Re: Einstein's math and physical objects

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From: Todd (*nope_at_nospam.com*)
Date: 01/15/05

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"Tom Roberts" <tjroberts@lucent.com> wrote in message
news:Zo_Fd.9184$Vj3.729@newssvr17.news.prodigy.com...

> *dseppala@austin.rr.com wrote: [...]*
> *Harry wrote: [...]*
> *Todd wrote: [...]*
>
> *You guys are all confused.*

>

Possibly.

> *In its initial inertial frame A, start the disks and wires spinning*
> *(together). So at any instant in time in this frame the wires remain*
> *parallel to the X axis and do not touch or cross. Note I stipulate stiff*
> *wires that do not bend outward due to their rotation, and that the disks*
> *remain rotating synchronously in this frame (e.g. mounted on a common*
> *axle).*
>
> *If you don't agree with that, then that's the problem −− you don't*
> *understand the physical situation.*
>

Harry and I are interested in the original situation proposed by David.
Unfortunately, the situation you are describing is different.

> *Given that, look at it from another inertial frame B moving along the X*
> *axis relative to frame A. In this frame, due to the difference in*
> *simultaneity, at any instant in time the wires will not be straight, but*
> *will be a helix wrapped around the surface of the cylinder with the same*
> *radius as the disks. How much wrapping there is depends on the spacing of*
> *the disks in frame A, their rotation rate, and the relative speed of frame*
> *B wrt frame A. In particular, no matter how much wrapping there is, the*
> *wires never touch or cross[#].*
>
> *If you don't agree with that, then that's the problem −− you don't*

> understand SR.
>

You've just described a simple scenario that I (and Harry, too, I bet) have no problem with. Unfortunately, this is not the situation we find interesting.

> Yes, Harry, I have indeed "inversed" the original situation
> here. Because this is simpler to describe and understand.
> So back to the original situation:
>
> Instead of the previous situation, accelerate the spinning disks using
> Born rigid motion until their speed wrt frame A is the same as that of
> frame B above, but in the opposite direction; call this frame C. Now
> looking at the wires from frame A, they appear EXACTLY the same as when in
> the previous situation we looked from frame B at the spinning system at
> rest in frame A. In particular, no matter how much wrapping there is, the
> wires never touch or cross[#].
>
> If you don't agree with that, then that's the problem −− you don't
> understand acceleration via Born rigid motion.
>

I'll venture to speak for Harry and say we both agree. But, again, this is not the situation we find intriguing. We want to consider David's original situation where the disks and wires are NOT Born accelerated. In David's situation the disks are accelerated in identical manners relative to A (reminiscent of the Bell spaceship paradox). Hence, there never develops any relative rotation of the disks from the point of view of A. If the wires are thought of as light−weight elastic threads, what will be the final configuration of the threads from the viewpoints of A and B? One thing we have realized is that this question is somewhat ambiguous. To make it well defined (hopefully) we have to stipulate not only how the disks are accelerated, but also how the _threads_ are accelerated.

One possibility is to assume that external forces are applied not only to the disk but also to the threads in such a manner that all points of the threads undergo identical accelerations in frame A (the same acceleration as the disks) such that the threads are always parallel to the x−axis in frame A. Once, the acceleration is over, it should be clear that B will see the threads in a helix shape.

Another possibility (the one we are intrigued by) is where we assume no external forces are applied to the threads at all − thus they assume whatever shape is dictated by their internal tensions and stresses alone. Although we feel that we know what the final shapes will be in A and B, we would like to understand the DYNAMICS of what's going on from the point of view of A. That is, how do observers in A account for the forces that distort the threads into variable radius helices (if, in fact, that is the shape they assume).

If you don't agree that the shapes are variable radius helices in A in the second possibility, then please explain. (I wouldn't be too surprised to find out that I'm mistaken about this.) If you do agree, then why did you start off by saying we are confused?

> *[#] Exercise for the reader: prove they do not touch or cross*
> *even if the rotation rate and/or relative velocity are so*
> *large that there are N full−turn wraps, with N greater*
> *than the ratio of disk spacing in frame A to wire diameter*
> *in frame A (i.e. if one wrapped such wire smoothly and*
> *tightly around the cylinder one could not put N turns*
> *in a single layer because the wire is too thick).*
> *Hint: This is a very easy proof.*
>

Well, I don't think you could ever have N greater than the ratio of disk spacing in A to diameter of wire _in A_ unless you are defining 'diameter of wire in A' differently than I would. Frame A sees the wire wrapped around the cylinder and I would define the diameter of the wire in A as the diameter of a perpendicular cross−section of the wire according to measurements in frame A. That is, suppose you take a 'snapshot' of the cylinder 'at one instant of time' according to simultaneity in A. The wire will be wrapped around the cylinder and it's diameter in A will be contracted relative to the wire diameter in B. The diameter of the wire in A is inversely related to the number of wraps in A such a way that you can never succeed in making N greater than the ratio of disk spacing in A to diameter of wire in A.

>
> *[This is getting too repetitive, so I probably won't respond*
> *further.]*
>

[Shrug]

Todd