

General Information			
Course name	Cosmology	ECTS Credits	4
		Semester	W
Aims			
<p>The main aim of the lectures is to give the basic notions of the classical cosmology (the standard cosmological model) as well as of the modern cosmology, i.e., to describe the basic possible scenarios of the evolution of the universe as well as to define and to describe basic eras which probably take place during the evolution of the universe from its very early stages up to present days.</p>			
Contents			
<p><u>Introduction:</u> Subject of cosmology, cosmological principle, cosmological paradoxies, cosmological models. (1. week)</p> <p><u>Standard cosmological model:</u> Basic facts about the universe: expansion of the universe – the Hubble law, cosmic background radiation. (2. week)</p> <p><u>Standard cosmological model – cont.:</u> The Robertson-Walker metric of the nonstatic, homogeneous, and isotropic universe. (3. week)</p> <p><u>Standard cosmological model – cont.:</u> The Hubble law in the Robertson-Walker metric, cosmological red shifts. (4. week)</p> <p><u>Cosmic dynamics:</u> Gravitational field equations of the universe – the Einstein tensor, The Friedmann equations. (5.-6. week)</p> <p><u>Nonstatic models of the universe:</u> Solutions of the Friedmann equations: the flat, the closed, and the open universe. (7. week)</p> <p><u>Nonstatic models of the universe – cont.:</u> Newtonian cosmology. (8. week)</p> <p><u>Basic facts about quantum cosmology:</u> Planck epoch of the universe, the Wheeler-DeWitt equation and its solution, the wave function of the universe. (9.-10. week)</p> <p><u>Dark matter and dark energy:</u> Accelerating expansion of the universe. (11. week)</p> <p><u>The early universe:</u> The Standard Model of elementary particles, spontaneous symmetry breaking, unification of fundamental interactions. (12. week)</p> <p><u>The early universe – cont.:</u> Negative pressure of the vacuum, cosmic inflation. (13. week)</p> <p><u>The early universe – cont.:</u> Physics of the early universe, eras of the early universe. (14. week)</p>			
Evaluation			
<p>The students must understand the basic experimental facts about our universe, to derive the Robertson –Walker metric, to solve the Friedmann equations of the matter dominated universe and to know the basic facts from the modern notions about the universe (the Planck epoch, inflation, physics of the early universe, etc.).</p>			
Bibliography			
<ol style="list-style-type: none"> Weinberg S., <i>Gravitation and Cosmology</i>, John Wiley and Sons, New York, 1972. Chow T.L., <i>Gravity, Black Holes and the Very Early Universe</i>, Springer, 2008. Roos M., <i>Introduction to Cosmology</i>, John Wiley and Sons, 2015 Misner, C.W., Thorne, K.S., Wheller, J.A., <i>Gravitation</i>, Freeman, San Francisco, 1973. 			

