

Escape Velocity

Let's think about the event horizon of a black hole.

First, let's review the idea of escape velocity. For a spherical object of mass M and radius R , use the equation for gravitational potential energy, and the idea of energy conservation, to derive an expression for the escape speed from the surface of the object.

$$U_g = -\frac{GmM}{R}$$

What is the escape speed for planet Earth?

What is it for the Sun?

The **event horizon** for a black hole is defined to be the radius at which the escape speed is the speed of light, c .

Derive an expression for the ratio of the mass to the radius of the event horizon of a black hole.

What is the radius of the event horizon if the black hole has a mass equal to that of our Sun?

If we increase the mass by a factor of 10^6 by what factor does the radius of the event horizon increase?