Solving the black hole information paradox

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Abstract: I show an issue with an experiment involving the event horizon of a black hole, and use it to solve the black hole information paradox.

Thought experiments

Measurements are mine unless otherwise specified. Rockets herein have constant proper accelerations. About spherical shells concentric to a black hole, see Chapter 3 of Exploring Black Holes.

I'm freely falling, just below the event horizon of a supermassive black hole. The equivalence principle (EP) says that the laws of special relativity (SR) hold in my local inertial frame (LIF). SR predicts that a shell in my LIF can reach me in principle, but general relativity (GR) disagrees, thus it violates its EP.

The shell's proper acceleration can be calculated by eq. 46 at Chapter 6 of Exploring Black Holes. A rocket substitutes for the shell. Using SR's equations at The Relativistic Rocket, the shell / rocket reaches me when it moves toward me initially at >= the velocity given by eq. 7 for the time *t* , where *t* is given by eq. 4 for the shell's initial distance *d*. When the shell has that initial velocity then I'm above its Rindler horizon.

For example, see "Here are some of the times you will age when journeying to a few well known space marks, arriving at low speed". For the trip to Andromeda input 1 million light years for *d* into eq. 4, and then input the resulting *t* into eq. 7. That's the speed in Andromeda's frame at which the rocket moves toward the galaxy when the rocket starts braking at the midpoint. At that moment it's 1 million light years away in Andromeda's frame. The rocket reaches the galaxy even though the rocket's Rindler horizon is less than 1 light year below the rocket in the rocket's frame. When the rocket starts braking, in its frame Andromeda is less than 1 light year away, above the rocket's Rindler horizon.

I'm not required to be falling below the shell, or else GR violates its EP. A rocket substitutes for the shell. SR allows the shell / rocket to decelerate toward me at any initial velocity < *c* in principle. There are no event horizons in SR, so per the EP an event horizon isn't an impediment to the shell decelerating toward me. Indeed the EP restricts

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me to SR's laws and equations when predicting the shell's movements. SR doesn't require me to be below the shell's Rindler horizon. GR's prediction or interpretation that I'm falling below the event horizon at *c* seems to be based on a false assumption that I must be below the shell's Rindler horizon, and that therefore I must be falling below the event horizon at *c*, so that light I shine toward the shell can recede at *c* while never reaching the shell.

Here's how to avoid the thinking that I can reach the shell only when I'm between it and the event horizon initially: Let the shell be 1 meter away from me initially. GR allows me to be below the event horizon when I'm 1 meter below the shell. SR allows me to be above the shell's Rindler horizon initially. Therefore the shell can reach me in principle when I'm below the event horizon initially. There are no event horizons in SR, so per the EP an event horizon isn't an impediment to the shell reaching me.

Here's a variant of the barn-pole paradox for Rindler horizons: Consider the barn frame. Let the pole enter the barn through its back door. When the switch is flipped the pole is completely within the barn. Instead of the barn doors closing, a rocket starts accelerating outward from the front of the barn, and simultaneously a laser at the back of the barn fires toward the rocket. Let the rocket accelerate such that its Rindler horizon is initially between the back end of the pole and the laser. Now consider the pole frame. When the rocket starts accelerating, the back end of the pole hasn't yet entered the barn. The paradox is, how can the back end of the pole possibly reach the rocket, when the laser's light can't reach the rocket? The answer is, the laser fires after the back end of the pole is in the barn.

Let rockets *A* and *B* be floating in space a fixed distance apart, and then start their engines simultaneously as they measure, with *A* chasing *B*. Let *A* start below *B*'s Rindler horizon so that *A* can't reach *B*. Can freely falling Sue reach *B*, when in her frame she starts below *A* when *B* starts accelerating? Yes she can, and the variant of the barn-pole paradox shows that she'd pass *A* before it starts accelerating.

Conclusion

To resolve the issue the shell must be able to reach me in principle, which precludes black holes, and so the escape velocity must be < *c* everywhere. The black hole information paradox vanishes by accepting that black holes don't exist in nature, and that GR only approximates a valid theory of gravity.