Piotr Chrusciel
(University of Vienna)

Lorentzian geometry with continuous metrics

The celebrated Choquet-Bruhat Geroch theorem, of existence and uniqueness of maximal globally hyperbolic developments of general relativistic initial data, appears to require initial data in a Sobolev class which implies C^3 differentiability of the solution. On the other hand, classical local existence and uniqueness works with $H^3 + H^2$ initial data, and recent studies by Klainerman and Rodnianski require even lower differentiability. One of the problems in matching the thresholds is classical Lorentzian causality theory, which requires C^3 metrics.

In this talk we will revisit causality theory for Lorentzian metrics which are assumed to be merely continuous. We will discuss which standard facts of the theory become wrong for metrics which are not differentiable. In particular we will exhibit a surprising family of continuous metrics with light-cones which are not topological hypersurfaces.

The talk is based on joint work with James Grant and Greg Galloway.

For a list of open problems, see Appendix A of P.T. Chrusciel, G. Galloway, D. Pollack: *Mathematical general relativity: a sampler* Bulletin of the AMS **47** (2010), 567638, arXiv:1004.1016 [gr-qc].