Course Title:	**Astroparticles and Cosmology**
Number of hours/semester:	60h, 1st Semester
Number of ECTS:	6
Lecture outline, contents:	This course provides an introduction to cosmology and astroparticle physics. The lectures and tutorials are organized into three parts. The principles of cosmology and high-energy astrophysics are covered in the first chapter. We provide a formal account of the expanding universe that includes the Friedmann-Lemaître-Robertson-Walker metric, cosmological parameters (with a phenomenological introduction to dark matter and dark energy), the Friedmann equations and their solutions. Particular emphasis is placed on the definition of redshift and cosmological distances. We then introduce the thermal history of the Universe up to the present day, and discuss cosmic energy densities associated with known states of matter and radiation. After examining the distribution of baryons in the local Universe, we give a general overview of the non-thermal astrophysical sources that populate the cosmic web and our galaxy. The second chapter addresses observables in cosmology and astroparticle physics. We discuss the classical cosmological probes (type Ia supernovae, baryonic acoustic oscillations, cosmic microwave background) that enable us to measure cosmological parameters and test the properties of dark matter and dark energy. We describe the other electromagnetic and hadronic backgrounds that populate the cosmos, and explore their origins (star formation, accretion, ejection). Particular emphasis is placed on the cosmic backgrounds at the highest energies (gamma rays, neutrinos, cosmic rays), and on the physical processes underlying their production (acceleration, transport, radiative processes). The final chapter offers openings on hot topics in

	astroparticle physics and cosmology: the growth of matter overdensities, primordial inflation, modified gravity theories, indirect searches for dark matter and signatures of physics beyond the Standard Model.
Pedagogical methods:	Lectures and tutorials
Prerequisites:	Astronomy 101. Special Relativity. Technical knowledge of General Relativity is not required to follow the lectures, but is recommended.
Modalities of knowledge assessment:	Written examination at mid-term and at the end of the semester for the first session. Oral examination for second session (second-session maximum grade is limited to 10/20).
Bibliography	1. Malcolm Longair, “High Energy Astrophysics”, Cambridge 2. James Rich, “Fundamentals of Cosmology”, Springer 3. Jean-Philippe Uzan & Patrick Peter, “Cosmologie primordiale”, Belin 4. John Peacock, “Cosmological Physics”, Cambridge