

WINTER 2016/2017
“INTRODUCTION TO GENERAL RELATIVITY AND COSMOLOGY”

WILKENS, LIBESKIND

Contact:

Prof Dr. Martin Wilkens (MW)
Institut für Physik, Universität Potsdam (2.085)
mwilkens@uni-potsdam.de
Tel: 0331 977 1706

Dr. Noam Libeskind (NIL):
Leibniz Institute für Astrophysik (Schwarzschildhaus: 1-17)
nlibeskind@aip.de
Tel: 0331 7499 641

Format: (3x45 Min lecture + 1x45 Min exercise-session)/week

Language: Course in English Language

Literature: James B. Hartle “Gravity – An Introduction to Einsteins General Relativity”, Addison Wesley. For an extended list of literature and additional material see the course web page <http://www.quantum.physik.uni-potsdam.de/teaching/>

Attention: Some sessions will have to move from friday to some other day!

Date	Content	Teacher
Fri Oct 21	I. Overview II. Newtonian Gravity: II.1 Newtonian Space, Time and Galilean Relativity II.2 Celestial Mechanics (gravitational mass) II.3 Collisions (inertial mass)	MW/NIL MW
Fri Oct 28	II.4 Weak Equivalence Principle II.5 Newtonian Field Theory of Gravitation II.6 Newtonian Cosmology EXERCISE-SESSION: Problem Set No 1	MW TS
Fri Nov 04	III. Special Relativity: III.1 Meaning of $c = const$ (Einstein Relativity Principle)	MW
Fri Nov 11	III.2 Poincaré, Lorentz, Minkowski and all that	MW
Fri Nov 18	III.3 Tensors EXERCISE-SESSION: Problem Set No 2	MW TS
Fri Nov 25	III.4 Energy-Momentum Tensor	MW
Fri Dec 02	IV. Towards Einstein Field equations of GRT IV.1 Principles EXERCISE-SESSION: Problem Set No 3	MW TS
Fri Dec 09	IV.2 Basics of Differential Geometry	MW
Fri Dec 16	cancelled EXERCISE-SESSION: Problem Set No 4	TS
Fri Jan 06	IV.3 Einstein Field Equations V. Applications of Einstein Field Equations V.1 Schwarzschild solution (I)	MW
Fri Jan 13	V.1 Schwarzschild solution (II)	MW
Fri Jan 20	V.2 Cosmology (I)	NIL
Fri Jan 27	V.2 Cosmology (II)	NIL
Fri Feb 03	Research Topics EXERCISE-SESSION	NIL TS
Fri Feb 10	Student Presentations (I) Gravitational Waves – Description Gravitational Waves – Detection T.b.a Lense Thirring Effect Thermal History of the Universe	All Narayan Noman Ritschel Goessl El Sayed
Sat Feb 11	Student Presentations (II) Equivalence Principle and the accelerated Electron Hawking Radiation Einstein-Hilbert Action Wheeler-DeWitt Quantum Cosmology	14:00 – 16:00 Endres Deka Thomas Seidler

List of Topics for Student Presentations:

- (1) Principles of the Global Positioning System
- (2) Experimental determination of Newtons gravitational constant G
- (3) Experimental test of the equivalence principle
- (4) Perihelion precession
- (5) Shapiro effect
- (6) Gravitational lensing
- (7) Lense-Thirring effect
- (8) Kerr black holes
- (9) Gravitational wave description
- (10) Gravitational wave detection
- (11) Unruh effect
- (12) Hawking radiation