Tools for Reading Papers, Part 3

by Michael Hammer | Sep 6, 2018 | Career Navigation, Guides | 0 comments

Part 1 — Part 2 — Part 3

This post is the third in a three-part series on reading scientific papers in astronomy.

The last post in this series will focus on two types of papers — review articles and classic papers — that are helpful for learning more about a research topic, which in turn can help you understand everyday papers posted on arXiv. We will also go over how to extract equations and plot data from papers, as well as one way to explore more papers in general.

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(7) Review Articles

While reading a paper, have you ever thought: "I wish I knew more about the background of this topic?" The immediate solution to that dilemma is to read the introduction of the paper. However, introductions are only meant to provide a brief overview of the topic in the specific context of the paper itself.

A more in-depth solution is to look for a review article in that sub-field. Review articles go over the background of a topic in great detail. They discuss the fundamental ideas and also reference all of the original classic papers that are relevant to the topic (see the next section below). Additionally, they often focus on the latest developments in that research field. As a result, review articles offer a chance to see not just someone else's summary of that first paper you were reading on the topic, but also competitive studies. These other studies may take a similar approach or an entirely different approach to tackling that research question.

Many review articles are found in the journal *Annual Review of Astronomy and Astrophysics* (or ARA&A for short). They are typically very long (> 20 pages), but often divided into around ten chapters. If you are totally unfamiliar with the topic, start at the beginning with the introduction. If you are already familiar with the topic and want to see a specific topic or paper discussed, look through the table of contents for mentions of that topic or search the article for mentions of papers by that same author.

We have covered a review article on Astrobites once before, where the topic was protoplanetary disks. Here are some examples of more recent review articles on (A) the formation of gas giant planets, (B) the formation of rocky planets, (C) planet migration, (D) galaxy formation, (E) the circumgalactic medium, and (F) magnetars.

If you want to look for reviews on other topics, the new ADS Bumblebee is better tailored to search for review articles directly from the search bar. For example, if you want to search for

when applying for the NSF Graduate Research Fellowship as an undergraduate or a new graduate student, if you do not know much about your field yet.

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(8) Classic Papers

Have you ever felt like you "can't see the forest for the trees" when reading a paper? Classic papers are a great solution to preventing yourself from getting lost in the minutia of a paper. These papers are the original papers in a field. They may have made an important discovery or derived an important result that is used ubiquitously in research today.

Classic papers may "not be that good" in the sense that you cannot do everything well the first time, especially with exploring fine details. However, they do take you back to the beginning, and give you a sense of how something was figured out in the context of how little was known about the subject at the time.

Figure 1. Here are some trees. Do you see the forest too? *Source: Solutions21*.

It can be difficult to identify which papers are the classics when you are first exploring a new research field. They may be recognizable from having hundreds or even thousands of citations. A more direct way to look for classic papers is to find references to them in the introductions of review articles. You can also ask your research advisor for recommendations, as they will probably be familiar with the most important papers in their field.

We have covered a few dozen classic papers here on Astrobites. In these bites, you can explore (A) the strongest evidence for dark matter, (B) the birth of gamma-ray astronomy, (C) the first pulsar and the first binary pulsar, (D) why dust cannot just grow into planets, and (E) the prediction of volcanoes on Jupiter's moon Io, among many other topics.

(9a) Scavenger Tools: SciWeavers / LaTeXiT

Have you ever seen an equation in a paper and thought, "I want to use this equation in picture form in my presentation, but it will not look good if I just screenshot it?" The SciWeavers Latex

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Our Sister Sites
Astrobitos (Astrobites in Spanish)
staryab (Farsi)
Oceanbites
Particlebites
Evobites
Envirobites
Softbites
Chembites
BiteScis (K12)
PERbites (Physics Education Research)
OncoBites (Cancer)
ImmunoBites

More Astronomy
AAS
astro-ph
voxcharta
arXiver
AstroBetter
APOD

LaTeX here.)

Besides changing the colors, you can also abbreviate the equation or simplify it into a proportionality relation to make it easier to follow in a presentation (see Figure 2). (Tip: Don't include complicated equations in presentations!)

In addition to SciWeavers, the software LaTeXiT has similar functionality and also works offline.

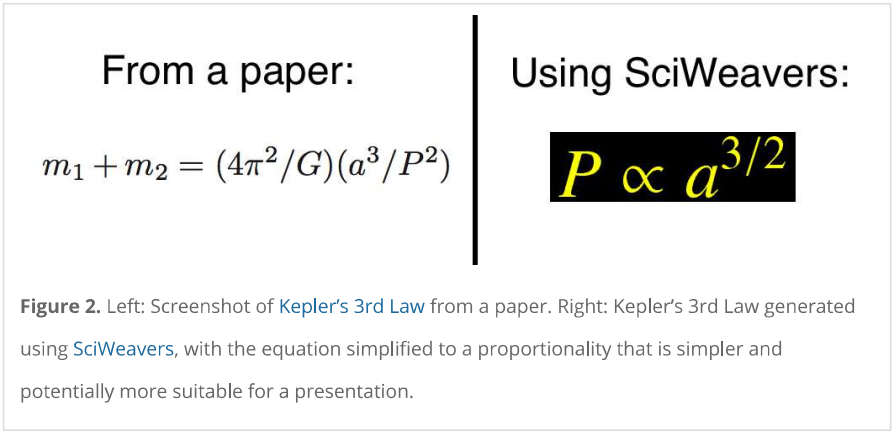

Figure 2. Left: Screenshot of Kepler's 3rd Law from a paper. Right: Kepler's 3rd Law generated using SciWeavers, with the equation simplified to a proportionality that is simpler and potentially more suitable for a presentation.

(9b) Scavenger Tools: Web Plot Digitizer

Have you even seen a plot and thought "This is a useful plot, but I need to know the exact values of specific data points" when reading a paper related to your own research? The Web Plot Digitizer (applet) lets you extract values from a plot. All you need to do is specify two data points on each of the 'x' and 'y' axes for reference. There is also an option for using logarithmic axes.

This tool can also be used to re-make an entire plot. The "Add Point" option (see Figure 3) lets you mark any points you want on the plot. Afterwards, you can save the data (under "View Data") and load it into your favorite plotting software (such as matplotlib in Python).

An alternative way to find the data used to generate a plot is to check on ADS if that data is supplied with the paper. You can also contact the authors of the paper and ask them to lend you the raw data.

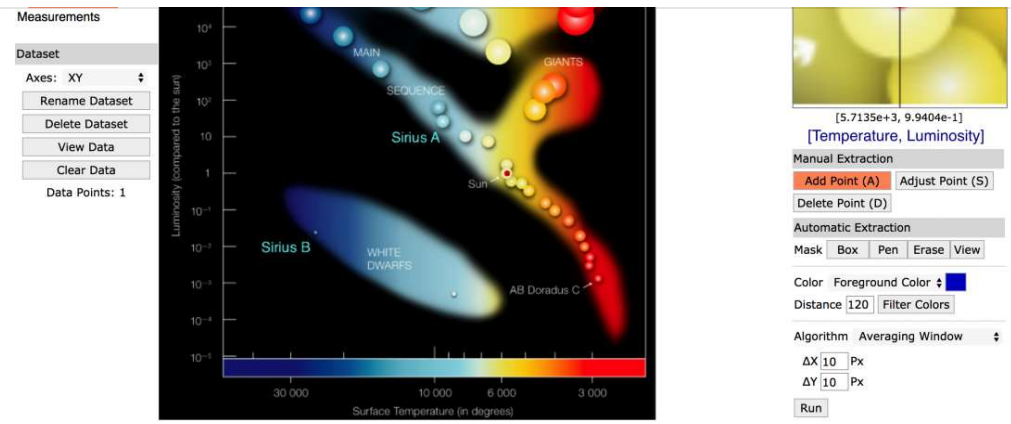

Figure 3. Web Plot Digitizer example. Using this tool, we can tell the Sun has a temperature of about 5700 K, and a luminosity of 0.994 solar luminosities (close enough), even though the Sun doesn't align with the ticks on the temperature axis. *Source: ESO. Full-size diagram: here.*

(10) Astrobites

Have you ever thought "I wish I could read more papers" when seeing the vast number of papers published each day? One solution to this problem is to read only the abstracts of papers. Or better yet, Astrobites is the best tool available for getting exposure to more papers and more research fields! (Disclosure: The author of this post is a writer for Astrobites.)

Astrobites publishes five new posts each week, often summaries of recent research papers in different fields. With each Astrobite, you get a summary of the entire paper – including the key points, the background, and the most important figures. You can also choose to delve deeper into any particular post by clicking on the links within the bite, or reading the related posts. After reading a bite, you can even click on the link to the paper itself and explore it with more familiarity.

Attending paper discussions (such as those described in Part 2 of this series) is another great way to gain exposure to different research fields.

From reading this series, you should now know how to find recent research papers and papers in general (Part 1), where you can participate in discussions of research papers (Part 2), as well as how to learn more about the background of a paper (Part 3). On top of that, you should also know to read Astrobites :-).

Do you have any other useful tips for reading papers? Post them in the comments!

About the Author

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I am a 3rd-year graduate student at the University of Arizona, where I am working with Kaitlin Kratter on simulating planets, vortices, and other

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