PHYS-465 **Astrophysics III : galaxy formation and evolution**

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Cursus	Sem.	Type
Ing.-phys	MA1, MA3	Opt.
Physicien	MA1, MA3	Opt.
Space technologies minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Oral
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

Galaxy formation & evolution is about studying how galaxies in our Universe come into existence, how they evolve and what shapes their properties. This course describes the observational facts of galaxies and the various processes of galaxy evolution as seen from theoretical/numerical models.

Content

- *Lecture 1 (Repetition of Astro-I and Astro-II)*:
  - Introduction (galaxy definition, astronomical scales, observable quantities)
  - Brief review on stars

- *Lecture 2*:
  - Radiation processes in galaxies and telescopes;
  - The Milky Way

- *Lecture 3*: The world of galaxies I
- *Lecture 4*:
  - The world of galaxies II;
  - Black holes and active galactic nuclei

- *Lecture 5:*
  - Galaxies and their environment;
  - High-redshift galaxies

- *Lecture 6*:
  - Cosmology in a nutshell
  - Linear structure formation in the early Universe

- *Lecture 7*:
  - Dark matter and the large-scale structure
  - Cosmological N-body simulations of dark matter

- *Lecture 8*: Populating dark matter halos with baryons:

    - Semi-empirical models
    - Semi-analytical models

- *Lecture 9:* Modelling the evolution of gas in galaxies: Hydrodynamics
- *Lecture 10*:
    - Gas cooling/heating
    - Star formation

- *Lecture 11*: Stellar feedback processes
- *Lecture 12*: Black hole growth and AGN feedback
- *Lecture 13*: Success and challenges of modern simulations
- *Lecture 14*: Future prospects and mock exam

Keywords

Astrophysics, Galaxies formation and evolution, Observations, Theoretical/numerical models of galaxies

Learning Prerequisites

Recommended courses

- Bachelor in physics or mathematics
- Astrophysics I, II (but there will be some revision)
- Basics in Python programming

Learning Outcomes

By the end of the course, the student must be able to:

- Theorize fundamental principles of galaxy formation and evolution
- Interpret observational results of galaxies
- Analyze observational data and theoretical/numerical simulations

Transversal skills

- Access and evaluate appropriate sources of information.

Teaching methods

Ex cathedra and exercices supervised in classroom.

Assessment methods

oral exam (100%).

Resources

Bibliography

- Extragalactic Astronomy and Cosmology (P. Schneider)
- Galaxy formation and evolution (Mo, van den Bosch & White)

- Galaxy formation (Longair)

Ressources en bibliothèque

- Galaxy formation and evolution / Mo, van den Bosch & White
- Extragalactic Astronomy and Cosmology / Schneider
- Galaxy formation /Longair

Moodle Link

- https://go.epfl.ch/PHYS-465