A Traveltime Inverse Problem in Spacetime

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We consider an inverse problem in a Lorentzian manifold \((M, g)\). We show that the time measurements, which is the knowledge of the Lorentzian separation function on a submanifold \(\Sigma\), determine the derivatives of the metric tensor. This result can be used to study the global determination of a spacetime if it either has a real-analytic structure or is stationary and satisfies the Einstein-scalar field equations. The presented results are Lorentzian counterparts of the extensively studied inverse problems in Riemannian geometry – determination of the jet of a metric and the boundary rigidity problem. This is a joint work with M. Lassas and L. Oksanen.

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