

**From:** Jeffrey Epstein <jeevacation@gmail.com>

**To:** Lisa Randall <[REDACTED]>

**Subject:** Re:

**Date:** Fri, 02 Oct 2009 21:59:50 +0000

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sorry,

On Fri, Oct 2, 2009 at 5:41 PM, Lisa Randall <[REDACTED]> wrote:

I think I'm reaching the limits of my ability to disentangle grammar and spelling but here goes:

Jeffrey Epstein wrote:

thanks , question , what does it look like if time is running backward , wouldn't it be decelerating,, into flat space from the singularity outward,, therefore explosion than

[then]

expansion.

It looks like big bang, not inflation before horizon. So not explosive expansion.

but always slowing after

crossing the horizon .

after crossing horizon there isn't really a cosmological interpretation anymore. Time and space have switched back.

looking in reverse it appears things accelerate

as they approach,, charged would be as a result of the deceleration.

don't understand this last comment.

On Fri, Oct 2, 2009 at 5:27 PM, Lisa Randall <[REDACTED]>  
<mailto:[REDACTED]>> wrote:

Hi Jeffrey. It was interesting-as always.

For your question, let's first straighten out that there are 3 types of bhs we might be discussing: Schwarzschild, charged, and Kerr. I didn't say much about Kerr--I mostly discussed charged-- since they are changing with time and a bit more complicated but indeed they have 2 horizons (just like charged black holes).

Two horizon scenario means time and space switch twice so at singularity you are back to ordinary time space identification. So let's first just consider Schwarzschild (uncharged, not rotating). In that case you are on the right track. Reversing time and coming from the singularity, it pretty much looks like a 2d big bang scenario (with the other 2d in a compact sphere). Space expands out until you reach the horizon and eventually goes over into flat space. It's not really accelerated expansion but still somewhat along lines you suggested.

If there are two horizons (charged black hole case) and you are in between them (we called this Whoville because it looks like space has shrunk to zero but actually spacetime has not and there is a

finite time between them so there's a whole world invisible to the outside) what happens is you alternate between big bang and big crunch in the full extended spacetime.

Jeffrey Epstein wrote:

Lisa . thanks,, for your time,and patience if i understand the Kerr equations , and your explanation correctly , time and space appear to exchange coordinates , inside a black hole. , that assumes that time is unidirectional. doesn't it appear that if you ran negative time , it would look like any other explosive transaction. great acceleration. emanating from the second horizon outward slowing to a mere expansion . It would appear that " time" got shot out of the black hole. created by a space collapse at the singularity.

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