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Minkowski formulae and Alexandrov's theorems in spacetimes

The classical Minkowski formulae for hypersurfaces is very important in the study of many problems in geometric analysis. I will talk about a generalization of those formulae with two important new features: codimension 2 submanifolds are considered instead of hypersurfaces, and the ambient manifold is Lorentzian. As applications, I will discuss some Alexandrov type theorems for spacelike submanifolds. This gives an analogue of the classical Alexandrov's theorem, which states that any closed embedded hypersurface of constant mean curvature in Euclidean space must be a round sphere. This is a recent joint work with M.-T. Wang and Y.-K. Wang.