**RUHR-UNIVERSITÄT** BOCHUM

FAKULTÄT FÜR MATHEMATIK

RUB

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# Oberseminar Dynamische Systeme

## Geometry of trapped photon region in a class of stationary spacetimes

**Dienstag, 20. Februar 2024**
**16:15 Uhr – Raum IA 1/53**

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## (Tübingen)

## Abstract:

In Einstein's general relativity, extremely strong gravity can trap light. In a spacetime admitting a singularity, we say that light (or a "photon") is trapped if it neither escapes to spatial infinity nor falls into the singularity. Null geodesics govern the trajectories of light. In the Schwarzschild spacetime with posi- tive mass M, there exist (unstable) circular orbits of trapped photons at the Schwarzschild radius r = 3M, outside the black hole horizon at r = 2M. These orbits fill a three-dimensional submanifold of topology S2 ×R called the photon sphere of the Schwarzschild spacetime. In general, a region in spacetime that is a union of all trapped null geodesics is called the Trapped Photon Region (TPR) of the spacetime. In this talk, we will consider a particular stationary space-time class constructed by the Newman-Jenis algorithm. We will see that, unlike the TPR of Schwarzschild spacetime, the TPR in such spacetimes is not a submanifold of the spacetime in general. However, the lift of TPR in the phase space is a five-dimensional submanifold. This result has applications in various problems in mathematical relativity (This work is an extension of the similar result but in Kerr spacetime, by Cederbaum and Jahns- 2019). This is a joint work with Carla Cederbaum.

Guests are very welcome!