



The
University
Of
Sheffield.

Dr Susan Cartwright
Dept of Physics & Astronomy

PHY340/PHY350

Professional Skills

Part 1

Finding and using information



Finding and Using Information

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Reliable

Complete

Up-to-Date

Properly Cited

Understood

Motivation

- “A year in the laboratory can save you an hour in the library”

John McMillan

- Why?
 - Someone has already done the experiment
 - Someone has proved that the method you intend to use doesn't work
 - Someone has done something closely related, and this will help you with your experimental design
 - Someone has produced results on your dominant background

Fast, efficient retrieval of relevant information is a **transferable skill**: it will be useful in any graduate career, not just physics

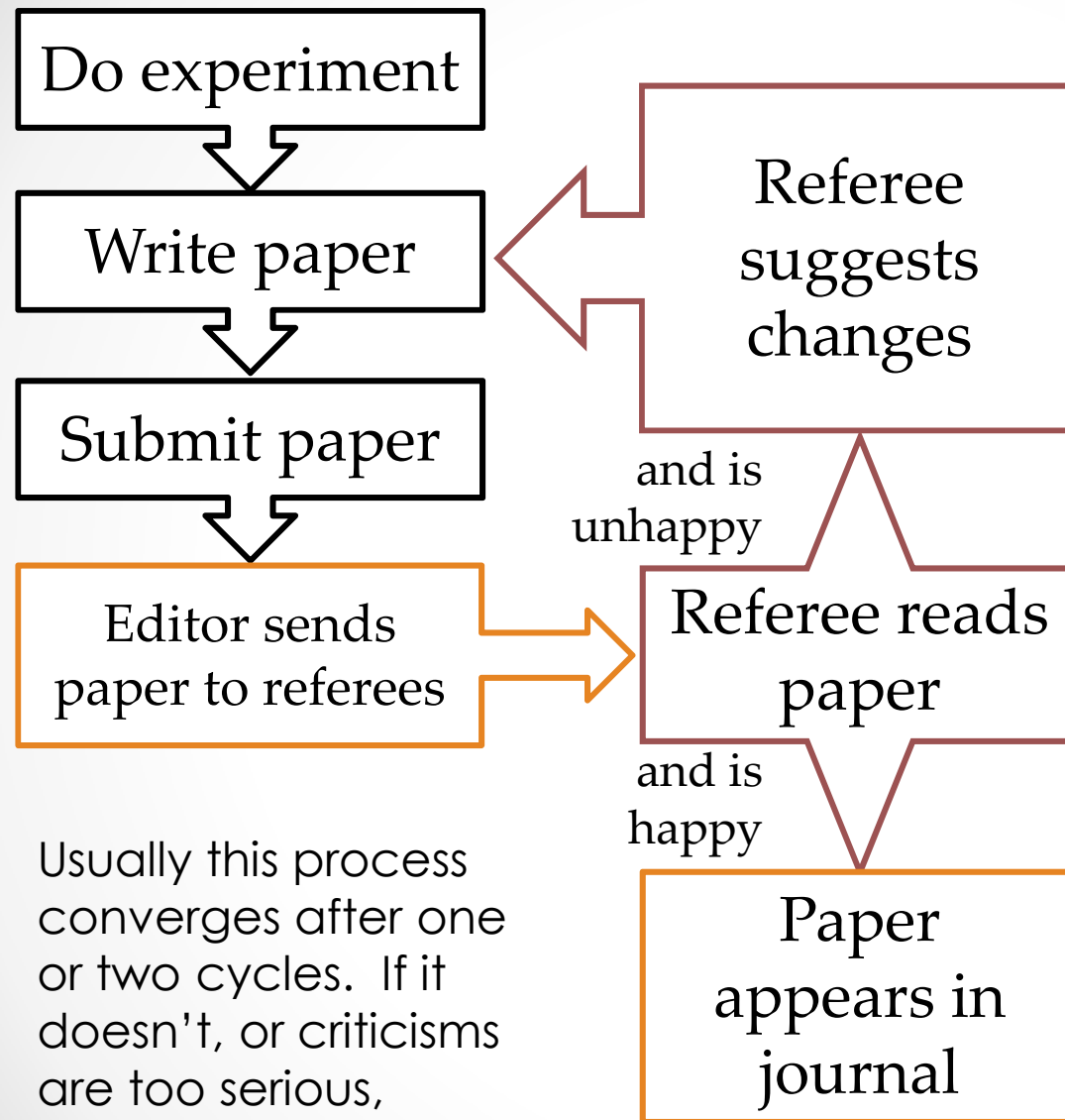
Finding reliable information

- If you are looking for scientific/technical information, your best options are, in general:
 1. a recent review article in a refereed journal
 - this should survey the whole field, at an advanced level, and it has been quality checked
 2. recent research papers in refereed journals
 - these are the primary sources of scientific results, and they have been quality checked
 3. papers from recent high-status conferences
 - these will give more recent results, but are less reliable
 4. advanced textbooks or monographs from reliable publishers
 - these may be easier to understand, but are likely to be less up-to-date (book production takes time)

Web pages

- The use of web pages as information sources is **usually a bad idea**
 - the web is not peer reviewed or policed—anyone can post anything about anything
 - it may be quite difficult to distinguish nutcases from reputable commentators
 - web pages change without notice, and sometimes vanish altogether
 - it does not aid your credibility if one of your references does not say what you claim it says, or returns 404 Page Not Found!
- However, there are some professional databases maintained on the web
 - e.g. Encyclopaedia of Extrasolar Planets, NASA Extragalactic Database, Particle Data Group, NuFIT
 - if in doubt, consult appropriate member of staff

Why refereed journals?



Usually this process converges after one or two cycles. If it doesn't, or criticisms are too serious, paper is rejected

If a paper appears in a refereed journal, a knowledgeable person has read and approved it. It could still be wrong, but it's unlikely to be obviously wrong.

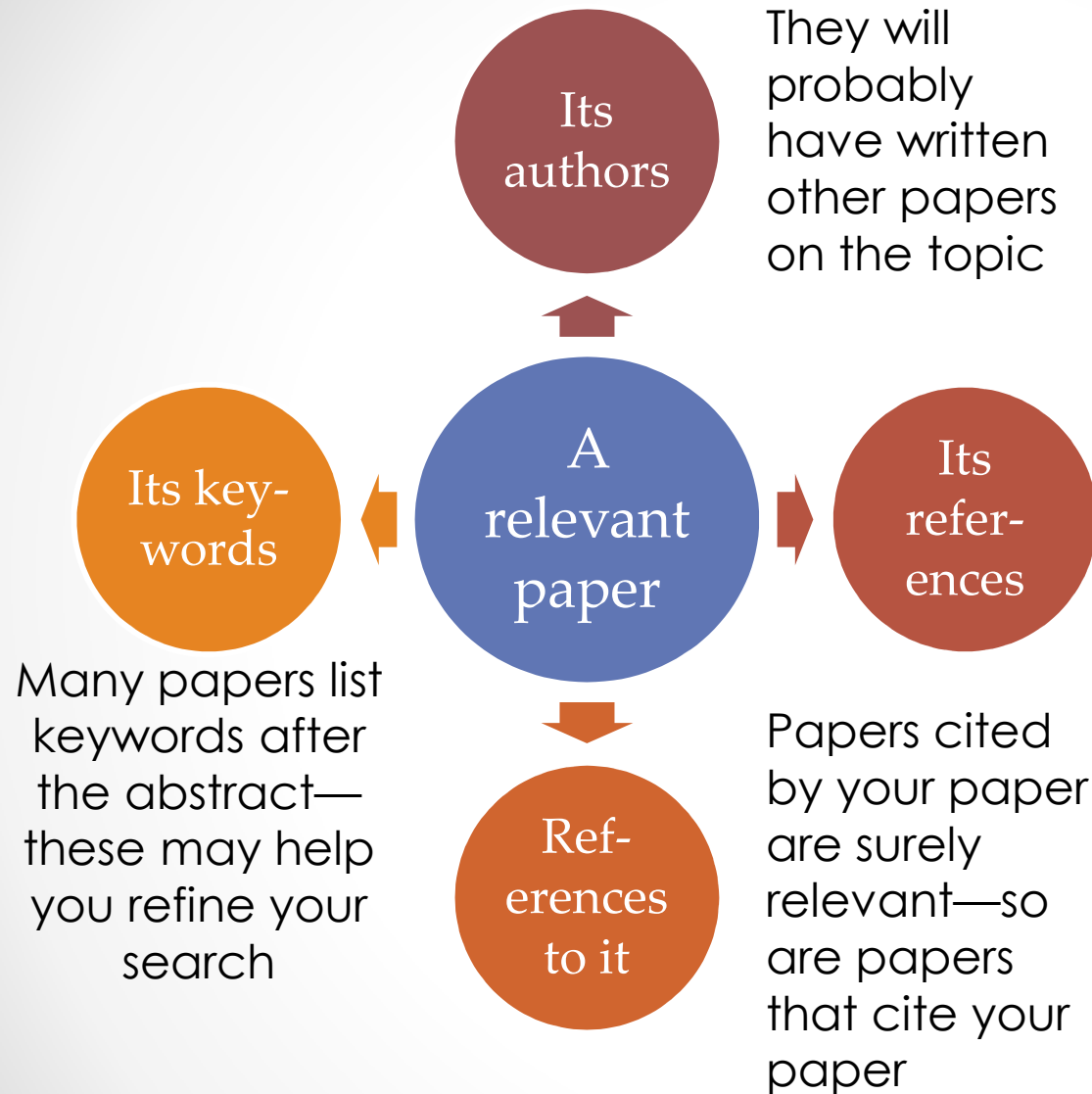
Refereed Journals

- There are many refereed journals in physics and astrophysics
 - Physics examples:
 - Physical Review, Physics Letters, European Journal of Physics, Journal of Physics, JHEP, Nuclear Physics, Journal of Instrumentation, Nuclear Instruments and Methods, ...
 - Astronomy examples:
 - Astrophysical Journal, Astronomical Journal, Astronomy & Astrophysics, Monthly Notices of the Royal Astronomical Society, ...
 - General (and very prestigious)
 - Nature (many sub-journals, e.g. Nature Physics), Science
 - Specifically focused on review articles
 - Annual Review (many species), Reviews of Modern Physics, Physics Reports
- Most of these are accessible online via the library

Finding relevant papers

- This does vary by area
 - astronomers have **adsabs** (adsabs.harvard.edu), an extremely complete searchable database
 - adsabs indexes physics journals too, but I'm not sure how complete its physics index is (I do know it's good for particle physics)
 - astronomers and particle physicists generally submit new papers to the **arXiv** eprint repository (arxiv.org)
 - note that when submitted, arXiv papers have **not** been peer-reviewed
 - good arXiv papers that are more than a few months old should have been published (published reference should be on the arXiv abstract page, but many authors forget to update)
- There are general tools, such as **Web of Science**

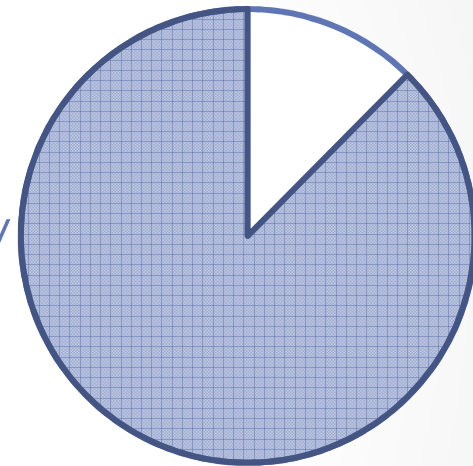
Build up from what you have



Once you have found one paper that is clearly relevant, you can use it as a starting point for further searches

Completeness

- You need to be sure that you have covered the topic completely
 - For a given length of report, shallower but more complete coverage is usually preferable to more detailed but patchy coverage
- Partial coverage may misrepresent the field
 - e.g. a literature review on dark matter covering only axions, not WIMPs (or vice versa!)
- If you know you are presenting only one aspect, **say so**



- **Read review articles**

- review articles are supposed to survey the whole field—that's their job

- Several journals are devoted to review articles (*Annual Review of ...*, *Physics Reports*, etc.)
 - Others have occasional review articles, e.g. *Nature*

- **Use keyword or title searches**

- author-based searches may give you a biased view

How to judge completeness

Providing a balanced view of the field is an important skill.

'Balance' does *not* imply equal space for all opinions—emphasis should reflect degree of acceptance in field

Making sure you're up to date

- Many research fields move very quickly
 - a review of neutrino oscillations from 2010 would be completely outdated now, as would a review of extrasolar planets from 2012
- Therefore, if any of your sources is >3 years old, check that the information is still current
 - do author searches in online databases, to see if the same team has updated its results
 - do keyword/title searches restricted to last few years
 - for groups that maintain websites (most particle physics experiments, NASA/ESA missions, etc.), check the “Publications” page (there will be one!)
- Health Warning: very new results may also be wrong!

Citing your sources

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When to cite

What to cite

How to cite

Tools

When do I need a reference?

- If the information you are communicating is not your own original work, you need a reference to your source
 - the source should be cited **at the point where it is used** (not at the end of the paragraph, for example)
 - this makes it clear what the source is being cited *for*
 - sources of figures should be cited **in the figure caption** (not just in the text)
 - you should recognise that many people will go straight to the pictures, before/instead of reading the text!
- Most students under-reference
 - so if you think you *might* need a reference, you almost certainly *do* need one!

From S Das et al., *Ann Rev Mat Res* **45**
(2015) 1-27:

Richard P. Feynman inspired generations of scientists to explore “the bottom” during his lecture “There's Plenty of Room at the Bottom” **(1)**. With his questions, “What could we do with layered structures with just the right layers? What would the properties of materials be if we could really arrange the atoms the way we want them?”, Feynman motivated researchers like Frindt to isolate few-layer MoS₂ by using the Scotch tape method **(2, 3)** as well as chemical routes involving the intercalation of Li ions between MoS₂ layers **(4)**. Ultimately, Novoselov, Geim, and colleagues first demonstrated that it was indeed possible to isolate and measure electronic transport on individual layers of *sp*²-hybridized carbon (now known as graphene) **(5)**.

An example of referencing

1. Feynman RP. 1959. There's plenty of room at the bottom. *Caltech Eng. Sci.* **23**(5):22–36
2. Frindt R. 1965. Optical absorption of a few unit-cell layers of MoS₂. *Phys. Rev.* **140**:A536
3. Frindt R. 1966. Single crystals of MoS₂ several molecular layers thick. *J. Appl. Phys.* **37**:1928–29
4. Joensen P, Frindt R, Morrison SR. 1986. Single-layer MoS₂. *Mater. Res. Bull.* **21**:457–61
5. Novoselov KS, Geim AK, Morozov S, Jiang D, Zhang Y, et al. 2004. Electric field effect in atomically thin carbon films. *Science* **306**:666–69

This 27-page paper has a total of 155 references.

What should I reference?

- Ideally, the information being referenced should be the **main topic** of the cited paper
 - if the information you are interested in is only a passing aside in the paper, there is almost certainly a better reference for it (try the reference that the first paper cites!)
- The cited paper should normally be the **original source** of the information
 - though sometimes you may be citing a review article which has collected together information from many papers
- **You should have read the source you cite**
 - **do not copy references from other people without reading them yourself**
 - if you can't find the original, make it clear that you are using second-hand information ("Bloggs, J, as quoted in Smith, A")

- The refereed journal article that is the original source of the information
 - or the refereed review article that provided the compilation
- Except for:
 - very new results
 - arXiv preprint or conference paper
 - standard derivations
 - textbook
 - images from web pages
 - web URL plus any figure credit given
 - “official” web databases

What should I reference?

Referencing the original source both gives credit where it's due and minimises the risk of misrepresenting the result (you are not relying on someone else's interpretation).

How should I reference?

- In the text:
 - two standard styles: Harvard (Author, year) and numeric [1]
 - see library information skills tutorials:
 - www.librarydevelopment.group.shef.ac.uk/referencing.html
- In the reference list:
 - the key point is that you must give all the information needed for your reader to find your source
 - journal papers: author(s) (or first author et al. for >3), journal name (usually abbreviated), volume number and year, page or article ID
 - title of paper not actually needed though often given
 - books: author(s) (+ editor(s) if a compilation), title, year and publisher, chapter or page(s)
 - arXiv preprints: author(s), arXiv preprint number and category, year [implicit in arXiv number, but given anyway]
 - **only cite the arXiv preprint if it has not been published (yet)**
 - websites: author (if identifiable), full URL, date accessed

Some referencing tips

- If you use the same source multiple times, you simply reuse the citation
 - do not “pad out” your reference list with 17 references to the same paper!
- For long author lists (>3 or 4 names), use First Author et al. (short for *et alii*, “and others”)
- For repeated citations, e.g. to different chapters of a book, use *ibid.* (*ibidem*, “the same”) or *op. cit.* (*opere citato*, “in the work [already] cited”)
 - *ibid.* if the citation is to the immediately preceding reference, *op. cit.* if it's to a reference higher up the list

Remember:
referencing a
source entitles you
to use the
information, not the
words. If you
paraphrase a
referenced source
too closely, you are
still plagiarising.

Referencing Tools

- There are tools that make referencing easier
 - Microsoft EndNote (on university computers)
 - BibTeX for LaTeX (free)
- You enter the information (author, journal, etc.) and the package formats it for you
 - many databases will automatically export reference in BibTeX and/or EndNote format
- LaTeX supports symbolic referencing
 - you cite the reference by a name you define, and when the file is processed this will be replaced by a number
 - very handy when you want to add/delete/rearrange references
- Word also has a reference manager (menu item on the References tab)
 - I've never used it, don't know how good it is

Putting it all together

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Assimilate

Analyse

Synthesise

Writing a literature review

- Your literature review should **not** consist of a series of summaries of papers strung together
- **Assimilate** the information
 - you need to understand what the paper says and what it means, or you won't be able to report it effectively
 - if you don't understand it, take a step back—try doing some background reading, e.g. in a textbook or lecture notes
- **Analyse** and **evaluate**
 - Do your sources agree? If not, why not—are there discordant results, or just differences in theoretical interpretation? Is there a mainstream position—i.e. is one set of results or opinions much more widely accepted than the other? If so, why?
- **Synthesise**
 - your final report should be a balanced account of the whole picture, taking into account the body of expert opinion

Worth consulting

- Library information skills tutorials:
 - https://librarydevelopment.group.shef.ac.uk/shef-only/info_skills/plagiarism.html
 - especially slides 8 and 10-15
 - referencing
 - http://www.librarydevelopment.group.shef.ac.uk/shef-only/referencing/physics_AIP.html
 - numeric style
 - http://www.librarydevelopment.group.shef.ac.uk/shef-only/referencing/physics_harvard.html
 - Harvard style
 - <http://www.librarydevelopment.group.shef.ac.uk/isr.html>
 - various tutorials on finding and using information
 - especially “successful database searching” and “database tutorials” (for Web of Science)