The twins paradox and quantized space-time

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Abstract

Albert Einstein's twin paradox [1] cannot be visualized through our standard four-dimensional (4D) space time structure and there is a need for a fundamental change in our space-time structure in order to truly overcome the paradox. This change will be an important step towards a unification theory, between general relativity and quantum mechanics.

Introduction

Imagine two identical trains A & B with an infinite length, standing still relative to each other (figure 1) and the passengers in both trains are biologically identical in their DNA and age (passengers in A are identical to each other and they all are identical to all the passengers in B). This means that trains A and B are an identical laboratory setup.

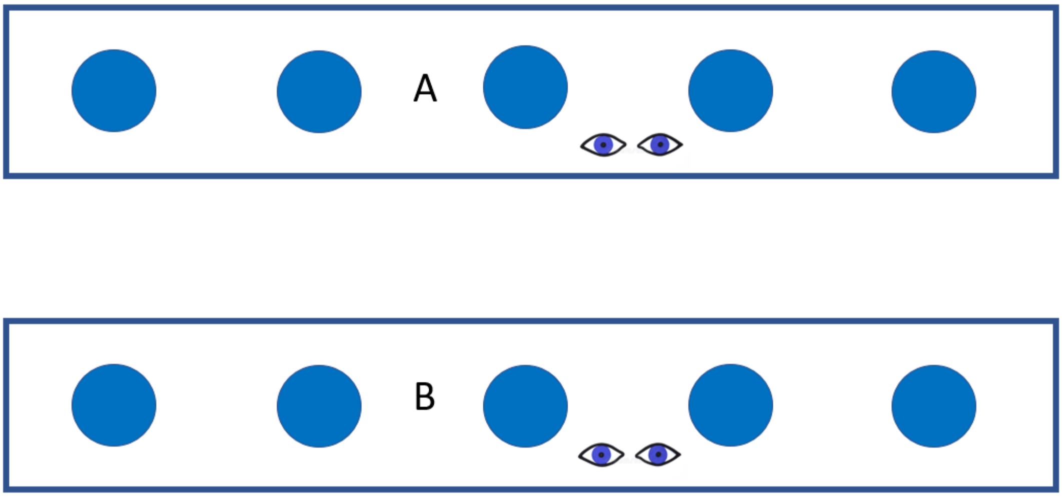

Figure 1: Trains A & B are identical, and they are both in the same frame of reference (can be also referred to as reference frame). The blue circles illustrate the identical passengers. The two trains are infinite in length so the entire time there will be an overlap between them and they can see one another the whole time.

At a specific time, the trains accelerate in opposite directions to 0.999, the speed of light relative to each other. After the acceleration phase, looking from train A's frame of reference (figure 2), The passengers in train A will age faster than their identical twins in train B. Looking from train B's frame of reference (figure 3), The passengers in train B will age faster than their identical twins in train A. Since both trains are identical, passengers on train A will see in train B their past in slow motion and passengers on train B will see in train A their past in slow motion. Now the paradox begins, imagine a passenger on train B suddenly jumping onto train A. Since no one can jump into his past he will seem to fade away and disappear when observed by the passengers in train B (figure 4). This paradox will lead to a new idea regarding the structure of space-time.

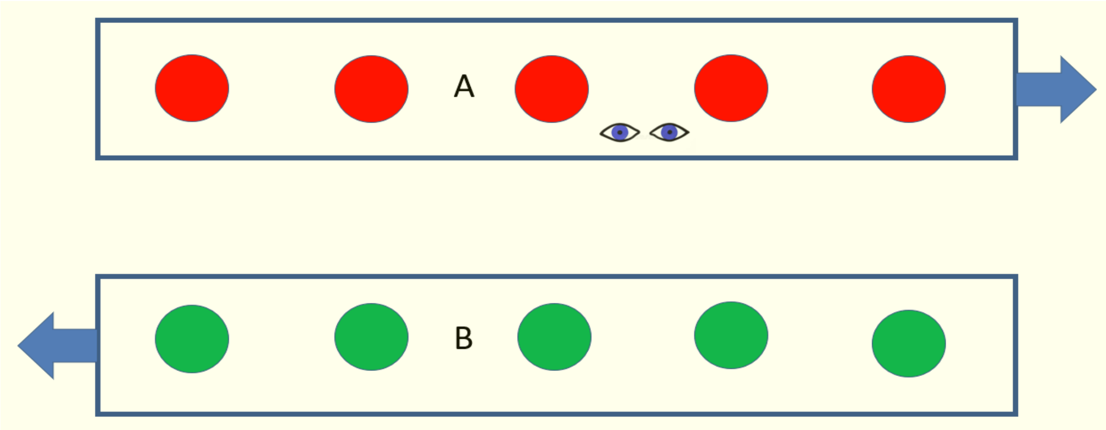

Figure 2: Trains A & B, infinite in length, travelling in opposite directions at 0.999 the speed of light relative to each other. This image represents the frame of reference A at train A illustrated by the yellowish background and the pair of eyes on train A. length contraction is not illustrated but time dilation is illustrated through the red color representing older passengers on train A versus their younger twins represented by the green color on train B.

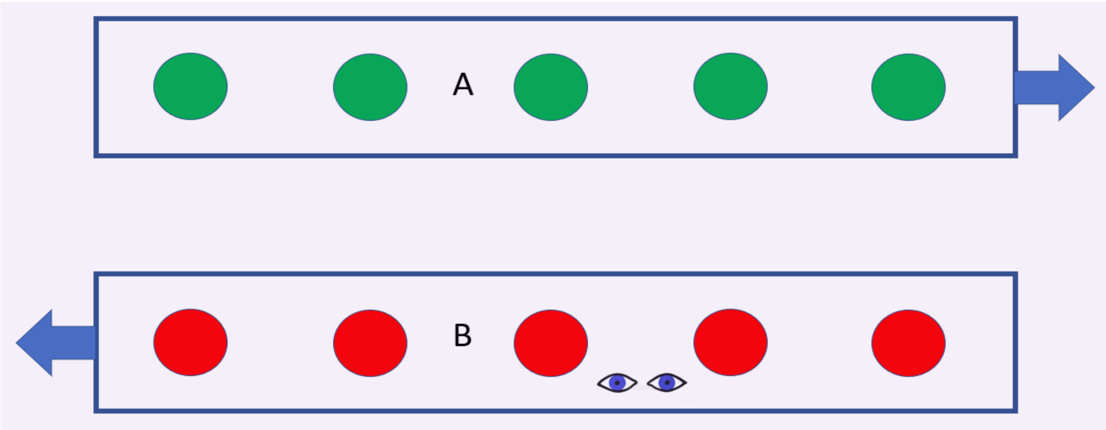

Figure 3: Trains A & B, infinite in length, travelling in opposite directions at 0.999 the speed of light relative to each other. This image represents the frame of reference B at train B illustrated by the purplish background and the pair of eyes on train B. length contraction is not illustrated but time dilation is illustrated through the red color representing older passengers on train B versus their younger twins represented by the green color on train A.

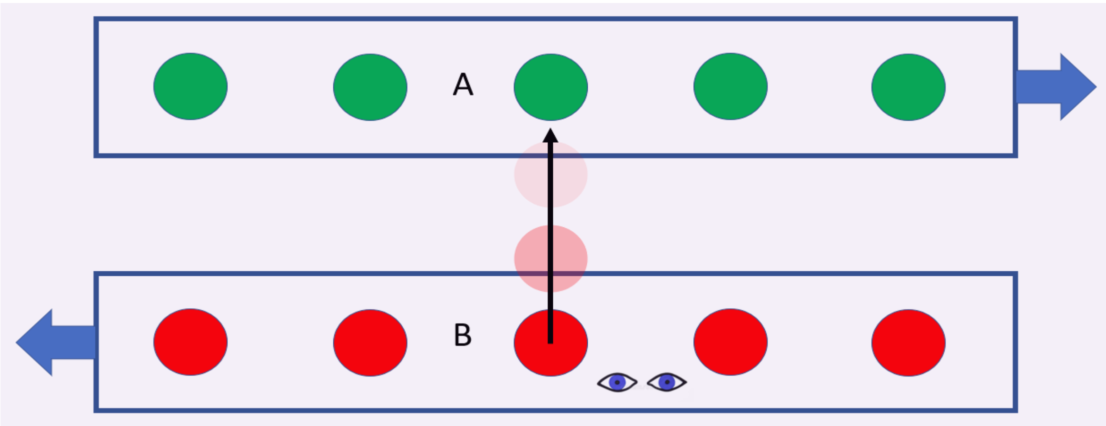

Figure 4: Trains A & B, infinite in length, travelling in opposite directions at 0.999 the speed of light relative to each other. This image represents the frame of reference B at train B illustrated by the purplish background and the pair of eyes on train B. length contraction is not

illustrated but time dilation is illustrated through the red color representing older passengers on train B versus their younger twins represented by the green color on train A. As one of the passengers on train B jumps suddenly onto train A, From the perspective of the passengers on train B he fades away and disappears since he cannot jump into his past, since train A represents their past in slow motion. This is another version of the twin's paradox. The passengers on train B (reference frame B) will observe one of their passengers fading away and disappearing as he jumps onto train A (reference frame A). He will reappear later, at reference frame A, based on the time dilation difference between reference frame A and B. But for a period of time, this passenger will disappear, based on the observations taken at reference frame B. This leads to the conclusion that reference frame A and reference frame B do not share the same space-time dimension and there must be another dimension to which passenger B can disappear for a period of time.

The grid dimensions

Let's quantize our three-dimensional spacetime into local three-dimensional symmetrical quantized units in the size of Planck length (the smallest physical length), in each of the three dimensions. Let's add another nonlocal (non-quantized) grid like dimension (the grid dimension). These space quantized units are floating in the grid dimension like a floating matrix. Each reference-frame is a different matrix floating in the grid dimension and all the reference frames are staggered next to each other (figure 5). Looking at figure 5, we can now visualize both reference frames A and B quantized and staggered next to each other, floating in the grid dimensions.

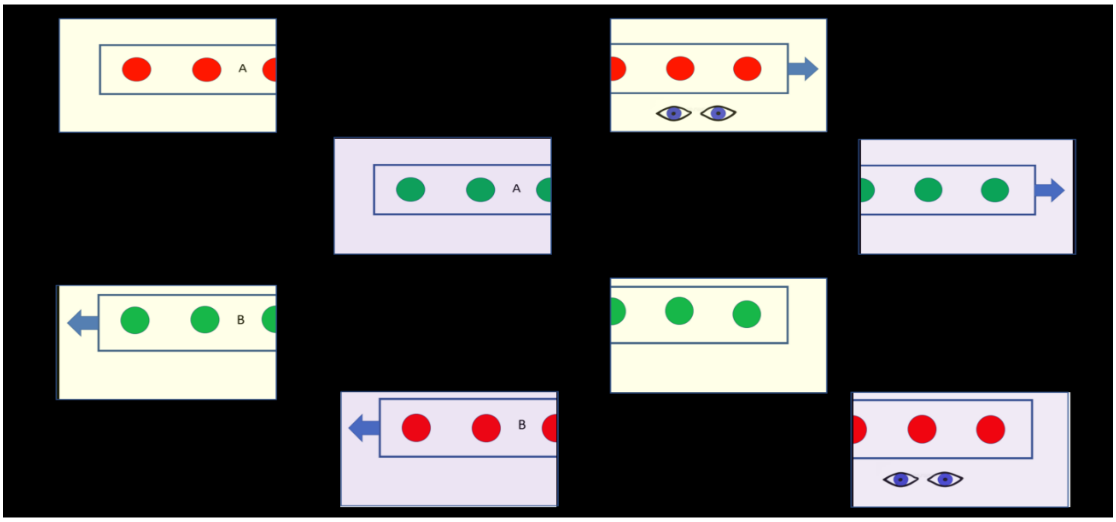

Figure 5: Both reference frames A & B are quantized and staggered next to each other floating in the three-dimensional grid dimensions (illustrated as the black background between them). The quantized unit of space is expected to be in the size of Planck's length, probably a symmetrical three-dimensional spherical shape. The large two-dimensional rectangle format is illustrated for convenience reasons only, as the quantized units of space in the figure. If time is quantized to Planck time, the grid dimension will be four dimensional. As the passenger from frame of reference B accelerates towards Frame of reference A, he will disappear from frame of reference B point of view, into the grid dimension and will pop up after a period, based on the time dilation between these reference frames. In the illustration there are only two frames of reference A & B, but there are infinite number of quantized frames of reference arranged together in some kind of pattern (e.g. staggered next to each other), connected by the grid dimension.

Conclusion

Based on train A point of view (frame of reference A), the passenger that jumped from train B, **was younger than them**. On the other hand, based on train B point of view (frame of reference B), he was **older than the passengers on train A**. in order to overcome this conflict in expectations between the two frames of reference, as the passenger from frame of reference B jumps and accelerates towards Frame of reference A, he will disappear from the frame of reference B space-time point of view, into the grid dimension, and will pop up on train A after time period t, when the passengers on train A are older than the passenger arriving from train B . During this entire time t, the passenger jumping from train B to train A almost stayed the same age, since from his accelerating frame of reference point of view, only a few seconds passed during the jump. Period of time t, is dependent on the time dilation between these two frames of reference A & B. Eistein's twin paradox is a deep paradox which can be solved in this case, only by separating the frames of reference A & B, into two space-time worlds. This can be done in a symmetric way, only by quantizing each frame of reference space-time world and staggering them together in an extra non-local grid like dimension. There are infinite number of quantized frames of reference staggered together floating in the grid dimension. Quantizing space time and adding an extra nonlocal grid dimension between them enables the quantum mechanics nonlocality (e.g., quantum entanglement [2] – "spooky action at a distance"). This new approach to space-time, can be the first step towards a new grand unification theory between general relativity and quantum mechanics.

REFERENCES:

[1] https://en.wikipedia.org/wiki/Twin_paradox

[2] https://en.wikipedia.org/wiki/EPR_paradox