Hawking Radiation

The Theories that Describe our Universe

Modern understanding of our universe tells us that it can be modelled by two theories: The Theory of General Relativity and Quantum Field Theory. These theories describe the events in our universe at their respective scales. The holy grail of theoretical physics is to devise a universal theory: one that unites quantum field theory with general relativity and incorporates all the fundamental constants of nature; a “theory of everything

General relativity:

The Theory of General Relativity focuses on physics at a large scale, describing the behaviour of planets and large masses in the universe. It can be thought of as describing the fabric of the universe as a surface, spacetime that can be bent by large masses, causing gravitation. But in reality, spacetime is a four-dimensional entity, three dimensions of space, and one dimension of time. Gravitation, in this framework, is not a force, but the result of the curvature of spacetime on the motion of bodies; this curvature is caused by large masses like planets. It can be visualised by imagining what would happen if you placed a heavy ball on a trampoline; the surface of the trampoline, representing spacetime, would sink and bend as a result of the ball, representing a planet.

The idea of spacetime curvature paves the way for another aspect of general relativity that is extremely important in the phenomenon of Hawking Radiation. This is the idea that measurements of space and time are not absolute. For all observers, the laws of physics never change, but their measurements of space and time do. This is called ‘Gravitational Time Dilation’. What these phenomena describe is how space and time can be measured differently depending on the observer. For example, time appears to move more slowly for an observer within a strong gravitational field than it does for one floating freely in space.

Quantum Field Theory:

Quantum Field Theory focuses on events and systems on a much smaller, sub-atomic level. One of the core elements of Quantum Field Theory is quantum