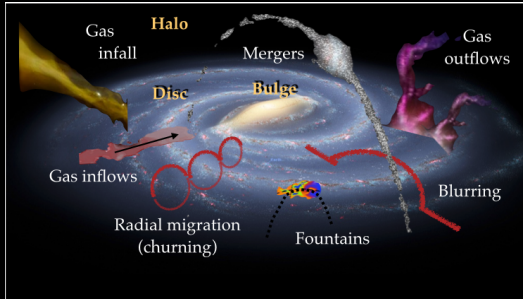


Galactic Archaeology and the Gaia mission



SUMMARY.

Galactic Archaeology consists in deciphering the Milky Way formation and evolution history through the study of its stars composing the different Galactic populations. Such studies are now possible on large scales thanks to devoted Galactic ground-based and space surveys, as the ESA Gaia mission, in particular those collecting huge numbers of stellar spectra.

OBJECTIVES

- The students will have a global view of the Milky Way formation and evolution history, thanks to lectures on Galactic stellar populations, in particular, Galactic dynamics and chemical evolution of the Milky Way. The main Galactic Archaeology surveys from the ground and space will also be described, together with their main results.
- Practical applications of Galactic data analysis will be performed by the students, focussing on those collected by the ESA Gaia mission .

PREREQUISITES

General Astrophysics - Stellar Physics and Evolution.

THEORY

by A. RECIO-BLANCO

Galactic Archaeology expects to reconstruct the history of the Milky Way by analysing stars, just as the history of life was deduced by examining rocks. Stars record their past in their ages, chemical compositions and kinematics and can provide unprecedented constraints on the early phases of galaxy formation back to redshifts greater than two (a look-back time of about 10 billion years). How did our galaxy form? What is its place and ours in the cosmic evolution? These

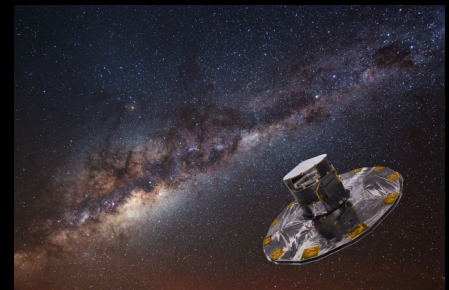
are part of the questions that this METEOR will present. We will also deeply discuss how these questions could be solved owing to the several on-going and planned spectroscopic surveys of the Milky Way, culminating in the Gaia mission, that are revolutionizing our knowledge about Galactic stellar populations.

The theoretical part will focus on the main tools available for Galactic Archaeology research and will be organised as follows: 1- Near field cosmology - Overview of the Milky Way as a spiral galaxy. Stellar populations and local environment. 2- Stellar evolution, nucleosynthesis and chemical yields. 3- Galactic chemical evolution. 4- Galactic dynamics. 5- Galactic Archaeology surveys from ground and space. 6- Origin and chemo-dynamical properties of Galactic populations as revealed by current surveys.

APPLICATIONS

by P. DE LAVERNY

Practical studies on the characterisation the Galactic disk stars based on very recent Gaia astrometric, photometric and spectroscopic data will be proposed to the students. The main topics covered will be: (i) Statistical analysis of large samples of stellar chemo-dynamical properties, (ii) Derivation of Galactic chemical gradients, metallicity distributions, ... and (iii) Constraints to Galactic disc formation models.



MAIN PROGRESSION STEPS

- First half: theoretical courses, bibliographic study, presentation of articles.
- Second half: Analysis of Gaia data and Preparation of the final oral presentation.

EVALUATION

- Written reports and oral presentations.

BIBLIOGRAPHY & RESSOURCES

The Milky Way, Combes & Lequeux, 2016
The origin of the Galaxy and Local Group, Bland-Hawthorn, Freeman & Matteucci, 2013, Springer

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