

Re: How long is a muon when at rest?

Source: <http://sci.tech--archive.net/Archive/sci.physics.relativity/2005-05/msg02151.html>

- *From:* dubious@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx (Bilge)
 - *Date:* Sat, 28 May 2005 09:38:31 GMT
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Arthur Dent:

>I was actually addressing Bilge, but I am surprised to learn that

If you're addressing me and you expect a reasonable response, you'll need to write a reasonable question. I've already addressed what you've listed below as objections. You saw fit to misquote me. You claimed that you didn't want to discuss particle properties. If that is true, then stop discussing particle properties. If you want to discuss particle properties, then I've already told you what needs to be discussed – relativistic quantum field theory. Whichever you want to do is fine with me. You decide which. I'm not going to go along with some hidden agenda in which you set up a strawman where you pretend not to discuss something until you see a good opportunity to try and create a contradiction where none exists.

>having mass does not imply having density since density is defined as
>mass/volume. When I went to school, division by zero was undefined and
>you seem to accept a zero volume for a finite mass, or, as some would
>put it, a singularity.

When you went to school, did they also tell you that your division by zero objection applies to classical theories and one of the reasons that relativistic quantum field theories exist is to solve the problems with classical theories?

>It is, however, immaterial to the original question,

So, why do you keep bringing it up? Just to keep saying something that is incorrect and has been answered by repeating that it's irrelevant?

>since I have now replaced the "length" of the muon with two
>comoving point-like muons a fixed distance apart, tagged as A and B,

Why are you making this so obtuse? What is it you want to know? If you aren't trying to set up some strawman as a troll, why all of the legerdemain? Is there some reason you can't just ask the question you want answered without creating a rube goldberg scenario?

>and am asking if Einstein's definition of time, to wit, the time for

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>light to travel from A to B is equal to the time it takes to travel
>from B back to A. Perhaps you could be kind enough to address the real

What's the problem? A and B are separated by a fixed distance.
You just said so above. The distance from A to B is the same as
the distance from B to A. Is there some reason that it should
take more time one way than the other given that the velocity
of light is the same in both directions?

>problem instead of skirting around it, or trying to make it into fault
>on my part, as others have tried to do. Or perhaps you cannot. There
[...]

This is straight forward. Take out a piece of paper and a pen.
Draw a horizontal axis and label it 'x'. Now, draw a vertical
axis and label it 'y'. Pick a point along the 'y' axis. Obviously,
the distance from the origin to the point y is,

$$d^2 = (0-0)^2 + (y-0)^2 = y^2$$

Now draw a curve from the origin that intersects the same point,
but isn't a straight line. Is that line the same length as the
vertical line I just described? Is it conceptually difficult
to understand how those two paths between the origin and the point,
(0, y) can be different lengths? How long is the second path?
Well, it's:

$$d = \int \sqrt{dx^2 + dy^2}$$
$$= \int \sqrt{1 + (dy/dx)^2} dx$$

Now erase the letter 'y' and write 't'. Does changing the letters
make the difference in the lengths of those two paths any more
mysterious? I hope not. The only difference is now there is a minus
sign in the expression for the arc length,

$$d = \int \sqrt{dt^2 - dx^2}$$
$$= \int \sqrt{1 - ((dx/dt)^2)} dt$$

Above, $dy/dx = \tan(A)$. Here, $dx/dt = \tanh(A)$. If you know how to
parameterize the curve you drew, then you can solve for the length
of the second path. Now just put the one twin on each path.

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- **Follow-Ups:**
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 - ◇ From: Arthur Dent

- **References:**
 - ◆ **Re: How long is a muon when at rest?**
 - ◇ From: Arthur Dent
 - ◆ **Re: How long is a muon when at rest?**
 - ◇ From: parallelepiped
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