Singularity Encyclopedia Article

Singularity

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Singularity

A mathematical function is said to be singular at a point if it "blows up" there; that is, if the function evaluated at that point becomes infinite. The point is a *singularity* of that particular function.

In physics, any point at which the mathematical expression for a physical quantity becomes infinite is a singular point. Thus, for example, the origin, r=0 is a singularity of the Coulomb expression for the electric field surrounding a point charge, q, given by *E=kq/r[sup2]*.

When discussing the physics of **space-time**, the relevant mathematical function is the curvature, which is represented mathematically by the Riemann curvature tensor. The Riemann tensor has twenty independent components, each of which is a function of the space-time coordinates. Loosely speaking, a space-time point at which any component of the Riemann tensor blows up is called a singular point, or a singularity. There is a curvature singularity in the Schwarzchild **space-time geometry**, again at the origin, r=0. As physical quantities can never take on infinite values, the laws of physics break down at a singularity--they lose their **power** to predict the results of a physical measurement.

This is referred to as "loosely speaking" because it is quite hard (and perhaps impossible) to give meaning to the idea of a singularity as a "place" in space-time if the very concept of space-time breaks down. The rigorous mathematical definition is thus more complicated, but in this, as in many other things, the simple, more intuitive picture certainly suffices as a way of visualization.