

What Happens Inside a Black Hole?

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Abstract:

The interior of a black hole is normally seen as a problem to be treated within classical general relativity. Such a view follows from the questionable notion that quantum theory is essential only for very small space regions. Correspondingly, it is often argued that for actual black holes, being so much larger than atoms, quantum theory does not matter. This, however, is a misconception, as a simple quantum theoretical argument may show: Restricting the spatial extent of a system-for example, by placing it into a box-affects the ground state of the system. The ultimately impenetrable boxes in the universe are the horizons of black holes. Here, it is not legitimate to suppose the same vacuum states inside and outside of the horizon. Using an essentially quantum theoretical approach, the unphysical singularity at the centre of the black hole disappears, and the interior solution is seen to represent a Friedman-Robertson-Walker-cosmos. The approach is based on the notion of protyposis, that is, abstract and absolute quantum bits, regarded as the elementary entities in the universe. Along these lines, also the entropy of black holes can be derived in a simple and straightforward way.