Quasiblack and black holes

José Pizarro de Sande e Lemos
Universidade de Lisboa, Portugal

A quasiblack hole is defined as the static or stationary limiting configuration of an object composed of matter when its boundary approaches its own gravitational radius, i.e., its quasihorizon. We display some of their features: there are infinite redshift whole regions; the curvature invariants remain perfectly regular everywhere in the quasiblack hole limit; a freely falling observer finds in his own frame infinitely large tidal forces in the whole inner region, showing some form of degeneracy; outer and inner regions become mutually impenetrable and disjoint, although, in contrast to the usual black holes, this separation is of a dynamical nature, rather than purely causal; for external far away observers the spacetime is virtually indistinguishable from that of black holes. Important quasiblack holes properties are the mass and entropy. Using the Tolman mass definition we reproduce the black hole mass formula, hinting for a deeper relation between the Komar and Tolman masses. To know the entropy, one generally needs an equation of state for the matter to integrate the first law of thermodynamics on some path. For a quasi black hole the answer is model independent yielding in a natural way the Bekenstein-Hawking horizon area over four result, showing that the horizon is a place where pure gravitational effects take over. The entropy of the extremal quasiblack hole can also be treated within this approach, giving surprisingly a pure function of the horizon area, presumably between zero and the area over four.