

Advanced Lectures on General Relativity

International Solvay Institutes' Amsterdam-Brussels-Geneva-Paris Doctoral School on
"Quantum Field Theory, Strings and Gravity"

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Plan of the class:

1 Surface charges (4h)

References: [1], Chapter 1 (see references therein);

Mathematica package [SurfaceCharges](#).

2 Black hole thermodynamics (4h)

References: [2] [3] [4] [5] [6]; Material: see [6].

3 Three dimensional gravity (3h)

References: [1], Chapter 2 (see references therein)

4 Kerr black hole (3h)

References: [1], Chapter 4 (see references therein)

5 Gravitational waves: Post-Newtonian/Post-Minkowskian theory (6h)

References: [7] [8]; Material: see pdf slides.

6 Gravitational waves: Black hole perturbation theory (3h)

References: [9] [10] [11] [1]; Material: see pdf slides.

7 Asymptotically flat spacetimes (if interest)

References: [1], Chapter 3 (see references therein)

References

- [1] G. Compère and A. Fiorucci, “Advanced Lectures on General Relativity”, [arXiv:1801.07064 \[hep-th\]](#).
- [2] B. Carter, “Black hole equilibrium states.”, in *Black Holes (Les Astres Occlus)*, C. Dewitt and B. S. Dewitt, eds., pp. 57–214. 1973.
- [3] J. M. Bardeen, B. Carter, and S. Hawking, “The Four laws of black hole mechanics”, *Commun.Math.Phys.* **31** (1973) 161–170.
- [4] P. K. Townsend, “Black holes: Lecture notes”, [arXiv:gr-qc/9707012 \[gr-qc\]](#).
- [5] R. M. Wald, “The thermodynamics of black holes”, *Living Rev. Rel.* **4** (2001) 6, [arXiv:gr-qc/9912119 \[gr-qc\]](#).
- [6] G. Compère, “An introduction to the mechanics of black holes”, in *2nd Modave Summer School in Theoretical Physics*. 11, 2006. [arXiv:gr-qc/0611129](#).
- [7] M. Maggiore, *Gravitational Waves. Vol. 1: Theory and Experiments*. Oxford Master Series in Physics. Oxford University Press, 2007.
- [8] L. Blanchet, “Gravitational Radiation from Post-Newtonian Sources and Inspiralling Compact Binaries”, *Living Rev. Rel.* **17** (2014) 2, [arXiv:1310.1528 \[gr-qc\]](#).
- [9] L. Barack and A. Pound, “Self-force and radiation reaction in general relativity”, *Rept. Prog. Phys.* **82** no. 1, (2019) 016904, [arXiv:1805.10385 \[gr-qc\]](#).
- [10] A. I. Harte, “Motion in classical field theories and the foundations of the self-force problem”, *Fund. Theor. Phys.* **179** (2015) 327–398, [arXiv:1405.5077 \[gr-qc\]](#).
- [11] E. Berti, V. Cardoso, and A. O. Starinets, “Quasinormal modes of black holes and black branes”, *Class. Quant. Grav.* **26** (2009) 163001, [arXiv:0905.2975 \[gr-qc\]](#).