

CURVATURE FLOWS IN RELATIVITY - SYLLABUS OUTLINE

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We are going to cover all or a selection of the following topics, depending on how quickly we proceed. We will not rush through it and in case there is high demand for discussion, we allow for that. In the references below you will find some helpful material for your information, but nothing of it is prerequisite reading. We assume some familiarity with the concepts of Riemannian geometry and we will also see one or another PDE.

COURSE TOPICS

Background material in Lorentzian geometry, variational formulae, null geometry. [O’N83]

Hawking energy and inverse mean curvature flow. [Ger90, GL09, HI01, FMP19]

Isoperimetric inequalities in Lorentz manifolds. [LS21]

Curvature flows in null hypersurfaces. [RS22]

Relations to the Yamabe flow. [Wol23]

REFERENCES

- [FMP19] Mattia Fogagnolo, Lorenzo Mazzieri, and Andrea Pinamonti, *Geometric aspects of p -capacitary potentials*, Ann. I. H. Poincaré (C) Anal. Non Linéaire **36** (2019), no. 4, 1151–1179, [MR3955113](#).
- [Ger90] Claus Gerhardt, *Flow of nonconvex hypersurfaces into spheres*, J. Differ. Geom. **32** (1990), no. 1, 299–314, [MR1064876](#).
- [GL09] Pengfei Guan and Junfang Li, *The quermassintegral inequalities for k -convex starshaped domains*, Adv. Math. **221** (2009), no. 5, 1725–1732, [MR2522433](#).
- [HI01] Gerhard Huisken and Tom Ilmanen, *The inverse mean curvature flow and the Riemannian Penrose inequality*, J. Differ. Geom. **59** (2001), no. 3, 353–437, [MR1916951](#).
- [LS21] Ben Lambert and Julian Scheuer, *Isoperimetric problems for spacelike domains in generalized Robertson-Walker spaces*, J. Evol. Equ. **21** (2021), no. 1, 377–389, [MR4238210](#).
- [O’N83] Barrett O’Neill, *Semi-Riemannian geometry with applications to relativity*, Pure and applied mathematics, vol. 103, Academic Press, San Diego, 1983, [MR0719023](#).
- [RS22] Henri Roesch and Julian Scheuer, *Mean curvature flow in null hypersurfaces and the detection of MOTS*, Commun. Math. Phys. **390** (2022), no. 3, 1149–1173, [MR4389079](#).
- [Wol23] Markus Wolff, *Ricci flow on surfaces along the standard lightcone in the 3+1-Minkowski spacetime*, Calc. Var. Partial Differ. Equ. **62** (2023), no. 3, art. 90, [MR4541080](#).