Level: bachelor

Course title: Theory of gravity

Status: elective

ECTS: 6

Requirements: Theory of relativity, Geometry, Fundamentals of mathematical physics

Learning objectives

Introduction to foundations of Einstein's theory of gravitation. Providing the basic knowledge in general tensor calculus in Rieman spaces, relation between gravitation and geometry. Sequential introduction of Rieman, Ricci and Einstein tensor. Derivation of Einstein's equations. Familiarity with applications and experimental verifications of this theory.

Learning outcomes

After taking the course, students should have developed:

General abilities: basic knowledge of this field, following the literature, analysis of various solutions and the choice of the most adequate solution, application in practice and other subjects.

Subject-specific capabilities:

- mastering the elements of tensor calculus;
- understanding of the basic principles of Einstein's theory of the gravitational field;
- independent formulation and solution of Einstein's equations for particular problems;
- application of knowledge for higher courses.

Syllabus

Theory

The princlipes of general relativity. Basics of Einstein theory of gravitation. Tensor calculation in Riemann space, basics of general theory of relativity, connection between gravity and geometry. Riemann, Ricci and Einstein tensor. Geodesics in curved space-time. Energy-momentum tensor. General relativity from a variational principe. The Einstein Lagrangian. Schwarzshild solution. Black holes. Experimental tests of general relativity. Planetary precession. Propagation of light in curved space-time. Gravitational redshift. Gravitational waves. Cosmological models.

Practice

Problem solving.

Weekly teaching load				**Other:**
Lectures:	**Exercises:**	**Other forms of teaching:**	**Student research:**	
3	2			