The geometry of Vaidya spacetimes.

Abstract

In 1943, Prahalad Chunnilal Vaidya solved a long standing problem in relativity : finding a modification of the Schwarzschild metric in order to allow for a radiating mass. We investigate the geometrical structure of Vaidya's spacetime in the case of a white hole with decreasing mass, stabilising to a black hole in finite or infinite time or evaporating completely. We focus on the behaviour of the two null congruences of principal null geodesics that are the conformal skeleton of the spacetime and among which are the generators of the past and future horizons. We devote special attention to the case of a complete evaporation in infinite time and establish the existence of an asymptotic light-like singularity of the conformal curvature, touching both the past space-like singularity and future time-like infinity. This singularity is present independently of the decay rate of the mass. We derive an explicit formula that relates directly the strength of this null singularity to the asymptotic behaviour of the mass function. This is work in collaboration with Armand Coudray (Brest).

A possible point of connection with the topic of the conference is the quasi normal modes (i.e. resonances) of dynamic black holes, which appear to be an essentially open problem.