Journal of Theoretics

Volume 3-4

Wormholes Create Unresolvable Paradoxes

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Abstract: In the last chapter of Kip Thorne's book "Black Holes & Time Warps, Einstein's Outrageous Legacy," Thorne contemplates the possibility of time machines and suggests that such machines may be theoretically impossible. I would like to put forward an alternative approach suggesting, that just maybe, our models of wormholes may be incorrect.

Keywords: blackhole, wormhole, time.

I. INTRODUCTION

To understand wormholes, one needs to understand the following three concepts.

1. **Matricide paradox**: is about going back in time to change history. A person goes back in time to kill his mother to prevent his birth. The particular characteristic of this problem is that, free will is in play.

2. **The Polchinski's billiard ball paradox**: is a version of the matricide paradox without the element of free will.

   "Take a wormhole that has been made into a time machine and place its two mouths at rest near each other. Then, if a billiard ball is launched toward the right mouth from an appropriate initial location, and with an appropriate initial velocity, the ball will enter the right mouth, travel backward in time, and fly out of the left mouth before it entered the right (as seen by you and me outside the wormhole), and it will then hit its younger self, thereby preventing itself from ever entering the right mouth and hitting itself." (Kip S. Thorne)

3. **Echeverria-Klinhammer trajectory**: is that trajectory of the billiard ball, different from Polchinski's paradoxical trajectory, such that when the “old” billiard ball hits its young self, causing its young self to enter the right mouth of the wormhole and complete the Polchinski's billiard ball scenario in a non-paradoxical manner - that of the old billiard ball exiting the left mouth of the wormhole colliding with its young self and causing its young self to enter the right mouth of the wormhole and . . . .

II. THOUGHT EXPERIMENT

By using Polchinski's paradox, with the Echeverria-Klinhammer trajectory one is able to conduct a recursive experiment as follows,

1. Time now is 12:00 noon. Set-up the billiard ball and let lie for a given time period, say 10 hours, until 10.00 p.m.

2. Set the two wormhole mouths so that the returning “old” ball, exits from the left mouth of the wormhole at time “T.” For starting conditions, let T = 9:55 p.m.

3. Start billiard ball experiment using the Echeverria-Klinhammer trajectory.

4. “Old” ball exits the left wormhole mouth.

5. As soon as “old” ball is detected, the wormhole machine is to adjust itself so that T is decremented by time “t.” Say is t=5 minutes. That is, T = T – t = T - 5 minutes. (Prior to first collision, T= 9:55 p.m., prior to second collision, T= 9:50 p.m., prior to third collision, T=9:45p.m., prior to fourth collision, T=9:40p.m., and so on.

6. “Old” ball collides with its “young” self, causing its “young” self to enter the right wormhole mouth.

7. Immediately, after collision, collect “old” ball in basket by allowing it to roll off the table into a basket (and avoid introducing free will).

This experiment is a self-replicating nested loop (typical stuff of programmers) which is bounded by 12:00 noon and 10:00 p.m. because the Echeverria-Klinhammer trajectory does not physically exists for collision to occur outside this time period.

I had originally thought that by the end of the experiment there would be 120 billiard balls, and that was the end of this story, but there is another option.

III. UNRESOLVABLE PARADOXES

Let’s make the billiard balls very small, almost point size, and also make them very dense. Reduce the scale, “x”, of the experiment to almost microscopic level so that the Echeverria-Klinhammer trajectory is preserved. Decrement “t” to almost zero. Then, we see that as “x” and “t” approach zero, the number of billiard balls collected, approaches infinity. Nothing is wrong with this just yet.

The problem is that since the mass of the mouths of the wormholes are conserved and assuming that both wormhole mouths have finite mass, at some point in the experiment the left mouth will attain a negative mass.

Morris, Yurtsever, and Thorne introduced the conjecture that there be “no unresolvable paradoxes” (Thorne). For an idea to have some degree of success in the practical world there cannot be inconsistencies in the logical outcomes of the proposed idea. In the case of the time machine, we see that the logical outcome of the time machine concept is the breakdown in the law of conservation of mass, the first unresolvable paradox, unless negative mass is allowed.

If conservation of mass applies to both wormhole mouths together, and their masses are transferable, then the left wormhole mouth will never reach negative mass. But this, however, raises another question. How many balls are there in the basket and at what time?

You will note that the number of balls in the basket, soon after the experiment is started at 12:00+ p.m., will approach infinity, if the experiment is “started” at 10:00 p.m.. It will be zero if the experiment is not started. That is cause and effect, though they are bound together, they are reversed in time. Cause occurs after the effect is observed. This is the second unresolvable paradox. At this time, I am not willing to accept the hypothesis that cause can occur after the effect.

The third unresolvable paradox is "What can I do?" That is, if the basket fills up with billiard balls before I set off the experiment, can I choose not to set off the experiment? More programmers' stuff - a nested loop within a nested loop.

IV. CONCLUSION

Time travel can only be possible if we can prove, without unresolvable paradoxes, an effect prior to cause, for any case within the boundaries defined by the wormhole mechanics. The example above shows that this is not possible with our current understanding of space-time.

"Our current understanding" is the crux of the issue here. Let's explore options in an unbounded manner. One possible explanation is that the wormholes mechanics are not correct. It might be mathematically correct and yet not be the correct model of the universe. If we start with the axiom that there is no past or future, only the present, then wormholes will always return us to the present. We observe the past only because the fastest signals, light, take time to travel across vast distances. What is happening "now", in that vast distance is different from what we are observing "now."

In order for any theory of time travel to be viable we must first resolve any paradoxes or at least expose them as not being paradoxes. Only then can we develop any plausible theory of time travel. I hope that this paper has helped to lead us in that direction.

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