FYS4160 – General Relativity (Spring 2023)

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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 7 – 9 (from Feb 14)	Curved space(time) and Riemannian geometry [∼Car 2–3]
week 10 (from Mar 7)	Einstein's field equations [Car 4.2, 4.4]
week 11 (from Mar 14)	General Relativity as a classical field theory [Car 1.10, 4.3]
week 12-13 (from Mar 21)	Schwarzschild solution [Car 5.1–5.4]
week 14 (from Apr 4)	**Easter (no lectures)**
week 15 (from Apr 11)	Black holes [∼ Car 5.6–5.8, (6)]
week 16 (from Apr 18)	Classical tests of General Relativity [Car 5.5, ∼7.1-7.3]
week 17 – 18 (from Apr 25)	Gravitational waves [∼ Car 7.4–7.7]
week 19 – 21 (from May 9)	Cosmology [∼ Car 8.1–8.5]
June 14 (15:00 – 19:00)	**Final exam**