Every (astronomy) research paper has a similar layout:

Title

- This should be short, yet contain the major result
- Often this is the only part of your paper to be read (or scanned) by other scientists

Authors Names (Work addresses)

- Simple in theory, but the order matters a great deal.
- Typically the first Author has done the majority of the writing, and led the project (in astronomy)
- The second author also has helped significantly with the entire project
- The third author etc. will have often played an important role in one or two aspects of the project
- Make sure everyone's name is spelled correctly and all the usual middle initials are used.
- Make sure the affiliations are correct.

Abstract

- This is the most important part of the paper.
- No one reads a paper without first reading the abstract.
- Often only the abstract is read...
- It must be short (less than 250 words typically)
- But it must also tell the reader:
    - What was Done,
    - What Hypothesis was being investigated
    - What was in fact measured
    - What Hypothesis (or model) was supported by your measurements
    - Why this is important, and broader impact
- This is the hardest part of a paper to write, and should be done last.
- Read other abstracts from the journal you are writing for to get an idea of the structure, and check journal websites. (For instance, Nature abstracts have a fairly structured and specific format.)

Introduction

- This section should tell the reader the history of what other papers in this field have discovered
- for example,
    - The age and distance to your star cluster
    - The mass, age, and evolutionary state of your variable star
    - The nature of the extrasolar planet and star that you studied
- Be sure and check NASA ADS (or a paper service for your discipline) for any papers similar to yours or

    - on your object (do this before writing the paper!)
    - Also be sure to check the arXiv as well (astroph for astronomers)
- One should try read, understand and cite the major papers, especially the discovery papers (when relevant), that have led to the current understanding of the problem.
- The introduction should very clearly spell out what the problem is you are writing about, and why it is important.
- Overly long introductions should be avoided, but complete understanding of past papers should be presented.
- The last paragraph in the Introduction outlines how your paper is written, section by section.

Observations or Simulations

- This is the easiest section of the paper to write (since you have done this)
- For an observing paper,
    - Clearly state what was observed
    - Clearly note the telescope and/or instrument used. Cite the right paper for the instrument. Include any obligatory footnotes.
    - Summarize the specs of the telescope and instrument (size of CCD, size of FOV, etc.), note size of scope.
    - Note the weather conditions, UT date/times, moon phase, airmass, seeing, clouds, etc.
    - Include all details about the observations, (e.g., total integration times, calibrations, filters used, wavelength range, etc.)
- For a theory paper,
    - Clearly state what was modelled
    - If you used others' software, cite their papers, but also give a brief summary of what the software does
    - If you wrote your own software, give a very detailed description (including equations when necessary, and hopefully with a link to a repository where readers can download and use your code).
    - Summarize all of the models that you generated (e.g., number of particles, relevant physical size and time scales, etc.)
- Use a table to summarize the list of targets observed or models generated, with the relevant details
- Note any special techniques that you used to optimize your science

Data Reduction (or Special Analysis Software?)

- This section is mostly relevant to an observational paper, but in some theory papers one might make synthetic observations to compare directly with real observations. In that case the following can apply to those synthetic observations.
- This can be an easy section to write-up as well, if you have carried out the observations & calibrations.

- Be clear in how calibrations were used etc. to tell the reader how you removed the signatures of the telescope & instrument
- Describe any software that was used here (and give appropriate references).
- Clearly present your reduced data in some (or all) of the following:
    - In a table of photometry
    - A final reduced image of your target
    - A final spectrum (or time series)
- Always include a discussion on the errors and error analysis of your observations
- By the end of this section the "science" is ready to be extracted from your tables, and/or figures.

Analysis / Results

- This section is where you actually "extract" that science from your (reduced) data.
- For example,
    - from your table of B & V photometry you can plot a Color-Magnitude diagram (with errors)
    - Or from a timeseries you can create a power spectrum (with errors, and pick out significant periods)
    - Or fit your planet transit data, smooth your data? and give errors.
- For an observational paper, you may use someone else's theoretical models to fit the data and to derive difficult to measure quantities. For a theory paper, you may instead compare with observations to show how your theory can give you these quantities.
- There should be a careful discussion of errors (in particular systematic errors for observations) here as well.
- This section is normally where most of the plots and pretty figures will be placed. All of these should be referenced in the text and explained in detail. In most papers, we save the interpretation of these results for the next section.

Discussion

- In this section one should try to relate how the quantities measured above relate to the scientific questions you are trying to answer.
- Here you should be relating your work to the "big picture" presented in your introduction
- How do you interpret the results from your analysis? How do these results compare to other similar studies? What is new here?
- Why do your observations / models support one physical picture and not another?
- For example,
    - From a Color-Magnitude diagram, determine which stars are members, and size, age, and distance to the cluster

- From the significant periods found from a variable star, understand the interior structure of the star and compare your results to other published ones
- From the best fits of the transit model, determine the size of the planet in the system, and orbit

Future Observations / Simulations

- This section is optional (and could be included as a paragraph in either the Discussions or Conclusions section), but it helps point out where you see the field moving
- Note how your results could have been improved
- Outline how much more could be gleaned from a better approach, or bigger scope, etc.

Conclusions

- This section should written just before the abstract
- It should be longer and a bit more detailed than the abstract
- It should restate what your goals were (briefly)
- What observations you made (briefly)
- What your main measurements were (with error bars)
- What physical model (hypothesis) is supported (and/or not supported) by your measurements and analysis

Acknowledgment

- Here you thank all who helped make your paper possible (e.g., the telescope TAC and operators, the compute staff, other researchers who provided input but are not in the author list, etc.)
- Thank any funding sponsor (like NSF, NASA etc.), and include the proper grant number and any specific wording specified by the agency (important to check on this and get it right!)

References

- VERY important to cite references throughout the text (otherwise plagiarism!)
- Often easier to use bibtex, rather than typing out all references yourself
- Be as complete as possible.
- As also noted above, be sure and check NASA ADS and the arXiv (astroph) for any papers similar to yours or on your object (do this before writing the paper!)

See latex version on overleaf: https://www.overleaf.com/read/qkvwrwqgtbxb#/32586893/

Above was adapted from this website: http://exoplanet.as.arizona.edu/~lclose/a302/Lecture17/Lecture_17.html