

DISSERTATION
DEFENSE

Rotationally Symmetric Planes in Comparison Geometry

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Abstract: Global Riemannian geometry is concerned with relating geometric data such as curvature, volume, and radius to topological data. Cheeger-Gromoll showed that any noncompact complete manifold M with nonnegative sectional curvature contains a boundaryless, totally convex, compact submanifold S , called a soul, such that M is homeomorphic to the normal bundle over S . In the first part of our talk, we show that if M is a rotationally symmetric plane M_m , defined by metric $dr^2 + m^2(r)d\theta^2$, then the set of souls is a closed geometric ball centered at the origin, and if furthermore M_m is a von Mangoldt plane, then the radius of this ball can be explicitly determined. We show that the set of critical points of infinity in M_m is equal to this set of souls, and we make some additional observations on the set of critical points of infinity when M_m is von Mangoldt with a point at which the sectional curvature is negative. We close out the first part of the talk with showing that the slope $m'(r)$ of M_m near infinity can be prescribed with any number in $(0, 1]$. In the second part of our talk, we extend results in a paper by Kondo-Tanaka in which the authors generalize the Toponogov Comparison Theorem such that an arbitrary noncompact manifold M is compared with a rotationally symmetric plane M_m satisfying certain conditions to establish that M is topologically finite. We substitute one of the conditions for M_m with a weaker condition and show that our method using this weaker condition enables us to draw further conclusions on the topology of M . We also completely remove one of the conditions required for the Sector Theorem, one of the principal results in the same paper.

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