



Introduction to
General Relativity
and its
astrophysical applications

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General Informations

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Dates, etc.

- Lectures+Tutorials: Jungiusstr. 11, **Lecture Hall INF**
Tuesdays, 10.00 – 13.30
Wednesdays, **10.00 – 11:30**
- Weekly home work, in groups of 2 to 3
- submit via Moodle:
<https://lernen.min.uni-hamburg.de/course/view.php?id=4335>
- Credits: 8 LP
- Exam: Tuesday, July 10. 2024, 10:00 (planned)

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Outline / Topics

This is an introductory course to the theory of *General Relativity* where we will focus on the **physics** basics.

The concepts of GR will than be applied to astrophysical phenomena.

Lecture is based on **James Hartle's book: *GRAVITY: An introduction to Einstein's General Relativity***, Addison Wesley, 2003

Outline of the **physical basics** & mathematics :

- Newton's physics of gravity
- Curvilinear space
- Geometry as physics (and vice versa)
- Concepts of *Special Relativity* / SPACETIME
- The Equivalence Principle
- Curved SPACETIME
- Geodesics
- Differential Geometry (a pragmatic summary)
- Einstein's field equations

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Outline / Topics

Astrophysical applications:

- Solar system
- Black holes
- Kerr black holes
- Accretion discs
- Gravitational lensing
- Gravitational waves
- Cosmology in a nut shell
- ...

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further literature

- James Hartle: *GRAVITY: An introduction to Einstein's General Relativity*, (2003)
- Misner, Thorne & Wheeler: *GRAVITATION* (1973, “the brick”)
- Padmanabhan: *Gravitation: Foundations and Frontiers* (2010)
- Bernard Schutz: *A first course in General Relativity* (2009)
- Ray d’Inverno: *Introducing Einstein’s Relativity* (1990)
- ...
- online: www.bartleby.com/173:
Relativity: The Special and General Theory
Translation of Einstein’s original book (1920)