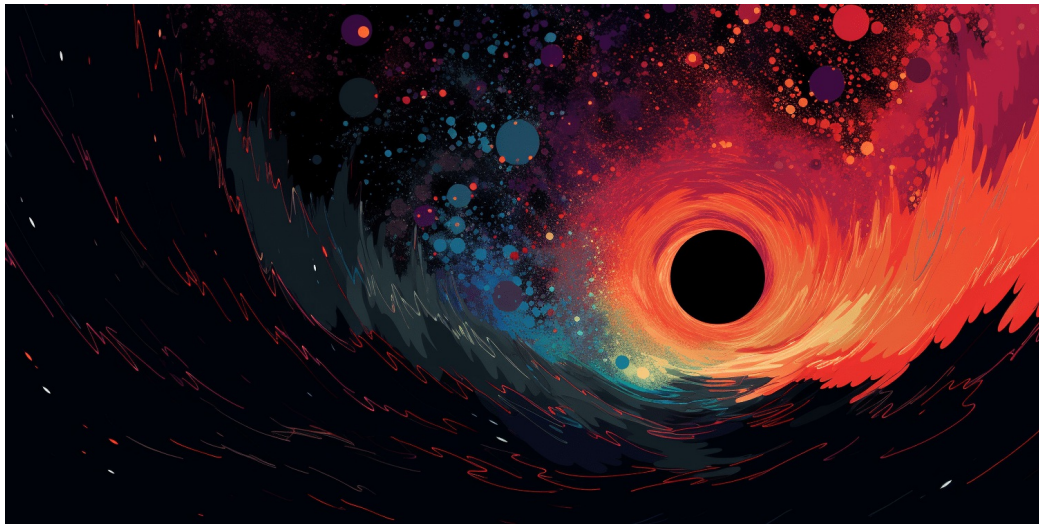


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[Commentary] On a Loophole in Quantum Gravity

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Abstract

I show that general relativity and quantum mechanics, broadly construed, are consistent in relation to black holes, if black holes are interfaces.

Keywords: Philosophy of science, Quantum gravity philosophy, Metaphysics of space-time, Philosophical foundations of physics, Causal closure.

1. Introduction

Say that if black holes have no extension in space-time they cannot be accounted for by quantum mechanics if quantum mechanics only is meaningful for events at least of the Planck length. Also, say that this would imply that general relativity is inconsistent with quantum mechanics. I will show that this inconsistency is dependent upon a premise that can be questioned.

2. Loophole causal closure

Loophole causal closure (Gamper, 2017) predicts that the physical universe is preceded by an earlier one (that can be mathematical). This is made possible by a redefinition of the principle of causal closure. The redefinition makes interfaces between universes consistent with the principle of causal closure, which is why it is ontologically meaningful to consider the possibility of a multiverse.

3. Loophole Quantum Gravity

The premise referred to in the Introduction is that a black hole is situated in the physical universe. If there is only one universe and that universe is physical, of course, the black hole is in the physical universe. If we consider, however, that there might be more than one universe and that loophole causal closure is true, we admit that there can be interfaces. According to this view, black holes can be viewed as interfaces.

This scenario can be unpacked as follows. Let us define the black hole predicament as the situation where the black hole is mathematical in its nature. Then we cannot explain how it has the non-mathematical, physical property of having mass. At the same time, it has mass, which is why it cannot be purely mathematical.

One solution is to view the black hole as an interface between the physical universe and the mathematical universe. According to this view, the black hole has a dual existence, both physical and mathematical.

4. Comment

I have written about this possibility elsewhere. See, for instance, (2023).

References

- Gamper, J. (2017). [On a Loophole in Causal Closure](#). *Philosophia* 45: 631-636.
- Gamper, J. (2023). [Mileva — a Dialogue About General Relativity as Regional](#). Qeios. doi:10.32388/6I9WNV.