FYS4160 – General Relativity (Spring 2022)

Torsten Bringmann (torsten.bringmann@fys.uio.no)

Literature

[Car] S. M. Carroll, *Spacetime and Geometry: An Introduction to General Relativity*, Addison Wesley (2004).

While the course content is defined by the lecture (and exercises !), I will often closely follow the textbook by Carroll, and always (try to) stick to its conventions. The lecture is divided into two main parts. The first part (until about a month before the Easter break) will introduce general relativity as our leading theory of gravitation, including the necessary mathematical tools. The second part, starting around week 12, will focus on some of the most important applications, namely *i)* the spacetime geometry resulting from a spherically symmetric mass distribution, *ii)* gravitational waves and *iii)* cosmology.

Tentative syllabus

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Date	**Subject**
week 4 – 5 (from Jan 24)	Recap: Special Relativity [Car 1.1–1.9]
week 6 (from Feb 7)	Equivalence principles; gravity as a geometric effect [∼ Car 2.1, 4.1]
week 9 – 11 (from Mar 1)	Curved space(time) and Riemannian geometry [∼Car 2–3]
week 12 (from Mar 22)	Einstein's field equations [Car 4.2, 4.4]
week 13 (from Mar 29)	General Relativity as a classical field theory [Car 1.10, 4.3]
week 14 (from Apr 5)	Schwarzschild solution [Car 5.1–5.4]
week 15 (from Mar 29)	**Easter (no lectures)**
week 16 – 17 (from Apr 22)	Black holes [∼ Car 5.6–5.8, (6)]
week 18 (from May 2)	Experimental tests of General Relativity [Car 5.5, ∼7.1-7.3]
week 19 – 20 (from May 9)	Gravitational waves [∼ Car 7.4–7.7]
week 21 – 22 (from May 23)	Cosmology [∼ Car 8.1–8.5]
June 16 (9:00 – 13:00)	**Final exam**