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Alexandrov's Uniqueness theorems

Uniqueness problem is always one of the central topics in the study of partial differential equations and differential geometry. A classical problem proposed by Alexandrov says that: a closed strictly convex twice differentiable surface in $\mathbb{R}^3$ is uniquely determined when one gives a $proper$ function of the principle curvatures, such as the mean curvature or Gauss curvature. I will talk about the history of this problem and give a proof by using the maximal principle from elliptic partial differential equations.

The second part of my talk will concern another classical theorem due to Alexandrov, which states that any closed embedded hypersurface of constant mean curvature in Euclidean space must be a round sphere. I will discuss an analogue of this theorem with two important new features, motivated by general relativity: codimension 2 submanifolds are considered instead of hypersurfaces, and the ambient manifold is Lorentzian.