Lecture III-A - course description

General information

Course name	Lecture III-A
Course ID	13.7-WF-FiAT-W-III-A- 18
Faculty	Faculty of Physics and Astronomy
Field of study	Physics and Astronom
Education profile	academic
Level of studies	PhD studies
Beginning semester	winter term 2018/2019

Course information

Semester	4
ECTS credits to win	3
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. Ulrich Geppert

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Exam

Aim of the course

Students will gain basic knowledge about the theories of Special Relativity and General Relativity, and their role in theinterpretation of astrophysical phenomena. Students will learn mathematical methods necessary to apply relativistic understanding in application to real astrophysical data concerning compact objects, such as neutron stars or white dwarfs.

Prerequisites

Knowledge of classical mechanics, electrodynamics and calculus at the master of science level.

Scope

- The rules of Special Relativity and General Relativity. Tensor calculus, Lorentz transformation, relativistic mechanics. , energy-momentum tensor.
- The equivalence principle.
- Gravitational redshift.
- Tensors in Riemann space, covariant differential.
- Space-time curvature around massive(relativistic) stars.
- Einstein's field equations, Schwartzschild metric.
- Stellar structure equations.
- Stellar collapse, supernovae.
- Black holes.
- Gravitational fields.

Teaching methods

Conventional lecture, discussion and consultaions.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Student has knowledge of the modern theories, research methods, the rules and ideas in the field of physics and astrophysics. She has detailed and advanced knowledge allowing to create new hypotheses, research methods and ideas through independent research in the field of science in which the PhD dissertation is prepared, or in similar fields.	• SD_W02	• Exam Discussions Consultations	• Lecture
Student has an advanced understanding of the relations between various fields of physics, astronomy and similar reasearch areas, and inderstands their interactions.	• SD_W03	• Exam Discussions Consultations	• Lecture

Outcome description	Outcome symbols	Methods of verification	The class form
Student has knowledge of physics and astronomy at the most advanced level, and the most detailed knowledge about the field of study chosen for the PhD dissertation.	• SD_W01	• Exam Discussions Consultations	• Lecture
Student understands the need of extending his knowledge, as a necessary condition for the constructive participation in the development of the chosen field of research.	• SD_K01	• Exam Discussions Consultations	• Lecture
Student knows the methodology of physics and/or astronomy at the level neccesary to independently plan and solve researrch problems.	• SD_W04	• Exam Discussions Consultations	• Lecture

Assignment conditions

Positive grade from an oral exam. Active participation in the duscussions during lectures may influence the outccome of the exam.

Recommended reading

[1] lecture notes

[2] L.D. Landau & E.M. Lifshitz, *Course of Theoretical Physics, Vol. 5, Statistical Physics*, Pergamon Press

[3] J.B. Hartle, *Gravity*, Addison Wesley, 2003

Further reading

[1] S.L. Shapiro & S.A. Teukolsky, *Black Holes, White Dwarfs, and Neutron Stars – the Physics of Compact Objects*, John Wiley & Sons, 1983

[2] V.M. Lipunov, *Astrophysics of Neutron Stars*, Springer 1987

[3] B.F. Schutz, *A First Course in General Relativity*, Cambridge University Press, 2016

Notes

Modified by dr Joanna Kalaga (last modification: 30-08-2018 10:44)