Conducting scientific research

Effective writing, finding scientific literature

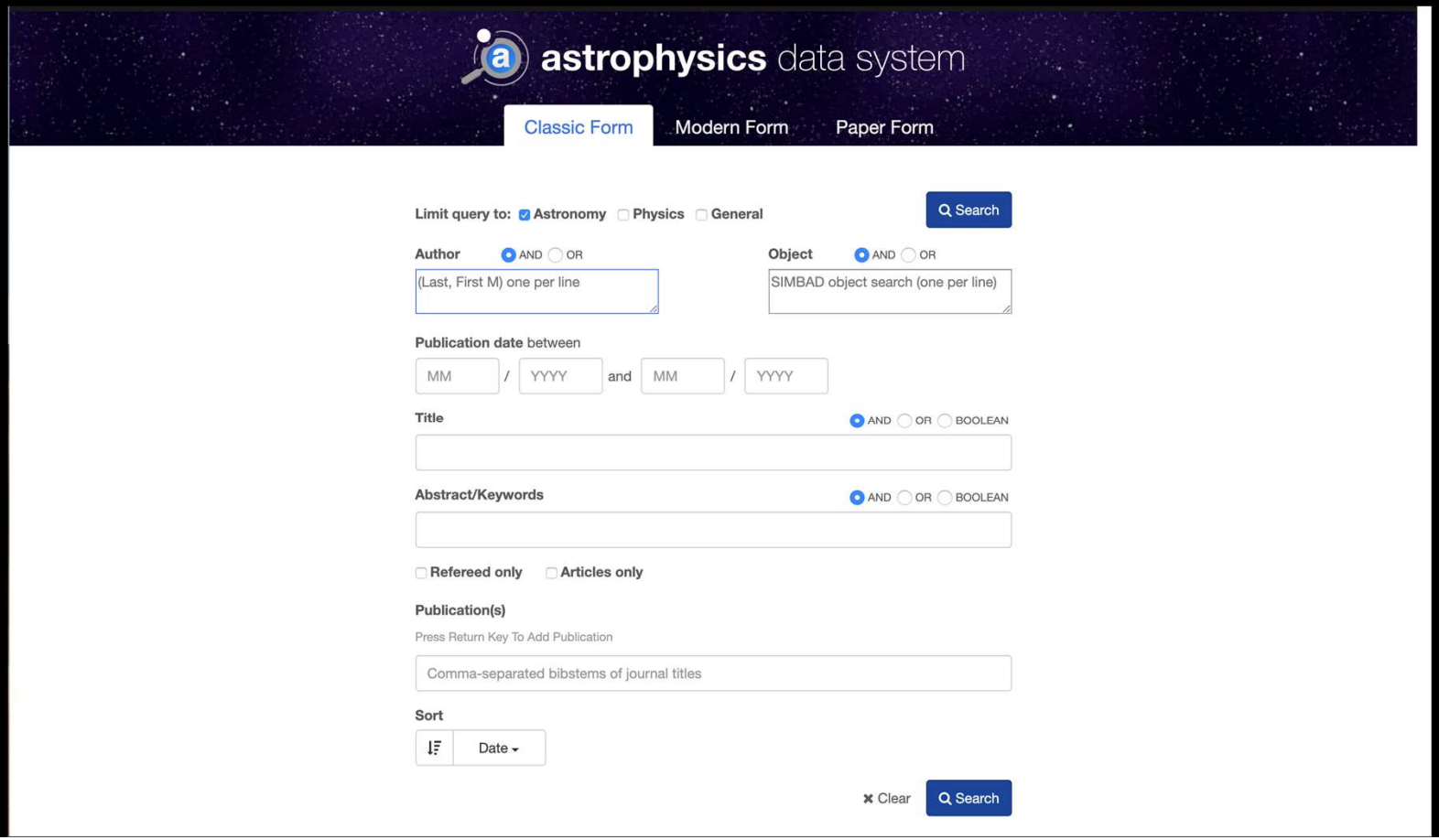
Effective writing, finding scientific literature
Searching for scientific literature
Identifying “good” articles
Effective writing

Magnetism & Applications
Monday 19.6.2023

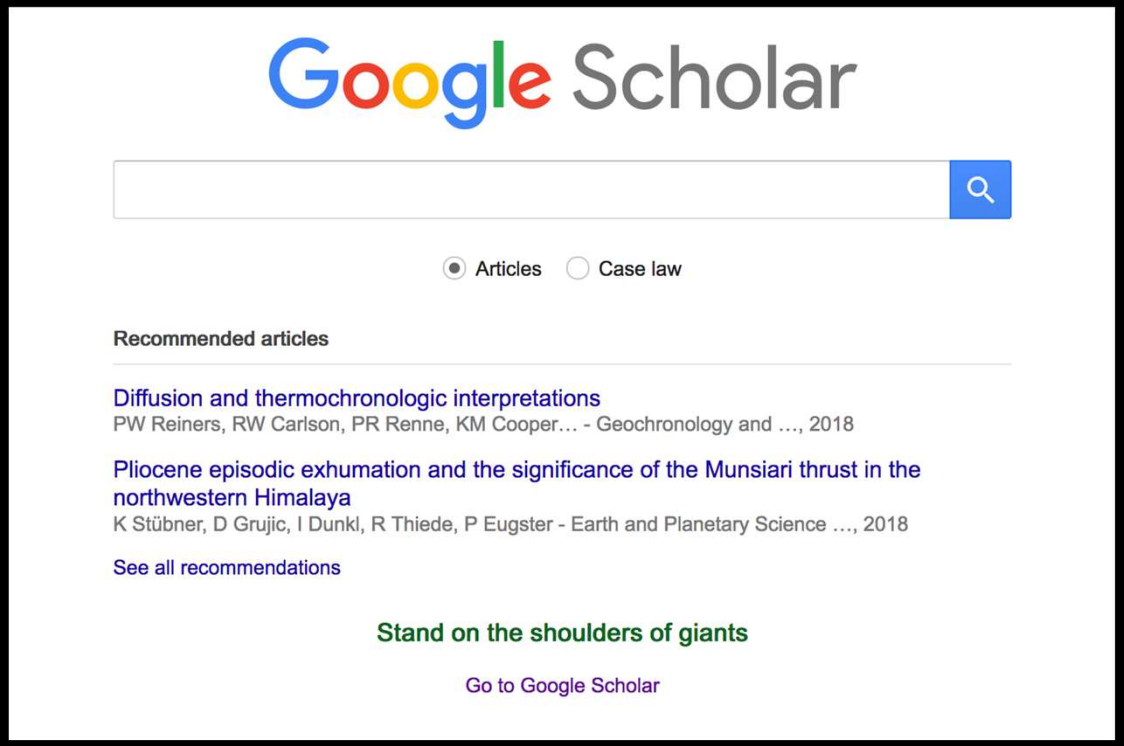
Based on lectures in HY by David Whipp (before ’18)
and Eija Tanskanen in ’19 (HY) & 2020 (Aalto) & ’22 (OU)

NASA, Astrophysics data system

→ https://adsabs.harvard.edu

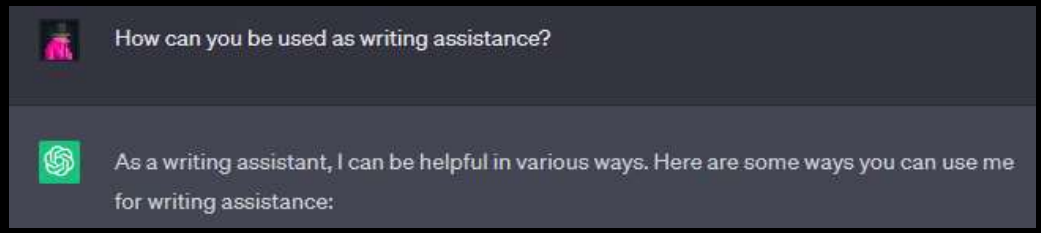


Google Scholar



- https://scholar.google.fi/ (or .com)
- Pros
  - Up to date and easy to use
  - Search returns highly cited results first
  - Handy “related articles” feature
- Cons
  - Links may not work for article access
  - May link to sites other than journals
  - Searches all fields of science

ChatGPT



1. Generating Ideas: If you're struggling to come up with ideas for a story, essay, or any other type of writing, you can provide me with some prompts or a general topic, and I can help you brainstorm ideas.
2. Outlining: I can assist you in creating an outline for your writing project. You can provide me with the main points or sections you want to cover, and I can help you organize them in a logical structure.
3. Improving Clarity: If you have a draft that needs clarification or restructuring, you can share it with me. I can suggest ways to improve the flow, coherence, and overall clarity of your writing.
4. Grammar and Style: Whether it's checking grammar, punctuation, or sentence structure, I can help identify and correct errors in your writing. Additionally, I can assist in refining your writing style by offering suggestions on word choice, tone, and sentence variety.
5. Editing and Proofreading: If you have a completed piece of writing, I can help you review and edit it for grammar, spelling, punctuation, and overall polish. I can also provide feedback on the structure, organization, and overall effectiveness of your writing.
6. Language Expansion: If you're looking to enhance your vocabulary and diversify your writing, I can provide alternative word choices, synonyms, and idiomatic expressions to enrich your language.

- Remember, while I can provide valuable assistance, **it's important to review and revise the suggestions I provide**. **Ultimately, the responsibility for the final content and quality of your writing rests with you as the writer.**

June 19, 2023

How do I find “good” scientific literature?

- What makes a “good” article?
  - Highly cited?
  - Easy to read?
  - Referenced by other well-cited works?
  - Published in a top international journal?
  - Written by a famous scientist?
  - Title sounds important?
  - Author’s make a strong case for the article’s importance?
  - Lengthy/detailed description of the study?

How do I find “good” scientific literature?

- What makes a “good” article?
  - Highly cited? - Probably, but other metrics matter too (continued citation, etc.)
  - Easy to read? - Probably, good studies are generally presented clearly
  - Referenced by other well-cited works? - Probably, but some cite themselves…
  - Published in a top international journal? - Maybe
  - Written by a famous scientist? - Maybe
  - Title sounds important? - Maybe
  - Author’s make a strong case for the article’s importance? - Probably not
  - Lengthy/detailed description of the study? - Maybe

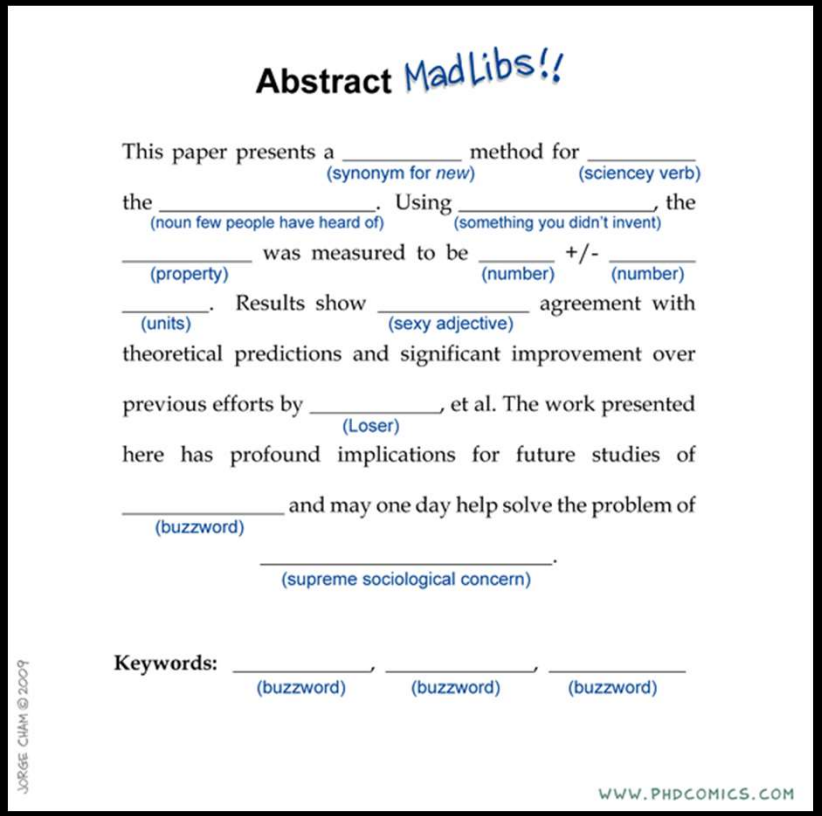
How do I find “good” scientific literature?

- Try to search using well-defined keywords (be specific)
  - Consider an example of trying to find literature about the transition from rifting a continent to forming an ocean
    - Searches for “plate tectonics” or “divergent margins” will be too broad
    - Instead, try “continental rifting”, “formation of ocean basins”, etc.
    - As you learn more from reading, you may find additional terms to include in further searches, such as “Wilson cycle extension” or “rift-drift transition”, which will further focus your searches

How do I find “good” scientific literature?

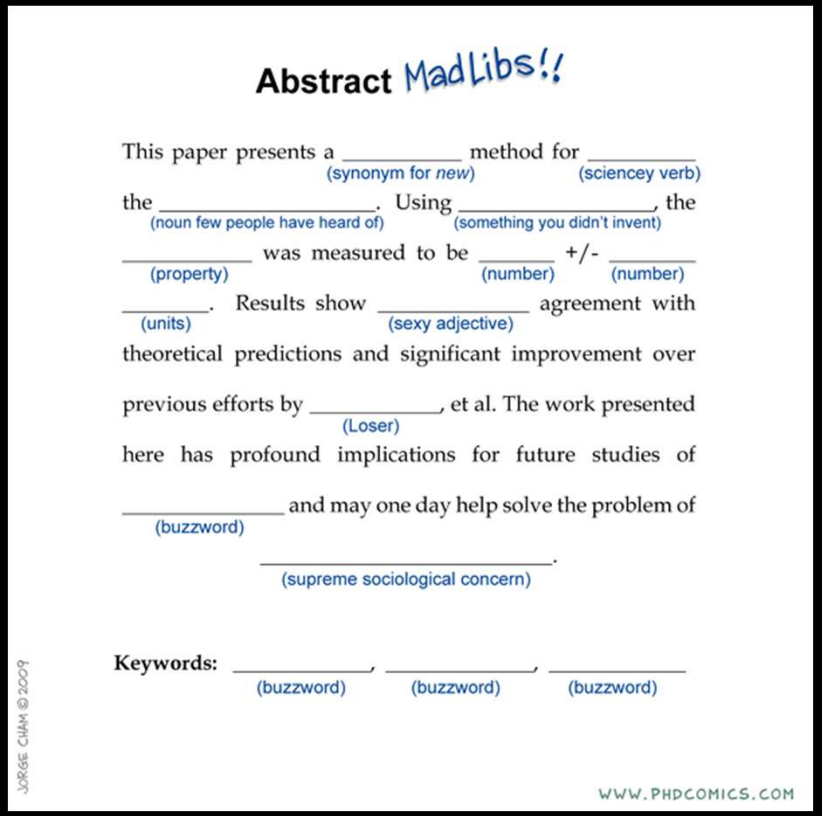
- Refine your searches and search again
  - As you learn more your search focus may shift
- Identify the “big” names, search for other articles they have published
- Ask your supervisor for some guidance. They should at least provide some of the more important articles as starting points
  - Check the references in those articles and who has cited them

Effective writing



- You're probably already getting the idea that there are some tricks and formulas for scientific writing
- Unfortunately, writing is hard
  - Not only do you need to figure out what to say, you also need to think about how (and when) to say it
- And you probably don't know some of these things, we've been there too (and sometimes still face this issue)
  - You're going to learn by writing, and we (all of us) are going to help you get better

Effective writing



- When learning to communicate science it is common to
  - Not know if/when something you've written is incorrect
  - Be sensitive to criticism
  - Not be aware of how important writing is to conducting critical review
  - Feel like you're alone in your struggles

- We aim to help guide you through some of these struggles

Three things to consider in effective writing

- Who is the audience?
- How much detail is needed?
- Writing technique

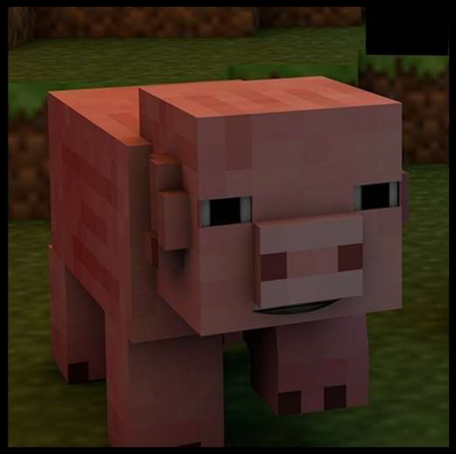
Who is the audience?

- Just like spoken communication, you will want to adjust your writing style and content based on the target audience
- In our case you're writing for a general audience of geoscientists
  - You can assume we have a bachelor's level education in geoscience, and any one of us in this classroom should be able understand your thesis proposal

Who is the audience?

- In general, considering the audience is often the starting point for considering what you will write
  - What kind of paper am I writing?
    - Journal article (short or long format), thesis chapter, technical report, research proposal, an abstract, an article for the general public
    - This will determine the length, level of detail, technicality of language, use of figures, references, etc.

How much detail is needed?



- How much detail you can include is mainly limited by the length of the text you are writing
  - In our case, you have 10 single spaced pages for the thesis proposal
    - This is certainly enough space to clearly describe the research you will conduct, and we should expect to have some detailed descriptions of the methods you will use and why you have selected them
    - This is likely not enough space to provide essential details AND include a comprehensive literature review. You're going to have to prioritise the most important references and make decisions about what can be left out

Writing technique

Writing is a form of art

- HOW you write your text is just as important as what you include, and the technique of scientific writing takes practice
- Grammar, spelling, style, and format matter
- Above all, the text should be clear
  - Clarity comes from being precise and concise
- A good scientific text starts by writing something, followed by frequent revision of the text

Common writing mistakes

- As mentioned, learning to write means making mistakes, and some of these mistakes are quite common
  - Here and in the slides that follow we review some of the most frequent mistakes, which we hope you'll aim to avoid

Where do I turn for help?

- The preceding slides should be helpful for many of the common mistakes
- The American Geophysical Union (AGU) also has an excellent Grammar and Style Guide available online at https://publications.agu.org/agu-grammar-and-style-guide/.

Common writing mistakes - In general

- Appropriate reference citation (format and completeness)
  - All necessary references cited; all cited references included in the reference list; references in appropriate format - APA style for this class
- Spelling and typographical errors
  - British and American English spelling is acceptable, but must be used consistently)
- End-of-sentence punctuation
  - Avoid run-on, comma splice, fragment, misuse of semi-colon
- Apostrophes and plurals
  - Know where to use apostrophes; appropriate plural forms

Common writing mistakes - In general

- Verb forms
  - Forms of lie, lay, etc.; rules for use of helping verbs, adding -ed, -s, etc.
- Consistent verb tense
  - Avoid confusing shifts in present vs. past tense, active vs. passive voice, etc.
- Agreement of subject and verb
- Pronoun form
  - I vs. me, they vs. them, etc.

Common writing mistakes - In general

- Agreement of pronoun (it, they, he, etc.) with antecedent (the word the pronoun refers to)
- Use of articles (a/an, the)
- Sentence sense
  - Words omitted, scrambled, or simply incomprehensible

Common writing mistakes - Missing articles

- Use of articles and missing articles (a/an, the)
  - One of the most common problems for Finnish students writing in English

    …numerical models where properties of (the) lithosphere and…

    (The) First studies are from (the) 1970s and (the) last is from 2007.

  - In most cases you should include an article before nouns in English
    - a/an for any part of a group (i.e., a dog, an alligator)
    - the for a specific member in a group (the dog, the cow)
- Tips: https://owl.english.purdue.edu/owl/resource/540/01/

Common writing mistakes - Using contractions

- Contractions are not appropriate for scientific writing
  - Contractions are informal, and scientific writing is formal

    …a correlation between rainfall and the rate of erosion wasn't (was not) observed.

    We didn't (did not) find evidence of…

Common writing mistakes - Topic sentences

- Topic sentences are important for the structure of your written works and for helping readers quickly read your text

  - A topic sentence is the first sentence in a paragraph, which states the main point(s) of that paragraph. A good topic sentence is essential.

    Analytical solutions (Fig. 4) are from (Stuwe, 2007). (not good)

    To ensure the numerical model calculations are correct, we compared simplified model predictions to published analytical solutions. (much better)

Common writing mistakes

- Excessive use of substantives

  …the President of Russia can, in case of need, call on a seven-person mudslide advisory panel.

- Sloppy adjective use

  we can get insurance against scheduled airline accidents

  we may meet a small college professor

  at the supermarket we deal with a frozen food clerk

Common writing mistakes - Which versus that

- Which versus that
  - The former introduces a nonrestrictive clause and must be separated by commas

    The Sandhill Formation, which is famous for its fossils, is of Jurassic age.
  - The latter introduces a clause that is essential to the meaning of the sentence. It must not be separated by commas.

    The information that I need is in this book
- Miss use of the pronoun which to refer to a clause
  - Correlation is difficult, because some of the rocks contain no fossils
    rather than
    Some of the rocks contain no fossils, which makes correlation difficult"

Common writing mistakes

- Use of occur (to happen)

  The rocks occur in the cliff (incorrect)

  The rocks are in the cliff
  The rocks are present in the cliff
  The rocks are found in the cliff

- Since (refers to time), as does occasional, while, often, sometimes, when, and usually

  Occasional outcrops of obsidian were observed since the bulldozer passed through the hill

Common writing mistakes

- Based on (adjectival), on the basis of (adverbial)

  Based on this tiny fossil collection, Smith proposed a new phylum (incorrect)

  On the basis of this tiny fossil collection, Smith proposed a new phylum (correct)

- Due to (adjectival), owing to (adverbial)

  Due to bad weather, the trip was cancelled (incorrect)

  Owing to bad weather, the trip was cancelled (correct)

  Because of bad weather, the trip was cancelled (better)

Common writing mistakes

- Infer versus imply
  - Infer means ”deduce by reasoning”
  - Imply means ”to express indirectly”

- Presently versus currently
  - Presently means ”in the near future”

    We are currently (now) doing this; we will presently (soon) do that.

Common writing mistakes

- Can/could; may/might

  This outcrop can be studied. [Studying it is possible]

  This outcrop could be studied. [If given permission, for example]

  This outcrop may be studied. [You have been given permission to do so]

  This outcrop might be studied. [If necessary or if you have time, for example]

Course project and **PRESENTATION**

- 10-12 min for the talk, 3-5 min afterwards for questions and discussion
  - For a total of 15 minutes

Usually contains:

1. Title slide
   - Titular topic, presenter, and the occasion (e.g. ”Magnetism & Applications 2023”)
2. 1-2 slides of introduction, possibly a content slide
3. 3-5 slides, ”the core” of the presentation
4. 1-2 slides for further discussion, ”the advanced” part, if applicable
5. 1-2 slides for Conclusions
6. May include a slide for end and/or references used

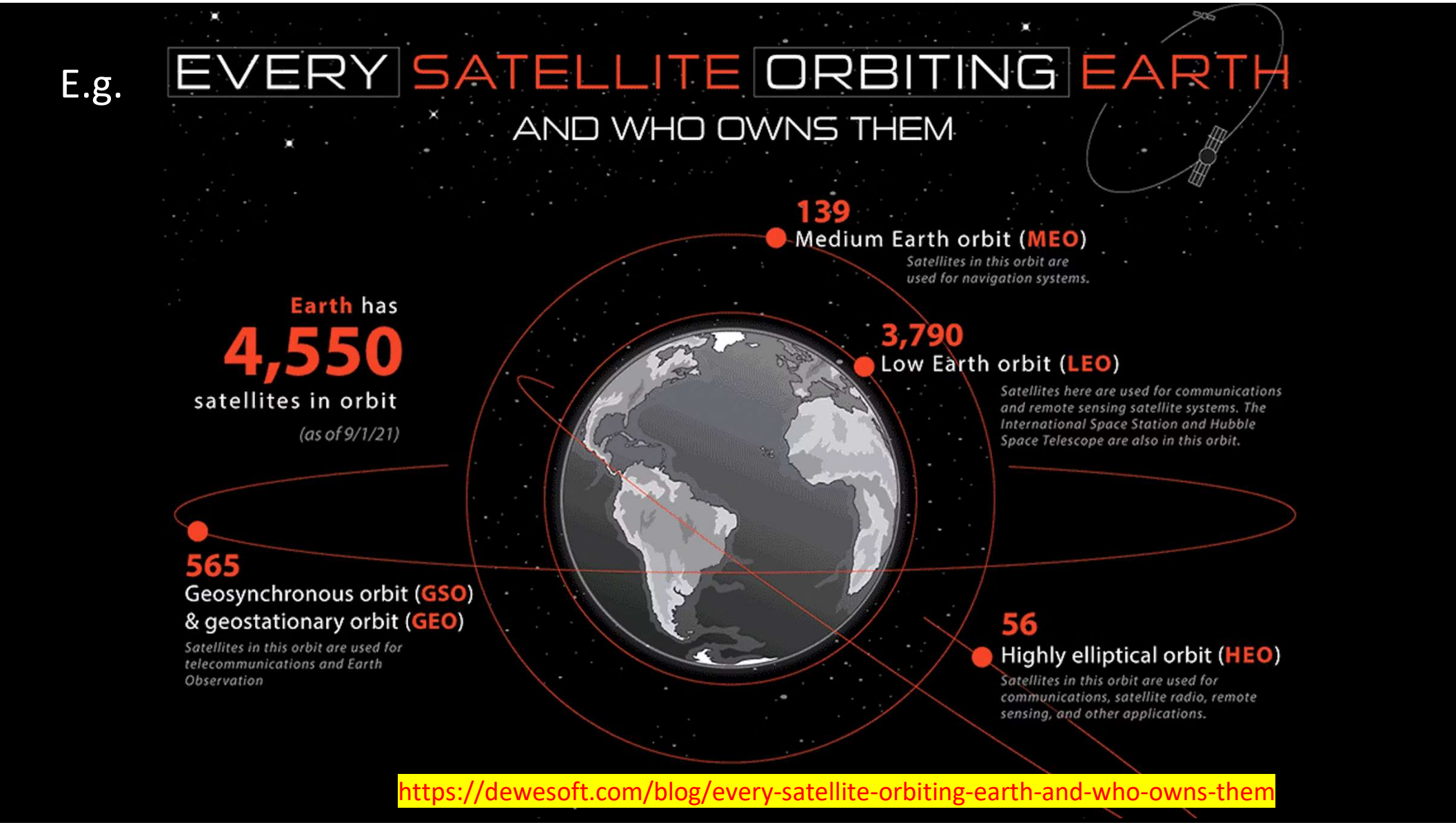
Total: probably about 8-12 slides

Course project and **PRESENTATION**

USEFUL TIPS, TRICKS, AND PRACTICES

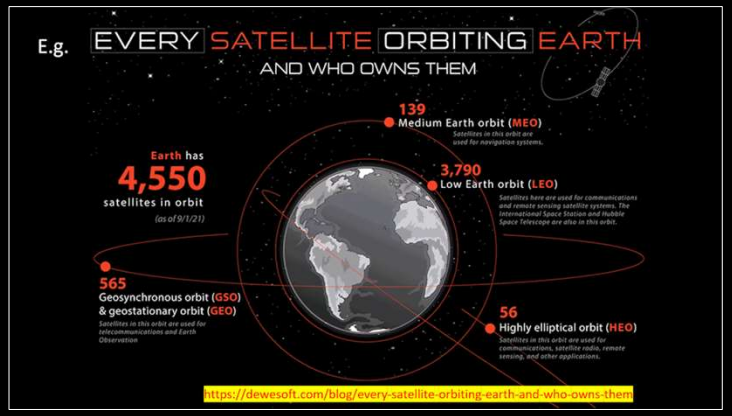
- Presentation's length
  - Rule of thumb: **Each slide adds a minute**
- Pictures are king and can even take the whole slide

E.g.



https://dewesoft.com/blog/every-satellite-orbiting-earth-and-who-owns-them

Course project and **PRESENTATION**



USEFUL TIPS, TRICKS, AND BEST PRACTICES

- Presentation's length
  - Rule of thumb: **Each slide adds a minute**
- Pictures are king and can even take the whole slide
- Pictures should have a source
  - In scientific presentations, this applies to referenced results if not "common knowledge"

Course **PROJECT** and presentation

About 10 pages, give or take, containing the following parts (as applicable)

OUTLINE OF A SCIENTIFIC REPORT

1. Title page, incl. title itself and writer
2. Abstract
3. Introduction
4. Data and methods (if applicable)
5. Results (renamed as applicable)
6. Discussion
7. Conclusions
8. References

Course **PROJECT** and presentation

ABSTRACT

- **Summarises the contents of the report**

Abstract – The solar cycle evolution of the ultra-low frequency (ULF) power was studied in solar wind and on ground. We aim finding out how the ULF power in interplanetary and on ground magnetic field evolves over the solar cycle 23 (SC23) and how well do they follow each other in monthly time scales. The hourly power of the ULF waves was computed in the Pc5 frequency range 2–7 mHz for years 1998–2008. The highest wave power in SC23 is found to occur in late 2003 and the lowest at the solar minimum. Ground ULF power follows the IMF power and solar wind speed, particularly well during declining phase. The ULF power in winter exceeds the ULF power in other seasons during the declining phase of SC23, while equinoxes dominate in the ascending phase and the solar maximum. The ground ULF power was found to rise with magnetic latitude from 54° to 73°, after which Pc5 power decreases towards the polar cap. The Pc5 power in the auroral zone is larger in the nightside than the dayside due to substorm activity implying that magnetotail processes are an important contributor to the nightside ULF power.

Course **PROJECT** and presentation

INTRODUCTION

- **Introduce the subject matter**
- **Define the key concepts**
- **Motivation: Tell about why this topic is interesting or useful to study**
- **Intention: Tell about how you studied the topic in this report**
  - **In a "real paper" you'd briefly tell about how you approach the topic and what you aim(ed) to find out, e.g. using particular mathematical or numeric methods or data.**

Course **PROJECT** and presentation

DATA AND METHODS

- Here you introduce your a) data sources and b) how you studied them
- You may omit this section if it’s not applicable to your report

Course **PROJECT** and presentation

RESULTS

- Here you tell what you found out in the project.
- If you have figures (and you should have some), this is the section usually most populated with them.
- Avoid making any deductions or conclusions. This section is only for telling what you found out, not making any allegations from that (that's reserved for Discussion).
- The section title "Results" can (and preferably should) be renamed as something more appropriate and informative.

Course **PROJECT** and presentation

DISCUSSION

- Here you discuss the results.
- What do the results mean, what is their importance, did any new understanding come out of them? Here you ”connect the dots”.
- This is also the space for critical reflection. E.g. what are the limitations of your study (or the studies you looked into)?
- You can also discuss the unknowns and challenges of the research, and/or any future studies that could be done in the field to advance it.

Course **PROJECT** and presentation

CONCLUSIONS

- Here you briefly tell:
  1. What was done in the study (your project)
  2. Why is it important or interesting for the topic
     - Alternatively, what did you learn and what you found particularly interesting

Course **PROJECT** and presentation

”If I have seen further than others, it is by standing on the shoulders of giants.” [1]

Sir Isaac Newton

REFERENCES

- Citing references is one of the driving forces of science.
- List of any (scientific or otherwise) sources of text and/or pictures or other material that you used.
- Only list references that you cite in the text.
- You can choose what kind of citing or reference syntax to use.

Example:

[1] *Newton, Isaac. "Letter from Sir Isaac Newton to Robert Hooke". Historical Society of Pennsylvania. Retrieved 7 June 2018.*

Course **PROJECT** and presentation

About 10 pages, give or take, containing the following parts (as applicable)

OUTLINE OF A SCIENTIFIC REPORT

1. Title page, incl. title itself and writer
2. Abstract
   - Summary or essentially a shortened version.
3. Introduction
   - Main concepts, motivations, and intentions
4. Data and methods (if applicable)
   - Data sources and math
5. Results (renamed as applicable)
   - Data analysis → figures, findings, results of the above math
   - E.g. renamed to “Types of geomagnetic pulsations”, “Magnetic senses in mammals”
6. Discussion
   - What does it mean? How does it connect to earlier knowledge? What are the limitations of this new insight?
7. Conclusions
   - Briefly stated most important findings or concepts
8. References