

**To:** Jeffrey Epstein[jeevacation@gmail.com];

**From:** Lisa Randall  
**Sent:** Fri 10/2/2009 9:41:49 PM  
**Subject:** Re:

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  
> <randall@physics.harvard.edu <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: Schwarschild, 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 Schwarschild (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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