EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Mathematisch-Naturwissenschaftliche Fakultät

Fachbereich Mathematik
AB Geometrische Analysis, Differentialgeometrie und Relativitätstheorie

Oberseminar
Geometrische Analysis, Differentialgeometrie und Relativitätstheorie

Am Donnerstag, den **19.10.2023** spricht um **15 Uhr s.t.** im Hörsaal **N14 (C-Bau) und über Zoom**

Markus Wolff (PhD defense)

(Universität Tübingen)

über das Thema

On the Spacetime Mean Curvature of Surfaces in General Relativity

The spacetime mean curvature of a 2-surface in a 4-dimensional spacetime is defined as the (Lorentzian) length of the codimension-2 mean curvature vector of the surface in the ambient spacetime. In particular, we are interested in surfaces of constant spacetime mean curvature (STCMC surfaces), i.e., surfaces such that the length of the mean curvature vector is constant along the surface. In recently published work Cederbaum-Sakovich constructed an asymptotic foliation of STCMC surfaces in asymptotically Euclidean initial data sets to define a new notion of center-of-mass in the context of General Relativity. Similar to the work of Cederbaum-Sakovich, we will consider the spacetime mean curvature of surfaces that are restricted to a hypersurface in the ambient spacetime. More explicitly, in this talk we consider the spacetime mean curvature restricted to either an asymptotically Euclidean, maximal initial data set, a totally umbilic, asymptotically hyperboloidal initial data set, or a null hypersurface in the ambient spacetime, where the main part of the talk is dedicated to the null hypersurface setting. In the asymptotically Euclidean setting joint work with Gerhard Huisken on the existence of weak solutions to inverse spacetime mean curvature flow in maximal initial data sets is presented. In the asymptotically hyperboloidal setting independent work on the characterization of STCMC surfaces in a class of spherically symmetric spacetimes is presented, building on an Alexandrov Theorem by Brendle. In the null hypersurface setting, we consider what is called null mean curvature flow here in the special case of the round Minkowski lightcone. This parabolic flow was first studied by Roesch and Scheuer on null hypersurface to detect marginally outer trapped surfaces. As no such surfaces exists on the Minkowski lightcone, the flow develops singularities in finite time. This can be proven rigorously by showing that null mean curvature flow along the standard 1+3-Minkowski lightcone is equivalent to 2d-Ricci flow in the conformal class of the round sphere and using a classical result first proven by Hamilton. This further establishes that the rescaled flow smoothly converges to an STCMC surface. Conversely, this new viewpoint on 2d-Ricci flow yields an independent proof of Hamilton's classical result under the additional assumption of strictly positive spacetime mean curvature, which is preserved under the flow. If time permits, a geometric estimate for conformally round surfaces as a further application of this flow is presented.

Den Zoom-Link erhalten Sie per E-Mail von Frau Martina Neu.

For participating online, please sign up by sending an email to Martina Neu.

Hierzu wird herzlich eingeladen.

Carla Cederbaum, Gerhard Huisken, zusammen mit Jan Metzger (Potsdam)