

# Reading scientific papers

ASTR 2910 ★ Week 3

# Types of papers

**Research article:** A paper that presents original research, including methods, analysis, and conclusions.

- Reputable journals in astronomy: ApJ, A&A, MNRAS, Nature
- Special formats: letters, research notes, books
- Tend to follow a common structure

**Review article:** Longer work that provides an overview of a broader topic or field, summarizing and synthesizing important results.

- Main journal: Annual Reviews of Astronomy and Astrophysics (ARAA)
- Meant to be accessible to a non-expert astronomer (e.g. term definitions)

Activity:

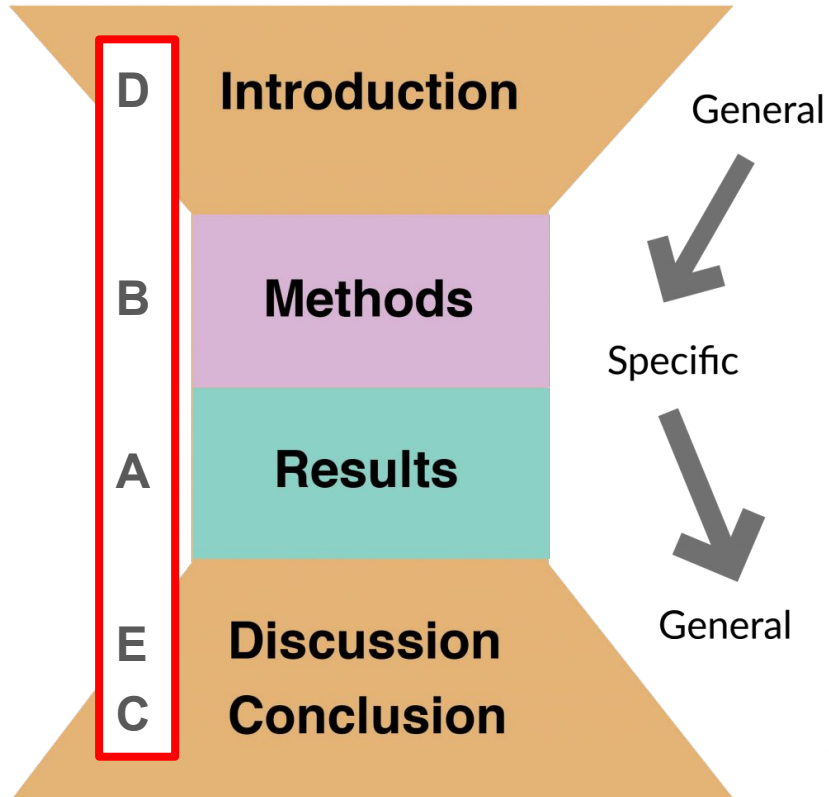
What does each part of an  
astronomy research paper do?

# Reading questions

*Look for answers to these questions in the text – interpret, but **don't guess!***

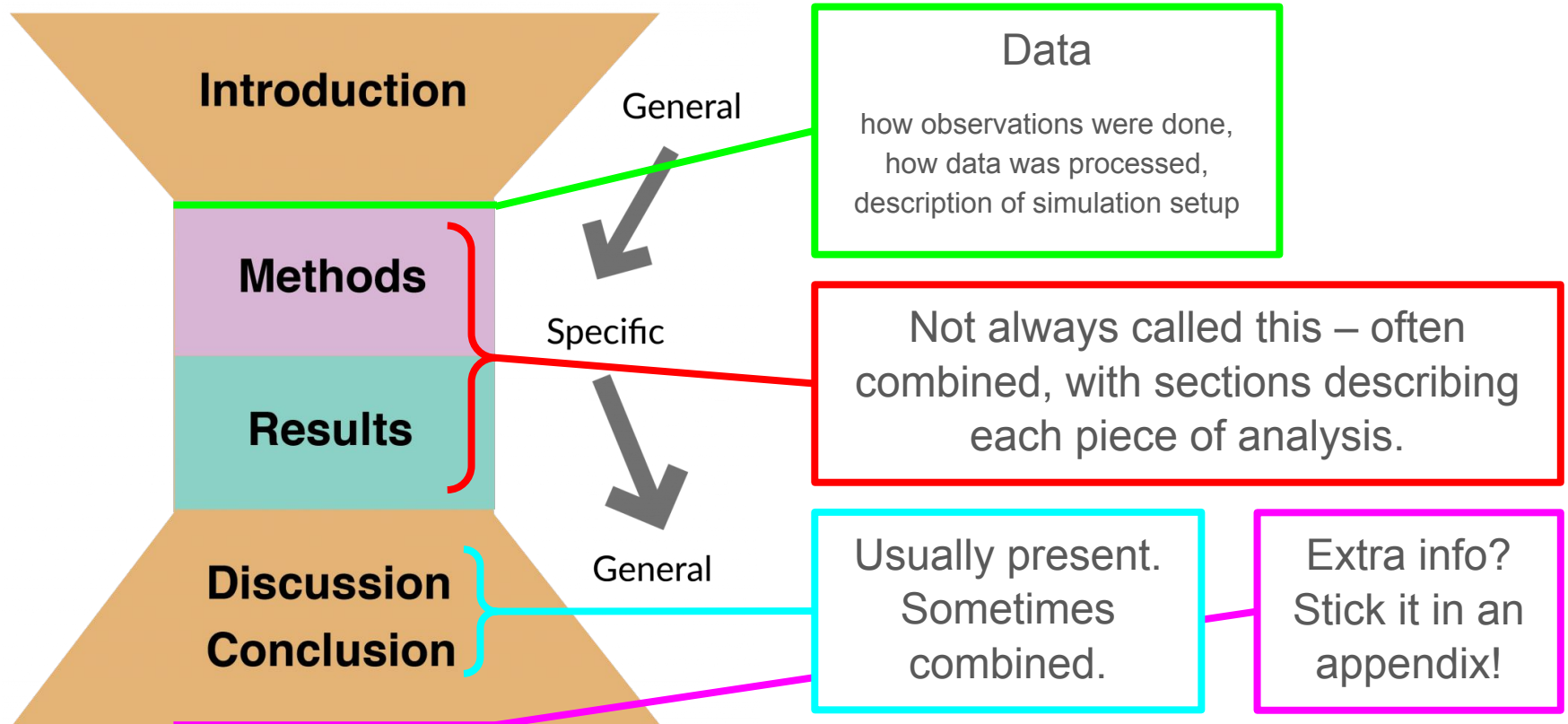
1. Why did the authors do this study?
2. How did the authors do this study?
  - a. What data did they use and where did it come from?
  - b. What analysis techniques did they use on the data?
3. What results emerged from the study?
4. How do the results fit into the context of other, similar studies?
5. What future work could be done to expand on this study?
6. What is the significance of the results?

# Research paper sections



Can you guess what letter from the in-class activity corresponds to each section?

# Research paper sections



# Abstract

## Summary – NOT a teaser!

### DETECTION OF PLANETARY TRANSITS ACROSS A SUN-LIKE STAR

DAVID CHARBONNEAU,<sup>1,2</sup> TIMOTHY M. BROWN,<sup>2</sup> DAVID W. LATHAM,<sup>1</sup> AND MICHEL MAYOR<sup>3</sup>

*Received 1999 November 19; accepted 1999 November 23; published 1999 December 16*

### ABSTRACT

We report high-precision, high-cadence photometric measurements of the star HD 209458, which is known from radial velocity measurements to have a planetary-mass companion in a close orbit. We detect two separate transit events at times that are consistent with the radial velocity measurements. In both cases, the detailed shape of the transit curve due to both the limb darkening of the star and the finite size of the planet is clearly evident. Assuming stellar parameters of  $1.1 R_{\odot}$  and  $1.1 M_{\odot}$ , we find that the data are best interpreted as a gas giant with a radius of  $1.27 \pm 0.02 R_{\text{Jup}}$  in an orbit with an inclination of  $87^{\circ}.1 \pm 0^{\circ}.2$ . We present values for the planetary surface gravity, escape velocity, and average density and discuss the numerous observations that are warranted now that a planet is known to transit the disk of its parent star.

*Subject headings:* binaries: eclipsing — planetary systems — stars: individual (HD 209458) — techniques: photometric — techniques: radial velocities

# Reading strategically

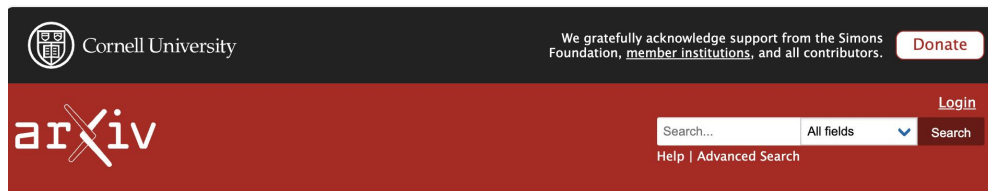
1. Always start with the abstract. Decide if the paper is worth your time
2. No background in this subfield? Read the introduction. (Can skip otherwise)
3. Scroll through the figures and read captions, trying to understand each one
4. If you didn't understand the figures, read the Results
5. Read the conclusion
6. Try to summarize the paper in a couple of sentences

**General strategies:** take notes/highlight, use apps like Zotero to stay organized, and don't sweat the small stuff!



# Review papers

# How to find astronomy papers



arXiv is a free distribution service and an open-access archive for nearly 2.4 million scholarly articles in the fields of physics, mathematics, computer science, quantitative biology, quantitative finance, statistics, electrical engineering and systems science, and economics. Materials on this site are not peer-reviewed by arXiv.

## Subject search and browse:

Physics

## Physics

- Astrophysics (**astro-ph** [new](#), [recent](#), [search](#)) Astrophysics of Galaxies; Cosmology and Nongalactic Astrophysics; Earth and Planetary Astrophysics; High Energy Astrophysical Phenomena; Instrumentation and Methods for Astrophysics; Solar and Stellar Astrophysics
- Condensed Matter (**cond-mat** [new](#), [recent](#), [search](#)) Disordered Systems and Neural Networks; Materials Science; Mesoscale and Nanoscale Physics; Other Condensed Matter; Quantum Gases; Soft Condensed Matter; Statistical Mechanics; Strongly Correlated Electrons; Superconductivity
- General Relativity and Quantum Cosmology (**gr-qc** [new](#), [recent](#), [search](#))
- High Energy Physics – Experiment (**hep-ex** [new](#), [recent](#), [search](#))
- High Energy Physics – Lattice (**hep-lat** [new](#), [recent](#), [search](#))
- High Energy Physics – Phenomenology (**hep-ph** [new](#), [recent](#), [search](#))
- High Energy Physics – Theory (**hep-th** [new](#), [recent](#), [search](#))
- Mathematical Physics (**math-ph** [new](#), [recent](#), [search](#))
- Nonlinear Sciences (**nlin** [new](#), [recent](#), [search](#))  
includes: Adaptation and Self-Organizing Systems; Cellular Automata and Lattice Gases; Chaotic Dynamics; Exactly Solvable and Integrable Systems; Pattern Formation and Solitons
- Nuclear Experiment (**nucl-ex** [new](#), [recent](#), [search](#))
- Nuclear Theory (**nucl-th** [new](#), [recent](#), [search](#))
- Physics (**physics** [new](#), [recent](#), [search](#))  
includes: Accelerator Physics; Applied Physics; Atmospheric and Oceanic Physics; Atomic and Molecular Clusters; Atomic Physics; Biological Physics; Chemical Physics; Classical Physics; Computational Physics; Data Analysis, Statistics and Probability; Fluid Dynamics; General Physics; Geophysics; History and Philosophy of Physics; Instrumentation and Detectors; Medical Physics; Optics; Physics and Society; Physics Education; Plasma Physics; Popular Physics; Space Physics
- Quantum Physics (**quant-ph** [new](#), [recent](#), [search](#))

arXiv

<https://arxiv.org/>

- Preprint server for many fields (including astro)
- Uploaded by authors
  - Often uploaded before peer review/publication
  - Not all papers uploaded are published
- Used as a “daily digest” for new research

# How to find astronomy papers

ads

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astrophysics data system

Classic Form Modern Form Paper Form

QUICK FIELD: Author First Author Abstract All Search Terms

Search examples

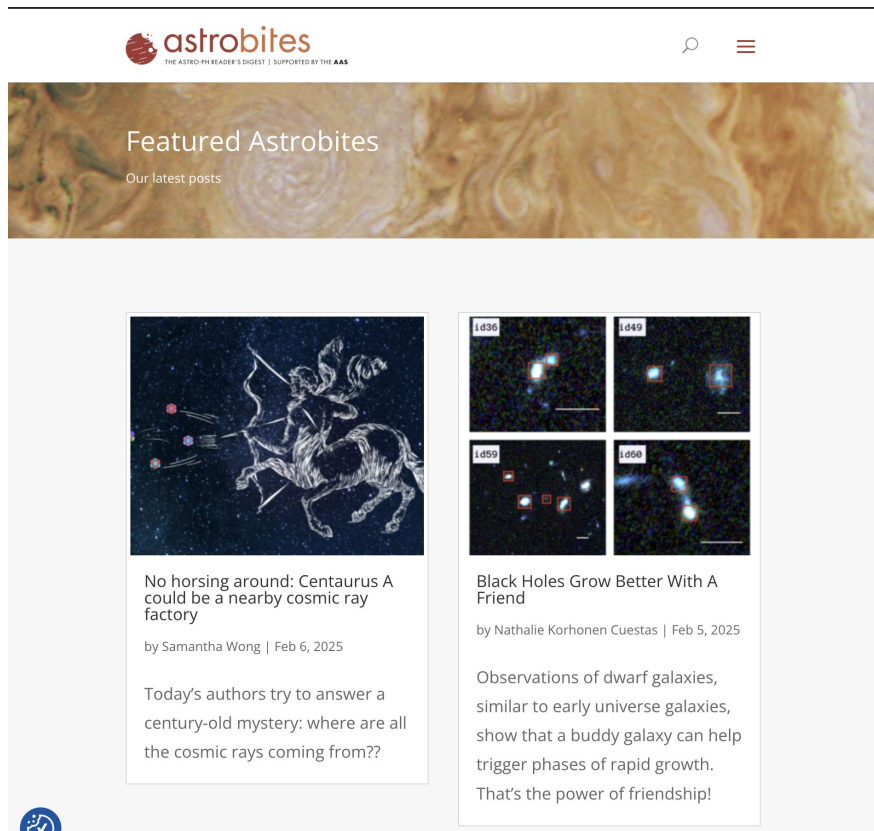
Recommendations	Search examples
author: "Miret-Roig, Núria"	refereed: property:refereed
first author: first_author: "Wizinowich, Peter"	astronomy: collection:astronomy
abstract + title: abs: "dark energy"	exact search: =body: "intracluster medium"
year: year: 2000	institution: inst: CfA
year range: year: 2000-2005	author count: author_count: [1 TO 10]
full text: full: "super Earth"	record type: doctype: software
publication: bibstem: ApJ	newly ingested: entdate: [NOW-7DAYS TO NOW]
citations: citations(abstr: JWST)	eprint: property: "eprint_openaccess"

NASA ADS

<https://ui.adsabs.harvard.edu/>

- Complete list of all astronomy papers published in basically any journal + everything on arXiv
- Also includes papers in related fields (physics)
- Archives old papers too! (Like Hubble 1929)
- Unique to astronomy

# How to find astronomy papers



Astrobites

<https://astrobites.org/>

- Graduate-student run blog posting daily summaries of new papers
- Content aimed at undergraduates
- Also a great option for exploring science communication when you're a grad student!