

Writing a paper in astrophysics

Basic info
Journals
Structure
Collaborative writing

Why write papers?

- Publishing the results and the methods they are based on is absolutely crucial for a scientist.
- C. Darwin: 'A naturalist's life would be a happy one if he had only to observe and never to write.'
- The **number and quality of publications** is, in practice, the most important aspect which decides the career of a scientist (e.g., 'Publish or perish'.)
- Specifically for the MUNI's astrophysics PhD program, it is required to have at least one first-author publication for successful thesis defense.

Before starting to write

- Publications are what people see as the result of your scientific work.
- Clarity, form, attractiveness of the paper are very important. Think clearly what you want to communicate. What is the main message of the paper?
- Keep a 'lab notebook'. Keep a record of your work as you do it.
- Start thinking about writing a paper once you get 'final results'.

What kind of publication?

- Contents, format and style differ between:
 - **Regular journal paper** – presents original results, description of a new method, etc. (**refereed**)
 - **Letter to the editor** – shorter paper that requires rapid publication (**refereed**)
 - **Review paper** – summarizes and evaluates the results already published
 - **Proceedings paper** – usually preliminary results, usually short

Basic structure of a regular paper

- Most scientific papers have the same structure:
 - Title, author list, addresses, key words...
 - Introduction
 - Methods/calculations/observations/data reduction or mathematical derivations
 - Results
 - Discussion
 - Conclusions
 - Acknowledgements
 - References

The title

- The choice of an appropriate title is very important, as it often decides if the paper will even be opened
- The title should be attractive and not too long
- Should reflect the general field of the paper (e.g. should have a name of the object or object class in it) and be as precise as possible.
- Should not be too grandiose or promise too much. Should not use excessive jargon.

Authors & authorship

- Author -> anyone who (intellectually) contributed to the core of the paper. Such a person is both qualified and required to be on an author list.
- Choosing the authors and their order can be a delicate matter.
- Order is often decided as a progression with delivered labor & effort, but this varies in various fields.

Abstract

- Must be short & concise (about 5% of the length of the paper).
- Condensating the paper into few senteces. 1-2 sentences on context and aims (WHY?). Short description on what has been done (HOW?). Main results and conclusions (WHAT?).
- Structured abstracts
- no figures, tables, references, equations and symbols

White dwarfs/open clusters associations based on Gaia DR2

TITLE

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ABSTRACT

Context. Fundamental parameters and physical processes leading to the formation of white dwarfs (WDs) may be constrained and refined by discovering WDs in open clusters (OCs). Cluster membership can be utilized to establish precise distances, luminosities, ages and progenitor masses of such WDs.

Aims. We compile a list of probable WDs that are OC members in order to facilitate WD studies that are impractical or difficult to conduct for Galactic field WDs.

Methods. We use recent catalogs of WDs and OCs that are based on the second data release of the *Gaia* satellite mission (GDR2) to identify WDs that are OC members. This crossmatch is facilitated by the astrometric and photometric data contained in GDR2 and the derived catalogs. Assuming that most of the WD members are of the DA type, we estimate the WD masses, cooling ages, and progenitor masses.

Results. We have detected several new likely WD members and reassessed the membership of the literature WDs that have been previously associated with the studied OCs. Several of the recovered WDs fall into the recently reported discontinuity in the initial-final mass relation (IFMR) around $M_i \sim 2.0M_\odot$, which allows for tighter constraints on the IFMR in this regime.

Key words. open clusters and associations: general – white dwarfs – catalogs – surveys

1. Introduction

White dwarfs (WDs) are the evolutionary endpoint of low and intermediate-mass stars, which constitute a vast majority of all

2017). Aside from the IFMR, other possible avenues of research utilizing cluster WDs include studying the effects of metallicity and binarity on the WD evolution, or measuring the WD masses using gravitational redshift (Pasquini et al. 2019). Such studies

The introduction

- Describes the background and context of your work. Involves a short overview of the relevant literature.
- Outlines why the present work needs to be done. Why it is important.
- Describes the goals of your paper. If similar papers exist, what is new in the methods and results.
- citations...

The methods (or similar)

- Describes the instruments and data used. Can be broken down into multiple subsections, if needed.
- What you have done, how you have done it.
- Include dates when needed. Time & dates of observations, software tool versions etc.
- A table or a figure can be useful for method clarification.
- This section is crucial for paper acceptance.

The results

- Core of the paper, where the results of the research are presented and described.
- Identify the important and new results before writing the results section.
- More closer analysis of the results and comparisons with the literature should be left to the discussion section.
- Figures, tables, etc.

The discussion/conclusions

- The obtained results are discussed and compared with the previous works, put into perspective.
- We discuss the limitations of the study, possible sources of errors and bias and possible improvements.
- Main conclusions of the paper must stand out!
- Not straightforward to write.

Publication process



Making the paper available to the community

- Publication can take several months from initial submission. In order to spread research more quickly, scientists used to send 'pre-prints' to one another.
- now, preprint servers are common
- for astro papers, we use arXiv/astro-ph server
- papers that appear on arxiv are more likely to get cited than the ones that do not.

Collaborative writing

- Authorea, **Overleaf**, etc.
- Overleaf is a collaborative cloud-based LaTeX editor used for writing, editing and publishing scientific documents.
- Overleaf has various templates for many journals...