

# PHYS-730 Cosmology: Dark and Luminous Matters

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Cursus	Sem.	Type
Physics		Obl.

Language of teaching
Credits 4
Session
Exam Oral
Workload 120h
Hours 56
Courses 56
Number of positions

### **Frequency**

Every year

#### Remark

Every year / Fall and Spring

#### **Summary**

Two of the most important problems in modern astrophysics and cosmology are (i) galaxy formation and their evolution with time and (ii) the study of the distribution and the nature of dark matter and dark energy in the Universe.

#### Content

A) Gravitational Lensing as a Tool for Astrophysics and Cosmology

- 1. Phenomenology and history
- 2. Basic equations
- 3. Multiple images, Fermat's principle, magnification, time delays
- 4. Quasar lensing
- 5. Lensing by individual galaxies: dark matter and substructures
- 6. Microlensing by stars
- 7. Extragalactic microlensing
- 8. Microlensing searches for exoplanets
- 9. Lensing by galaxy clusters
- 10. Gravitational lensing as a natural telescope
- 11. Weak gravitational lensing: principles and applications
- 12. Weak gravitational lensing: detection and analysis methods
- 13. Weak lensing by large scale structures
- 14. Gravitational lensing and cosmology: a bright future
- B) Galaxy Evolution: Stellar Populations and Cosmology
  - 1. The different classes of galaxies and their components
  - 2. Evolution of morphologies
  - 3. Basic equations of chemical evolu-tion
  - 4. The star formation rate
  - 5. The initial mass function
  - 6. First stars
  - 7. The chemical abundances
  - 8. Integrated stellar populations
  - 9. Resolved stellar populations
  - 10. The first galaxies
  - 11. Stellar populations and dynamical models
  - 12. Popula-tion synthesis
  - 13. Chemo-dynamical simulations
  - 14. Large structures of the Universe

#### Note



slides and exercises

# Keywords

cosmology; astrophysics; galaxies; gravitational lensing; stellar population; dark matter

# **Learning Prerequisites**

Recommended courses master in astrophysics or physics

### Resources

### Websites

• http://lastro.epfl.ch