Especialidad: Astrofísica, Cosmología y Gravitación

Nombre del curso	**TOPICOS ESPECIALES EN ASTROFÍSICA, COSMOLOGÍA Y GRAVITACIÓN I ó II: COSMOLOGY, DARK ENERGY AND MODIFIED GRAVITY** Código USM: FIS487/FIS488 Código PUCV: FIS901/FIS902
Descripción del curso	This specialized course of cosmology covers advanced topics on the subject and the current problems of the Standard Model. It also provides various alternative models of the universe in an attempt to solve these problems.
	Asignatura de Tópicos Especiales – Astrofísica, Cosmología y Gravitación PREREQUISITOS: Relatividad General I o Cosmología I Créditos USM: 5 Créditos PUCV: 7 Horas Semanales Cátedra: 4 Horas Semanales Ayudantía: - Horas Semanales Laboratorio: -
Objetivos	The student will study the late accelerated expansion of the universe. He will be able to develop the arguments for and against the Standard Model. Through the course, the student will assimilate the recent progress made towards understanding the nature of dark energy.
Contenidos	1. Preliminaries • The cosmological principle • Olbers' Paradox • The Hubble-Lemaître expansion 1. The standard model • Friedmann equations • Cosmic inventory • Cosmic distances 3. Cosmological constant • History of the cosmological constant • The classical cosmological constant problem • The quantum-mechanical cosmological constant problem 4. Observational evidence of the accelerated expansion of the universe • The age of the Universe • Supernova observations

	• Cosmic Microwave Background • Baryon acoustic oscillations • Large-scale structure • Measuring the cosmological constant in the lab • Weinberg's no-go theorem 5. Extensions of General Relativity • Quintessence • K-essence • f(R) gravity • Scalar-tensor theories • Lanczos-Lovelock models of gravity • Braneworld models • Chern-Simons gravity • Lorentz-violating theories • Massive gravity • Bimetric • Galileons • Effective field theory as a unifying language 6. Effective field theory diagnostics • Ostrogradsky's theorem • Ghosts • Gradient instabilities • Tachyonic instabilities • Analyticity, locality and superluminality 7. Experimental tests • Laboratory and solar system tests • Astrophysical tests in the nearby universe • Cosmological tests
Modalidad de evaluación	The students will have homework assignments and a final presentation.
Bibliografía	**Básica** ▪ L. Amendola and S. Tsujikawa, "Dark Energy Theory and Observations" ▪ Review on the cosmological constant problem: http://arxiv.org/abs/1205.3365)
	Recomendada: ▪ Review on modified gravity models: http://arxiv.org/abs/1106.2476 ▪ Review on dark energy models: http://arxiv.org/abs/hep-th/0603057