

# Wave equations and singular spacetimes

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The topic of this talk is existence theory of hyperbolic second order systems of partial differential equations with coefficients of low regularity in suitable algebras of generalized functions (in the sense of J. F. Colombeau, cf. [1]).

We start with an existence theorem by Grant, Mayerhofer and Steinbauer (see [2]) for a linear scalar wave equation on the special Colombeau algebra. From a geometrical viewpoint this is an existence result for the Laplace-Beltrami operator of a (generalized) Lorentzian metric. We extend this result to a certain class of tensorial linear hyperbolic equations, that are classically treated in [3] and [4], and give an outlook how to use this result for systems of quasilinear hyperbolic equations to solve the Cauchy problem for Einstein's field equations on a Colombeau-Algebra.

## References

- [1] Michael Grosser, Michael Kunzinger, Michael Oberguggenberger, and Roland Steinbauer. *Geometric theory of generalized functions with applications to general relativity*, volume 537 of *Mathematics and its Applications*. Kluwer Academic Publishers, Dordrecht, 2001.
- [2] James Grant, Eberhard Mayerhofer, and Roland Steinbauer. The wave equation on singular space-times. arXiv:0710.2007, to appear in *Commun. Math. Phys.*, February 2008.
- [3] Stephen W. Hawking and George F. R. Ellis. *The large scale structure of space-time*. Cambridge Monographs on Mathematical Physics, No. 1. Cambridge University Press, London, 1973.
- [4] Clemens Hanel. Linear hyperbolic second order partial differential equations on space time. Masters thesis, Universität Wien, November 2006.