

Black Hole Mysteries – installation by Ahmed Farooqui

The layperson's physics: According to the theory of relativity, Black Holes are simple objects made up of a "dot" (a point of infinite mass but zero volume called a singularity) surrounded by a shell (the event horizon) where gravity is so strongly curved that nothing can escape once it has entered the shell. Once we know a Black Hole's mass, charge and spin there is nothing more to be said about it. For example, we cannot distinguish a black hole that is made up of interstellar gas with one made up of just photons.

But from the point of view of quantum mechanics (QM) this poses a problem. One fundamental law of QM holds that quantum information can never be lost. Information about matter/energy falling into a black hole must be preserved in some way to satisfy this law. This creates a paradox called the "information paradox" where we are apparently forced to choose between relativity and quantum mechanics¹.

My artwork inserts my imagination into the space between relativity and quantum mechanics – borrowing ideas from "Fuzzball Model"² of black holes to address the information paradox.

The Artwork: My Black Hole is not a dark object but a blazing tangle of strings (one dimensional strings are the basic building blocks of matter and energy in "string theory") surrounded by quantum fuzz, rather than a neat event horizon. Strings fall into the Fuzzball from outside, adding their information to the tangle. Physicists propose that information leaks out through the fuzz over a long period in the form of "delicate correlations of outgoing quanta" which I've interpreted as alphabetic letters. Why alphabets? Because while alphabets in themselves carry no meaning, their correlation allows us to create meaning through words and sentences.

So I invite you to imagine that by some unimaginable process Earth has collapsed into a Black Hole. Everything we know and love is gone forever, but the information or "recipe" to recreate it is still there and will eventually leak out. In some far distant future, some enormously powerful intelligences, with a better grasp of gravity than we do and access to vast energies may be able to harvest this information and use it to recreate things at will. Use the letters to write down what single thing or idea you want recreated.

¹Stephen Hawking discovered that Black Holes actually radiate through quantum mechanical processes and can eventually evaporate. However this radiation is purely thermal and doesn't carry away any information. Other physicists have theorised that all the information about the contents of a black hole is stored on its surface area just outside its event horizon. When an object falls into a black hole its thermodynamic entropy is captured on the surface of its event horizon as information about all possible configurations of its microstates.

²Proposed by Samir Mathur and Oleg Lunin of Ohio State University in 2002