# General relativity: Preliminary courseplan, spring 2018

| | Date | Subject | Reading (Hartle) |
|---|---|---|---|
| 1 | 19 March (Monday) 13:15 – 15:00 | **Introduction to curved surfaces. Special relativity: the Minkowski metric** | Chap 2 Chap 3.1, 3.2 Chap 4 |
| | | Problem 2: 3, 4, 5, 7 Problem 4: 9, 13, 15 | |
| 2 | 21 March (Wednesday) 13:15 – 15:00 | **Special relativity: 4-vectors, energy-momentum and acceleration. The equivalence principle (EP)** | Chap 5 Chap 6.1, 6.2 |
| | | Problem 5: 2, 7, 8, 11, 20 | |
| 3 | 26 March (Monday) 13:15 –15:00 | **Newtonian gravity as spacetime geometry. Or: EP + SR = Curved spacetime!** | Chap 3.3 – 3.5 Chap 6.3 – 6.6 |
| | | Problem 6: 12, 13, 14 | |
| | 26 March, 15:15 – 17:00 | **Problem solving session** | |
| 4 | 28 March (Wednesday) 13:15 –15:00 | **The description of curved spacetimes: The metric** | Chap 7 |
| | | Problem 7: 2, 5, 9, 11, 12, 18, 20 | |
| 5 | 4 April (Wednesday) 13:15 –15:00 | **Geodesics and symmetries. Local inertial frames.** | Chap 8 |
| | | Problem 8: 3, 5, 6, 8 | |
| 6 | 9 April (Monday) 13:15 –15:00 | **The Schwarzschild geometry.** | Chap 9.1 – 9.3 |
| | | Problem 9: 1, 5, 6, 7, 8, 10, 12 | |
| | 9 April, 15:15 – 17:00 | **Problem solving session** | |
| 7 | 11 April (Wednesday) 13:15 –15:00 | <span style="color:red">**Bonustest I**</span> **More on the Schwarzschild geometry.** | Chap 9.4 (Chap 10) |
| | | Problem 9: 16 | |
| 8 | 16 April (Monday) 13:15 –15:00 | **Vectors, dual vectors and tensors.** | Chap 20.1 – 20.3 |
| | | Problem 20: 3, 4, 7 | |
| | 16 April, 15:15 – 17:00 | **Problem solving session** | |
| 9 | 18 April (Wednesday) 13:15 –15:00 | **The covariant derivative.** | Chap 20.4 – 20.5 |
| | | Problem 20: 5, 10, 14, 15, 17, 18, 20 | |
| 10 | 23 April (Monday) 13:15 –15:00 | **The Riemann tensor: the result of parallel transport.** | See lecture notes! |
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| | 23 April, 15:15 – 17:00 | **Problem solving session** | |

| 11 | 25 April (Wednesday)<br>13:15 –15:00 | **The Riemann tensor: geodetic deviation.**<br>**The Einstein vacuum equation.** | Chap 21.1 – 21.4 |
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| | | Problem 21: 4, 6, 7, 11, 12, 13, 14, 18 | |
| 12 | 2 May (Wednesday)<br>13:15 –15:00 | **The stress energy tensor.**<br>**The Einstein equation.** | Chap 22 |
| | | Problem 22: 4, 8, 9, 10, 13, 15 | |
| 13 | 7 May (Monday)<br>13:15 –15:00 | **Black holes.** | Chap 12<br>(Chap 15.1 – 15.3) |
| | | Problem 12: 3, 5, 13, 14, 15, 17<br>Problem 20: 16 | |
| | 7 May, 15:15 – 17:00 | **Problem solving session** | |
| 14 | 9 May (Wednesday)<br>13:15 –15:00 | **Bonustest II**<br>**More on black holes.** | |
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| 15 | 14 May (Monday)<br>13:15 –15:00 | **Causal structure and Penrose diagrams.** | Page 137, 274<br>+ Lecture notes |
| | | Problem 7: 6<br>Problem 12: 8, 9, 25 | |
| | 14 May, 15:15 – 17:00 | **Problem solving session** | |
| 16 | 16 May (Wednesday)<br>13:15 –15:00 | **Gravitational waves.** | Chap 21.5<br>Chap 16.1 – 16.3<br>(Chap 16.4 – 16.5) |
| | | Problem 21: 21, 22, 24<br>Problem 16: 1, 2, 5, 8 | |
| 17 | 21 May (Monday)<br>13:15 –15:00 | **Cosmology.** | (Chap 17)<br>Chap 18<br>(Chap 19) |
| | | Problem 18: 5, 6, 7, 11, 23, 24 | |
| | 21 May, 15:15 – 17:00 | **Problem solving session** | |
| 18 | 23 May (Wednesday)<br>13:15 – 15:00 | **Special topic session:**<br>**Black hole thermodynamics** | Extra material |
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| | 28 May (Monday) ?<br>13:15 – 15:00 | **Extra problem solving session** | |
| | 31 May (Thursday)<br>8:00 – 13:00 | **Exam**<br>(AlbaNova, rooms FA31, FA32) | |