Event Horizon Encyclopedia Article

Event Horizon

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Event Horizon

The boundary of a black hole is termed the event horizon. The size of the event horizon surrounding a black hole is termed the Schwarzschild radius, named after the German astronomer Karl Schwarzschild (1873-1916), who studied the properties of geometric **space** around a **singularity** when warped according to general **relativity theory**. **Light** is bent by gravitational fields, and within a black hole the **gravity** is so strong that light is actually bent back upon itself. Another explanation in accord with the wave-particle duality of light is that inside the event horizon the gravitational attraction of the singularity is so strong that the required escape **velocity** is greater than the **speed of light**. As a consequence, because no object can exceed the speed of light, not even light itself can escape from the region of space within the event horizon.

The event horizon is an observational boundary on the cosmic scale because no information generated within the black hole can escape. Processes occurring at or near the event horizon, however, are observable and offer important insights into the physics associated with **black holes**.

An accretion disk surrounding a black hole forms as **matter** accelerates toward the event horizon. The accelerating matter heats and emits strong, highly energetic electromagnetic **radiation**, including **x rays** and gamma rays, that may be associated with some of the properties exhibited by **quasars**.

Although light and matter cannot escape a black hole by crossing the event horizon, English physicist **Stephen Hawking** formed an important concept later named **Hawking radiation** that offers a possible explanation to possible matter and **energy** leakage from black holes. Relying on quantum theories regarding **virtual particles** (particle-antiparticle pairs that exist so briefly only their effects [not their masses] can be measured), Hawking radiation occurs when a virtual particle crosses the event horizon and its partner particle cannot be annihilated and thus becomes a real particle with **mass** and energy. With Hawking radiation, mass can thus leave the black hole in the form of new particles created just outside the event horizon.

In general usage, an event horizon is a limiting boundary beyond which nothing can be observed or measured with regard to a particular phenomena (e.g., the cosmic event horizon beyond which nothing can be observed from Earth).