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Black Hole Hawking radiation may never be found!

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The image we often see of photons as a tiny bit of light circling a black hole in well defined orbit of radius $r= 3GM/C^2$ (where G = Newton's universal constant of gravitation, C = speed of light in vacuum and M = mass of the black hole) is actually quite interesting. The photon must satisfy the condition $r= \hbar/mC$ (where m = mass of the photon and ħ = reduced Planck constant) much like an electron moving in a circular orbit. Since this condition forces the photon to orbit the hole in a circular orbit.

$$r= 3GM/C^2 = \hbar/mC \quad \text{or} \quad 3GM/C^2 = \hbar/mC \quad \text{or} \quad 3mM = (\text{Planck mass})^2$$

Because of this condition the photons orbiting the small black hole carry more mass than those orbiting the big black hole.

Its temperature is inversely proportional to its mass, making it hotter as it radiates energy L in the form of a photon, and thereby lose mass more than it absorb…. It is in this sense that the Hawking radiation is comprehensible. The fact that it is comprehensible is a miracle.

$$L = 2.821\, k_B T, \text{ where } k_B = \text{Boltzmann constant and } T = \text{black hole temperature.}$$

$$L = 2.821\, (\hbar C^3 / 8\pi GM) \quad \text{or} \quad \hbar C / r = 3.14L$$

$$mC^2 = 3.14L \quad \text{or} \quad mC^2 > L$$

"If a photon with energy mC^2 can't slip out of its influence, and so how can a photon with energy $L < mC^2$ run out of its influence?"

Looking at the unusual nature of Hawking radiation, it may be natural to question if such radiation exists in nature or to suggest that it is merely a theoretical solution to the hidden world of quantum gravity. The attempt to understand the Hawking radiation has had a profound impact upon the understanding of the black hole thermodynamics, leading to the description of what the black hole entropic energy is.

Black hole entropic energy = black hole temperature × black hole entropy

$$2 \times \text{black hole entropic energy} = \text{black hole mass} \times (\text{speed of light in vacuum})^2$$

$$2 \times E_s = MC^2$$

This means that the entropic energy makes up half of the total energy of the black hole. For a black hole of one solar mass ($M = 2 \times 10^{30}$ kg), we get an entropic energy of 9×10^{46} joules – much higher than the thermal entropic energy of the sun. Given that power emitted in Hawking radiation is the rate of energy loss of the black hole:

$$P = -C^2 (dM / dt) \quad \text{or} \quad P = 2 \times (-dE_s / dt)$$

The more power a black hole radiates per second, the more entropic energy being lost in Hawking radiation. However, the total entropic energy of the black hole of one solar mass is about 9×10^{46} joules of which only 9×10^{-29} joules per second is lost in Hawking radiation.