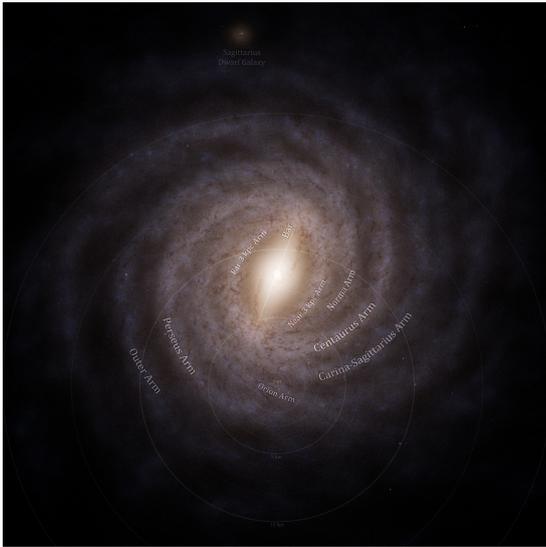




# Formation and evolution of Galactic stellar populations



## SUMMARY.

Understanding the formation and evolution of stellar populations in the Milky Way is fundamental to address some of the main open questions in contemporary astronomy: from the origin of the solar system to the physical processes driving the evolution of galaxies. In the last decade the field has been revolutionized by the *Gaia* space mission and several ground-based spectroscopic surveys. In this METEOR hosted at the Arcetri Observatory, we will review the properties of the Milky Way, with particular focus on its stellar populations and recent discoveries. We will introduce the student to the main galactic surveys and teach them how to mine a large catalogue and use this wealth of data to carry out a research project.

The figure on the left shows an artistic impression of the Milky Way based on data from the *Gaia* space mission (Credit: ESA/Gaia/DPAC, Stefan Payne-Wardenaar)

## — OBJECTIVES —

- The student will learn the main theories about the structure, the formation and the evolution of the Milky Way and its stellar populations (e.g., moving groups, star clusters, field stars) as well as the main open issues on this topic.
- The student will learn the properties of the main past and current stellar galactic survey (e.g., *Gaia*, *Gaia-ESO*, *APOGEE*, *4MOST*, *WEAVE*) and the main techniques for data mining.

## — INSTITUTE —

- INAF-Osservatorio Astrofisico di Arcetri
- [www.arcetri.inaf.it](http://www.arcetri.inaf.it)
- Largo E. Fermi, 50125, Firenze, Italy

## — THEORY —

by L. MAGRINI & G.G. SACCO

Theoretical lessons will be divided in two parts: In the first part, we will discuss structural properties of the Milky Way as well as the main theories about its formation and evolution. While in the second part, we will discuss the physical mechanisms regulating the formation, the evolution and dispersion of star clusters.

## — SURVEYS AND DATA MINING —

by G.G. SACCO

We will discuss in details the *Gaia* mission and its catalogue as well as recent and future ground based spectroscopic surveys. Then, we will describe the main techniques to retrieve data from public catalogue and analyse them.

## — APPLICATIONS —

by L. MAGRINI & G.G. SACCO

The supervisors will design a research project that will be carried out using data from the large galactic surveys and will allow the student to delve in one of the open issues in galactic astronomy discussed during the theory lessons.

## — MAIN PROGRESSION STEPS —

- Week 1-2: Lessons on Theory and bibliographic research.
- Week 3: Lessons on Surveys and data mining
- Week 4: Oral presentation and discussion of a research paper
- Week 5-8: Research project
- Week 9: Final exam with presentation of the research project

## — EVALUATION —

The evaluation will be divided in two steps. After the first four weeks the student will give an oral presentations based on one or more papers on the topics presented in the first weeks, while during the last weeks he or she

will prepare a presentation on the research project.

- Theory grade [30%]
  - Literature (70%): Oral exam on a research paper after the first four weeks
  - Research project (30%): Discussion of the research project in a broader scientific context
- Practice grade [30%]
  - Data mining (50%): Capability to select and retrieve data from archives of large surveys
  - Data analysis (50%): Data analysis capabilities
- Defense grade [40%]
  - Oral and slides quality
  - Context
  - Project / Personal work
  - Answers to questions

## — BIBLIOGRAPHY & RESOURCES —

- Sacco et al. 2023
- Magrini et al. 2023
- Gaia Archive
- The 4MOST spectrograph

## — CONTACT —

📧 Germano Sacco & Laura Magrini  
 ☎ 0390552752260  
 ✉ [germano.sacco@inaf.it](mailto:germano.sacco@inaf.it);  
[laura.magrini@inaf.it](mailto:laura.magrini@inaf.it)