(bA)$	$\sigma_f^2 \approx [ab \sin(bA) \sigma_A]^2$	$\sigma_f \approx ab \sin(bA) \sigma_A $
$f = a \tan(bA)$	$\sigma_f^2 \approx [ab \sec^2(bA) \sigma_A]^2$	$\sigma_f \approx ab \sec^2(bA) \sigma_A $
$f = A^B$	$\sigma_f^2 \approx f^2 \left[\left(\frac{B}{A} \sigma_A\right)^2 + (\ln(A) \sigma_B)^2 + 2\frac{B \ln(A)}{A} \sigma_{AB} \right]$	$\sigma_f \approx f \sqrt{\left(\frac{B}{A} \sigma_A\right)^2 + (\ln(A) \sigma_B)^2 + 2\frac{B \ln(A)}{A} \sigma_{AB}}$
$f = \sqrt{aA^2 \pm bB^2}$	$\sigma_f^2 \approx \left(\frac{A}{f}\right)^2 a^2 \sigma_A^2 + \left(\frac{B}{f}\right)^2 b^2 \sigma_B^2 \pm 2ab \frac{AB}{f^2} \sigma_{AB}$	$\sigma_f \approx \sqrt{\left(\frac{A}{f}\right)^2 a^2 \sigma_A^2 + \left(\frac{B}{f}\right)^2 b^2 \sigma_B^2 \pm 2ab \frac{AB}{f^2} \sigma_{AB}}$

- I constantly forget how different functions errors propagate.
- On Wikipedia there is a page listing how all the main functions propagate their errors!
- https://en.wikipedia.org/wiki/Propagation_of_uncertainty

Use a Reference Manager

- Use a reference manager to store and search papers!
- You can search through all mentions of a phrase from your entire library.
- I recently swapped over from Mendeley to Zotero.
- There is a Chrome/Firefox extension for automatically adding papers to your library.
- Download:

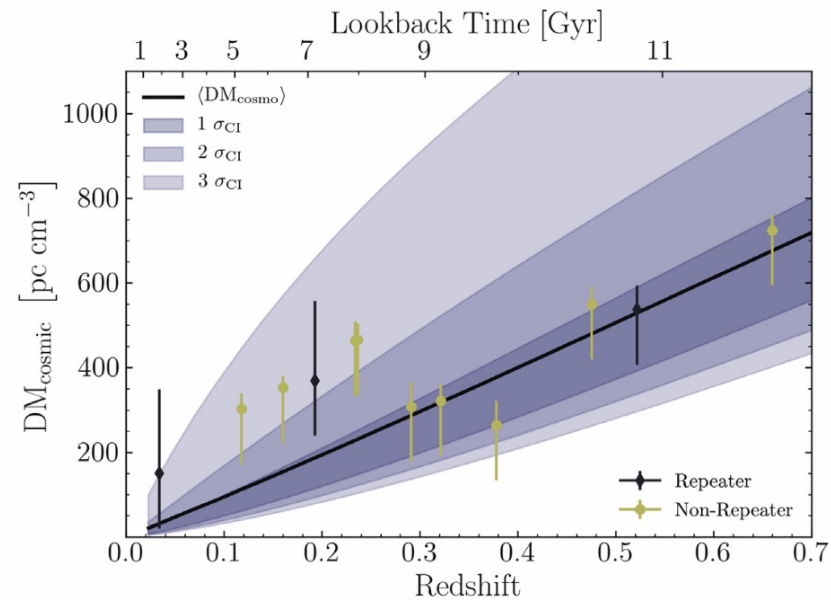
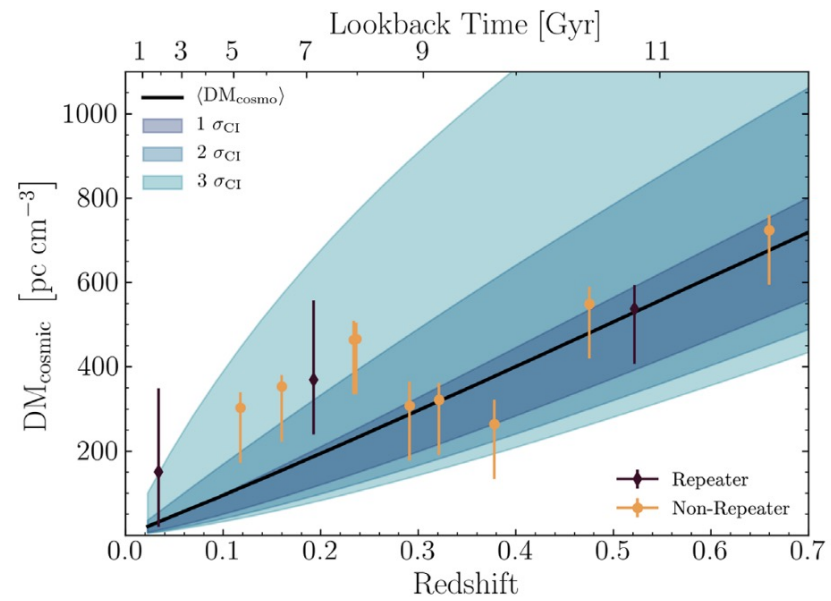
<https://www.zotero.org/download/>



Use your Universities Library Proxy

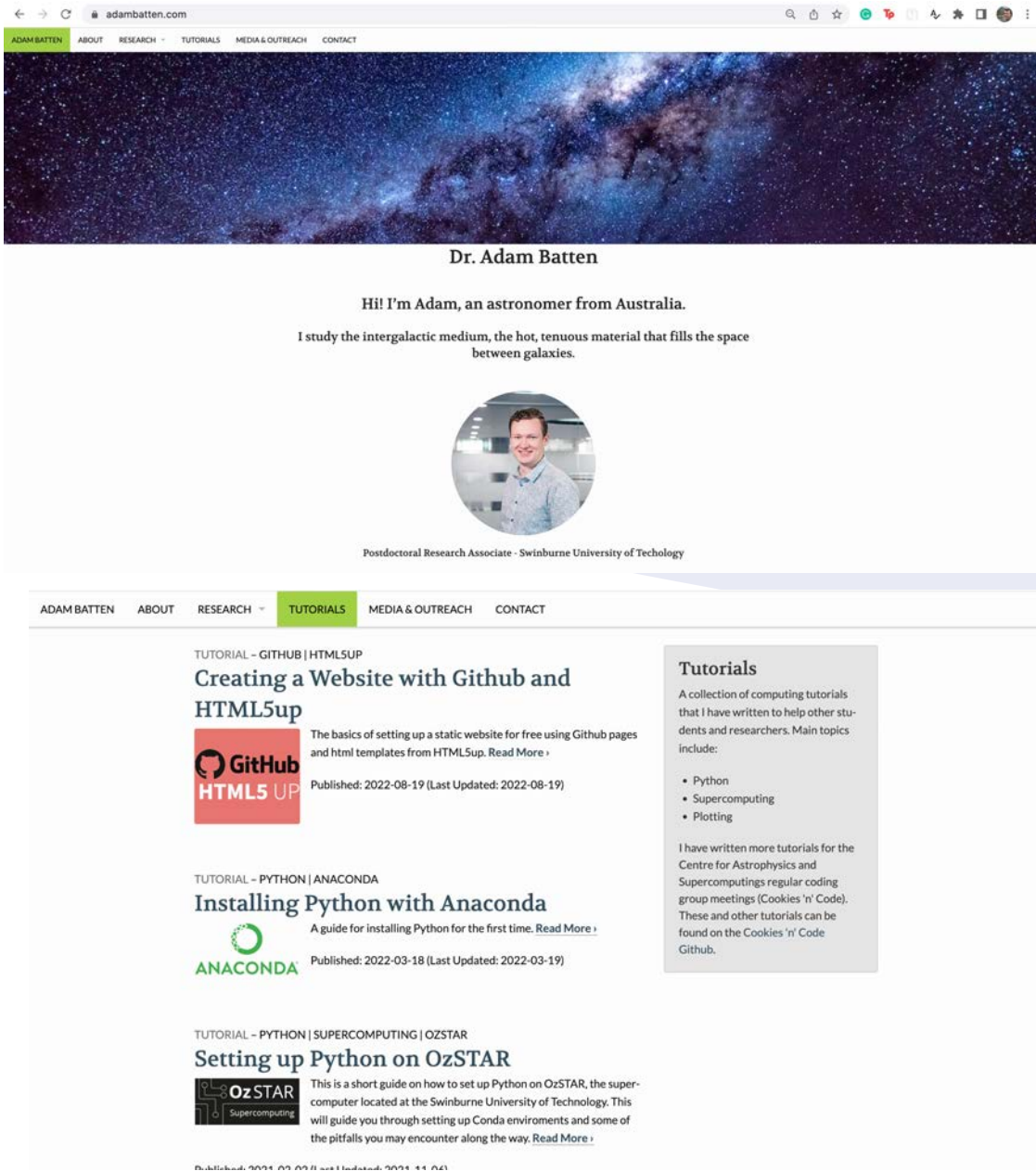
The screenshot shows the Paperpile website interface. At the top, there is a blue header with the Paperpile logo, a location icon, and the text "Research and Writing Guides" with the tagline "Writing a paper? Don't get lost." Below the header, there are navigation tabs for "Research", "Writing", and "Resources". The main content area is titled "Swinburne EZProxy" and includes a "Proxyfy!" button and a URL: <http://ezproxy.lib.swin.edu.au/login?url=>. There is also a "Proxy Bookmarklet" section with instructions to drag a link to the bookmarks toolbar. On the right side, there is a "Reference management with Paperpile" section with a "Try Paperpile" button and the text "SAVE hours of buswork".

- Your University probably has its own Library Proxy for you to access papers off campus.
- You can add the Proxy to your bookmarks and click it whenever you open a paper that requires an institution login.
- Swinburne EzProxy: <https://paperpile.com/p/proxy-swinburne/>



Color Oracle

- Use color Oracle to test if your plots are colour blind friendly.
- Download <https://colororacle.org/>
- Also colour blind friendly colourmaps for Python are available in the cmasher python package.
 - <https://github.com/1313e/CMasher>



Have your own website!

- You can set up a website for free with Github!
- And you can download free templates with HTML5Up.
- Who you are, what research you do (maybe a figure or two), any publications for people to read, and how to contact you.
- Tutorials:
 - https://www.adambatten.com/tutorials/creating_a_website_with_github_and_html5up/
 - https://github.com/swincas/cookies-n-code/blob/master/tutorials/github_websites/README.rst

Breakout Group Discussion 3

- In groups discuss the following:
- **What software or tools have you found useful during your PhD?**
- Choose one person (different from previous two discussions) to give a quick summary of the group discussion.

More Software and Tools

Summary

To Do In Your PhD

- Learn about areas outside your field!
- Ask questions during talks and presentations!
- Take Leadership Opportunities!
- Learn to give great talks!
- Make yourself known!

Writing Your PhD

- Start your thesis earlier than you think.
- Sketch out what your thesis is going to look like, early.
- Write reports like the content will be in your thesis.
- Consider going somewhere else to write your thesis
- If you have trouble starting, try starting to write ‘in the middle’.
- Use “because” instead of “since”

Lightning Round

- Hide Desktop Icons
- Mathpix
- Webplot Digitizer
- Wikipedia Error

Propagation

- Reference Managers
- Library Proxy
- Color Oracle
- Have a website