Wintersemester 2020/21

Oberseminar
Geometrische Analysis, Differentialgeometrie und Relativitätstheorie

Am Donnerstag, den **28.01.2021** spricht um **15:30** per Videoübertragung

Albachiara Cogo
(Universität Tübingen)

über das Thema

Uniqueness of photon spheres and equipotential photon surfaces in geometrostatic spacetimes via potential theory

Equipotential photon surfaces are timelike hypersurfaces in a static spacetime $(\mathfrak{L}^{n+1} = M^n \times \mathbb{R}, \mathfrak{g} = -N^2 dt^2 + g)$, which are null totally geodesic and such that the so called lapse function is constant on the connected components of each time slice. Photon spheres are a special case of equipotential photon surfaces, where the lapse function is constant on their connected components, namely the constant value of N on the photon sphere does not even depend on the time slice. In this talk I will prove an uniqueness theorem for photon spheres and, more generally, for equipotential photon surfaces in a geometro- static (static, vacuum and asymptotically flat) spacetime of dimension $n + 1 = 4$. This consists in showing that a geometrostatic spacetime $(\mathfrak{L}^4, \mathfrak{g})$ that admits such objects must be isometric to the Schwarzschild spacetime of the same ADM-mass. For this purpose, an approach via potential theory developed by Agostiniani & Mazzieri in [1] and [2] will be used, allowing not to assume the regular foliation of the spacetime by the so called lapse function, used in many other methods. Firstly, I will briefly recall the proof of uniqueness of photon spheres by Cederbaum & Galloway in [4], who adapted the proofs of uniqueness of black holes by Bunting & Masood-ul Alam in [3]. Then I will in fact proceed with a similar attitude, considering the application of potential theory to the proof of uniqueness of black holes by Agostiniani and Mazzieri as a starting point.

Hierzu wird herzlich eingeladen. Bei Interesse bitte per E-Mail an angelika.spoerer-schmidle@uni-tuebingen.de wenden, um den Link zur Videoübertragung zu erhalten.

Hierzu wird herzlich eingeladen.

C. Cederbaum, G. Huisken, K. Kröncke

Bibliography

[1] Virginia Agostiniani and Lorenzo Mazzieri, *On the Geometry of the Level Set of Bounded Static Potentials*, Communications in Mathematical Physics 355, n. 1, pages 261-301, 2017.

[2] Virginia Agostiniani and Lorenzo Mazzieri, *Monotonicity formulas in po- tential theory*, Springer Link https://doi.org/10.1007/s00526-019-1665-2, Calculus of Variations and Partial Differential Equations, 59, no. 1, 6, 2019.

[3] Gary L. Bunting and Abdul K. M. Masood-ul Alam, *Nonexistence of multiple black holes in asymptotically Euclidean static vacuum space-time*, General Relativity and Gravitation 19, no. 2, 147-154 1987.

[4] Carla Cederbaum and Gregory J. Galloway, *Uniqueness of photon spheres via positive mass rigidity*, arXiv:1504.05804 [gr-qc], 2015.