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The second Bianchi identity for spacetimes with timelike singularities

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The second Bianchi identity is a well-known and fundamental differential identity which holds on any smooth (semi-)Riemannian manifold. In general relativity, due to the relation of the curvature tensor and the energy-momentum tensor via the Einstein equations, this identity then naturally implies energy and momentum conservation for matter fields. What happens in situations where curvature singularities associated with timelike singularities occur and the classical Bianchi identity no longer makes sense? In this talk we establish a distributional version of the contracted Bianchi identity, and investigate for which matter fields this identity holds. Surprisingly, the well-known Reissner-Weyl-Nordström spacetime of a single point charge does not belong to this class, but other electromagnetic theories and certain perfect fluids with one-dimensional timelike singularities satisfy the second Bianchi identity weakly. Joint work with Michael Kiessling and Shadi Tahvildar-Zadeh.

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