Much ado about scientific papers

What kinds of scientific writing are there?

- All kinds, of course.
- Popular science writing (newspapers, magazines, popular websites, …)
  - Audience is not knowledgeable to any significant extent in the particular area, often not in science at all.
  - Purpose is general interest
  - Details are few and often wrong
  - Rigor is approximately zero
- Journal articles
  - Original research reports
  - Scientists reporting on original (= brand new, no one has done this before) work they have done
  - Usually very narrow topic/single result
  - Usually written for people very well versed in a sub-discipline
  - This is the primary way results are communicated among most scientists
  - Peer reviewed
- Review articles
  - Expert in a field providing an overview of the current state of the field/topic
  - Broad
  - Often written for scientists in same discipline, but maybe not the same sub field (=slightly more general)
- Many more (books, textbooks, ….)

Why should you read a journal article?

- If you are working in a field, it's how you get relevant, rigorous, up-to-date info on what folks in the field are doing
  - Understanding
  - Idea generation– "hmm…I wonder what would happen if I did x instead of y…"
  - Improvement—I can make that measurement much better than they did using my technique
  - Correction—scientific knowledge is conditional. We expect folks to be honest and clear, but people make mistakes and corrections need to be made/results confirmed/checked

How to read a journal article?

- Who here has read a journal article on original research? Was it easy going?
- Often highly specialized/technical
- Often dense (page charges…)
- Often written poorly (various historical/human failing related reasons)
- Still, some simple steps will help immensely

Journal Article structure

- Many journal articles follow a fairly similar structure—this can help you read them
- Here's a paper—don't read it, just look at it.
- What do you notice first?
- What makes up the paper?
- What fraction of paper is figures/tables/graphs?
- What's the last part of the paper?
- What's the second last thing?

- https://www.lib.purdue.edu/help/tutorials/scientific-paper

General recipe

- Read abstract first
- Conclusions/summary second
- Figures/graphs (w. captions third)
- Introduction
- Methods/details **last**

- Will you be able to understand every paper you pick up using that approach? ‘Course not
- Unless you are an expert in the field, there will always be some paper you just won’t have the background to read.
- Happens to us all the time:

New Kaluza-Klein instantons and the decay of AdS vacua

Hirosi Ooguri and Lev Spodyneiko

Phys. Rev. D 96, 026016 (2017) – Published 19 July 2017

By performing clever manipulations of complicated equations of motion, the authors obtain new instanton solutions of eleven-dimensional supergravity. These results support a previously proposed conjecture that all non-supersymmetric anti-de-Sitter (AdS) vacua must be unstable.

On the other hand:

- **Detection of High-Energy Gamma Rays from Winter Thunderclouds**
- **H. Tsuchiya, T. Enoto, S. Yamada, T. Yuasa, M. Kawaharada, T. Kitaguchi, M. Kokubun, H. Kato, M. Okano, S. Nakamura, and K. Makishima**
- **Phys. Rev. Lett. 99, 165002 – Published 17 October 2007**

A report is made on a comprehensive observation of a burstlike γ-ray emission from thunderclouds on the Sea of Japan, during strong thunderstorms on 6 January 2007. The detected emission, lasting for ∼40 sec, preceded cloud-to-ground lightning discharges. The burst spectrum, extending to 10 MeV, can be interpreted as consisting of bremsstrahlung photons originating from relativistic electrons. This ground-based observation provides the first clear evidence that strong electric fields in thunderclouds can continuously accelerate electrons beyond 10 MeV prior to lightning discharges.

Should you start out with such a journal article?

- Probably not in general, but you should always follow the trail back to the original research that you find out about in other sources.