Twins Paradox of Relativity Is Absolutely Wrong

Physicists neglected the effects of General Relativity, which changes Everything

Einstein had died in 1955. Around 1960, some Physicists came up with an idea which got a lot of attention but **it was dreadfully wrong for having been based on a wrong assumption. They had (correctly) considered Einstein's Special Relativity regarding a Time Dilation effect, but they (wrongly) neglected Einstein's General Relativity and any time-rate effect it might have.** In fact, being unable to actually **solve** Einstein's set of ten Tensor Calculus Riemannian (curved space) equations upon which he based his Theory of General Relativity, in the early 1960s they made a colossal blunder in **assuming** that General Relativity caused the **same** Time Dilation effect as was known for Special Relativity. That wrong assumption is STILL held by the entire Physics community as being valid, and it is **not**.

This universal logical blunder soon was developed into a very popular (and universally accepted) story about a pair of identical twin brothers. The "Twins Paradox" story started out with two identical twins, but then treated them very differently! **Two entirely different logical errors were applied.** One was that Einstein had made very clear that since each of the twins in that story was **not accelerating** (during their story), they must each see the entire Universe from what is called an "Inertial Rest Frame of Reference" (one from here on the non-accelerating Earth and the other from the non-accelerating spacecraft). The other enormous flaw was that they had wrongly overlooked that **before their story began, the traveling twin had to accelerate enormously** to go from being stationary having lunch on Earth with his brother to receding from the Earth at a speed comparable to the speed of light. During all that necessary acceleration, **those 1960s Physicists absolutely overlooked that Einstein's General Relativity must have a time-rate effect of its own, which was all neglected**.

The first major flaw can be more obvious if we put the traveling Twin onto a giant planet, exactly like our Earth. Still not accelerating, just a whole lot bigger than a tiny spaceship! We are going to call it "Earth2." **Actually, we cannot know for sure whether we are actually on Earth or on Earth2 in that story.**

The Earth twin does not accelerate so he **assumes** that he is also not moving (in the Earth's Inertial Rest Frame of Reference), but he does see that his distant twin (on Earth2) has a very high constant radial velocity, receding from the Earth. For our discussion here, we are going to say that we measured Earth2 as receding from us at 0.6 c (the speed of light), really fast! **As far as they went, the 1960s Physicists were correct, and they were right that the Earth twin would see his rapidly receding brother appear to be aging more slowly than himself, due to something called Time Dilation, an unavoidable effect of Einstein's Special Relativity**. A simple formula (from Lorentz and FitzGerald) below, shows that the Earth twin would see the rapidly receding twin on Earth2 appear to be aging at exactly 0.8 times as fast as he was aging. This includes wall clocks, which he could see on both Earth (next to him) and through his excellent telescope, in the room next to his twin on Earth2.

The part that those Physicists misunderstood was that they never considered the experiences of the traveling twin! Since his Earth2 is identical to our Earth, and the Traveling twin (on Earth2) does not accelerate so he assumes that he is also not moving (in the Earth2's Inertial Rest Frame of Reference). The twin on Earth2 looks back at the Earth through his excellent telescope and sees that his twin brother (and the entire Earth) has a high constant velocity, receding from him (at 0.6 c). Are you following? What he sees is absolutely exactly identical to what we described that his twin on Earth sees! **In other words, due to the same Time Dilation Effect of Special Relativity, he sees his twin on Earth to appear to be aging exactly 0.8 as fast as he was aging, due to the same Time Dilation**. He even sees the wall clock next to his twin on Earth moving exactly 4/5 as fast as he sees his own wall clock moving!

So a more complete **(and correct)** presentation of the Twins Paradox would have added that the Spaceship (or Earth2) Twin would also see his rapidly receding brother (on Earth) appear to be aging more slowly than himself, by the exact same Time Dilation effect of Einstein's Special Relativity.

There can be no doubt about it, he definitely sees his twin brother on Earth receding from him at 0.6c velocity, and due to Special Relativity's Time Dilation, he also sees his Earth brother appear to be aging 4/5 as fast as he himself was aging!

As weird as that sounds, it would be true that both of the twin brothers would be simultaneously watching each other age more slowly than himself! That even includes watching each other's clocks clearly run only 4/5 as fast as he watched his own clock run!

There are practical reasons that this situation could not endure long, but if they could watch each other for five of their own calendar years (birthdays), during that interval they would **each see** their identical twin brother only celebrate **four birthdays**! Really weird, but true! (The reason that is impractical is that if the observed target was receding at 0.6 of the speed of light, for five years, they would then be around three light years apart, a really long distance apart, even for a really good telescope!)

These time-rate issues get much more odd if either of the twins were accelerating, as they would then not be in the (simpler) Inertial Rest Frame of Reference. When acceleration is present, then much more peculiar Riemannian (curved-space math) (Non-Euclidean) Geometry is necessary, and none of the math or physics that we are normally used to in Euclidean space (which we call Plane Geometry) can be used. This discussion will avoid introducing acceleration in order to be able to use the Euclidean (Plane) Geometry that we are all familiar with. By the way, that Riemannian Calculus is immensely difficult to do and some people used to say that only a dozen people in the world might understand Einstein's General Relativity because so few people could understand how to do the Riemannian Calculus for it. There might be a few more people who understand such things today. Personally, it took me about ten years of study before I felt I could do Riemannian Calculus sufficiently to really understand General Relativity.

Einstein had made clear that either non-Accelerating Inertial Rest Frame of Reference is equivalent. The fact that a planet might be large or a spaceship small is irrelevant. The wrong or incomplete version of the Twins Paradox had correctly applied the Time Dilation effect of Special Relativity but only from one perspective, ours here on Earth! They totally incorrectly neglected the same Time Dilation effect of Special Relativity as seen by the traveling twin. **However, the Earth is not allowed to have a "specially preferred Inertial Rest Frameof Reference," just because we happen to live here!**

Continue your thinking of these two views of things and you can see how obvious this logical flaw is by looking at how the Twins Paradox story ends! Allegedly, the Earth twin believes that he will be older than his twin brother when they again meet at the end of the story (since he had continuously watched him aging more slowly during the entire story). However, that (other) (twin) Physicist would have started out the story with the perspective of a non-accelerating spacecraft (or Earth2). By Einstein, he has watched an absolutely identical story unfold, where he has continuously watched his twin brother on Earth aging more slowly than himself. So he would also believe that he is the older brother! **BOTH CANNOT BE THE OLDER TWIN WHEN THEY MEET!** Either one of them would have to be older or they are exactly the same age when they meet. The reasoning below establishes that, logically, this last situation is true and **they would meet where they are exactly the same age.** (as long as they were then again in the same Inertial Rest Frame of Reference when they met.

The result of this absolute demand of (Special) Relativity and Einstein is that both twins in that hypothetical story constantly watch the other one age more slowly than himself! The interesting part is what those 1960s Physicists had overlooked! They totally ignored the other viewpoint, of the other twin!

Those Physicists only looked at one perspective, that of viewing from Earth, and they never considered the absolutely equally logical and correct perspective of the spaceship (or Earth2) traveler.

Getting back to the first logical flaw, the (extended) story, where the travelling twin had to accelerate ferociously to go from sitting in a cafe with his brother on Earth to whizzing away from Earth at a velocity of 0.6 c, they absolutely overlooked the enormous time-rate effect of that acceleration. If the Twins Paradox story was extended to include that very important part of the trip, everything would be very different. For their Twins Paradox story, they necessarily excluded everything EXCEPT for the "constant velocity" portion of the trip, when their limited logic seemed acceptable. The entire true story is absolutely different.

A fuller view of their incorrect Twins Paradox story would correctly have both twins watching their twin brother age more slowly than himself. This peculiar situation is a necessary result of Special Relativity and Time Dilation, for each of the brothers!

No Physicist ever considered what the Universe looked like from the spaceship, then or since, so the only perspective that was considered has been from here on Earth, which was dreadfully wrong regarding logic and Relativity.

The true situation actually makes perfect sense! It necessarily includes an issue which those 1960s Physicists never even considered, that of General Relativity and its own time-rate effect applying during the (neglected) Acceleration and Deceleration portions of the Twins Paradox trip.

The true story would need to be corrected from some of its flaws, for an actual result to be determined. **One main part of that correction is that the constant velocity portion of a space trip, where Special Relativity would apply, is actually only a small portion of the entire trip.** Much of the trip is taken up during acceleration and later, deceleration, where the General Relativity time-rate effect applies. In fact, as fully described and discussed below, an entire round trip involves six different (sequential) situations, three on the way out (acceleration, constant speed cruising, and deceleration) and the same three on the way back home. The different stages are quite different regarding the rate of passage of time, and **an important result is that an entire trip always takes the exact same total amount of time**, although the six different perceived time rates and periods of passage of time are quite different for the two twin brothers and also different for their perception of the life of the other brother.

For example, during a popular version of the Twins trip to a planet orbiting Alpha Centauri, the traveling twin might initially experience more than two years of acceleration (under GR circumstances), followed by a few weeks of constant velocity cruising (under SR circumstances), followed by another two years of deceleration (and again under GR circumstances), where he personally experienced an entire outbound trip of around 4.5 years (that is, 2.2 + 0.1 + 2.2 years). The observing brother on Earth might have watched an Earth month of acceleration, followed by four Earth years of constant velocity cruising, followed by an Earth month of intense deceleration, where he watched a full outbound trip of about 4.5 years (that is, 0.1 + 4.3 + 0.1 years). However, note that the two would describe the trip very differently! The traveling twin would (naturally) experience two birthdays during the acceleration and another two birthdays during the deceleration, so he would not sense anything weird. **The Earth twin would see the traveling twin seem to move and age really fast during that**

"officially observed and logged Earth month of acceleration" where he watched two (annual) birthdays be celebrated. Then, for the next four Earth years of observing, he would see Time Dilation of Special Relativity, where he would log the activities of the really slow moving traveling twin as occurring really slowly! No birthdays are seen during those four Earth years of observing from Earth while four birthdays were celebrated here on Earth! Then he must decelerate, in order to return to the Inertial Rest Frame, which means very rapid aging as seen from Earth, while the traveling twin would not experience anything weird while he had two more birthdays, while the Earth twin logged watching only one month of apparent really fast activities!

Each brother would celebrate four birthdays and watch his brother celebrate four birthdays, but just not at the same time!

There are two other perspectives which we can examine. The traveling twin, looking back at us, watches his Earth twin brother spend about 2.2 years of aging slightly faster during which he watched the Earth twin age an extra day, then he would watch his Earth twin age slightly more slowly during the next few weeks, followed by another 2.2 years of slightly faster aging during deceleration, which results in him watching the Earth twin age a total of about 4.5 years during his outbound trip. The remaining perspective is that of the Earth twin regarding his own life during the whole observed trip, where he would age 4.5 years, as is considered normal in this Inertial Rest Frame of Reference here on Earth. Note that in all four perspectives, exactly the same total amount of time passes during the whole trip, 4.5 years. They each celebrate four birthdays and see their brother celebrate four birthdays, although not at the same time!

Neither of the twins either experiences or sees the twin age any total amount of time except the correct 4.5 years. Neither of the twins would ever experience any travel velocity greater than the speed of light and neither would ever see his brother do so. **More interesting is that exactly at the halfway point of the trip, during the constant velocity cruising period, both twins watch each other age more slowly than himself, exactly per the Time Dilation of the Special Relativity that applies then. This is the explanation for how and why they both see the other age more slowly than himself, which IS an unavoidable consequence of Special Relativity of constant velocity cruising!** Also, during each of the acceleration and deceleration portions of the trip, both twins see the other age faster than himself. In one case, this appearance of "faster living" could be very obvious while in the other case, the "faster living" would be difficult to detect. **The net effects of these factors exactly cancel out the Special Relativity Dilation effects seen during the relatively brief constant velocity portion of the trip, so the total length of the entire trip does not and can not change**.

(I apologize for one detail in the above story regarding Alpha Centauri. In order to keep the logic and math simplest for clarity, I used a faster maximum trip velocity than the 0.6 c referred to above. At a maximum velocity of 0.6 c, the Earth observer would see the Time Dilation effect of 0.8 so that the constant velocity portion of the trip appear to last shorter than the 4.3 years described above and the traveler would experience a much longer time than one month during that constant velocity portion of the trip. The math to calculate the exact values is fairly complex Integral Calculus, and so I used simpler time intervals that would have applied to a much more powerful rocket and a higher maximum trip velocity.)

That popular (wrong) Twins Paradox trip to Alpha Centauri also has another enormous logical flaw. Any school student can calculate that for a spacecraft to rapidly accelerate up to near the speed of light, the spacecraft would have to accelerate at many Gs for the whole trip. No human could survive such a trip! If the spaceship passenger(s) were considered, the acceleration and deceleration during the entire trip needs to be around 1.0 G. Otherwise the passengers might struggle around as though they weighed two times or ten times their normal body weight, where their muscles would struggle. Their hearts would also not be able to pump blood to their brains at G = 3 or higher without passing out and dying! At a continual acceleration of 1.0 G, which is 9.8 meter/second^2, such an acceleration would obviously take 15 million seconds (about one-half year of acceleration) before it could get up to even a velocity of half the speed of light (or $1.5 * 10^8$ meters/second). If the spacecraft had an acceleration of just 2 Gs, the passengers' bodies would have to endure three months of severe stress on their hearts and circulatory system, where none might survive such a lengthy stress. Then two times the stress again, for another three months, during the deceleration of the trip out and again for both the acceleration and deceleration of the return trip to Earth. Where StarTrek zips around the Universe at conveniently enormous accelerations, no humans could survive such episodes!

Einstein clearly said that if there is no acceleration, what he called Special Relativity, and Time Dilation can occur, both ways! The Earth cannot be treated as a special reference source. So when a Twin who remained on Earth (who does not detect any acceleration on Earth) looked at his traveling twin in a spacecraft, he does see that the traveler appears to be aging more slowly than himself, so that that claim of the Twins Paradox is true. **But it is also true that the Twin in the spacecraft does not detect any acceleration of the spacecraft and so he also considers himself to be in a Rest Frame of Reference, and so he also sees his Twin on Earth to seem to be aging more slowly than himself.** They both see the other as aging more slowly than themselves! (briefly, and only during constant velocity travel!)

Einstein had died in 1955, so he was not around to correct those logical blunders of the Twins Paradox Storytellers! The Physicists who dreamed up the Twins Paradox in the early 1960s were somehow ignorant of these basic requirements of Einstein's Relativity, and so they came up with an idea that is totally illogical and impossible. In the following sixty years, no Physicist or anyone else has seemed to notice this really obvious blunder, and the world seems to universally accept the clearly fallacious Twins Paradox!

Several fields of modern Astrophysics are even completely built on this wrong idea! Time Travel, Wormholes, and maybe even Black Holes have never actually been detected, because they are impossible and illogical ideas that were dreamed up based on foolish assumptions.

The entire principle on which Relativity is based is that two observers in different circumstances in the Universe must see a Universe which makes logical sense to each of them and that they must also agree on basic things when they would ever meet again after being out of contact.

The central assumption of the very popular (wrong) Twins Paradox entirely violates both of these requirements!

The people who dreamed up the Twins Paradox (in the early 1960s) had made a drastic error in only considering everything from the perspective of the Earth. And in never even considering the time-rate effects of Einstein's General Relativity.

The claim that a space ship moving away from (or toward) the Earth (or any other viewer) at extremely high constant velocity would show an Earth observer that the spaceship occupant was apparently moving in slow motion **is correct**.

It does not have to be a spaceship, but it could equally well be an entire planet (but it still has to be moving away or toward you at constant velocity.)

The popular but wrong Twins Paradox also has yet another obvious flaw! According to that story, the traveler leaves the Earth (knowing that Alpha Centauri is 4.3 light years away, and since nothing can travel faster than light, it clearly requires more than 4.3 years for even light to get there from Earth). **However, supposedly, in that Twins Paradox story, after only three weeks of traveling, he arrives at Alpha Centauri**. There are a lot of wrong assumptions which were made to create this preposterous claim! Relativity has an absolute limit of nothing ever being able to travel faster than the speed of light. But that story would have the traveler be able to go into Court to testify that he had had lunch with his twin brother on Earth and then three weeks later, had lunch at a cafe on a planet of Alpha Centauri. **In other words, he had just traveled at 70 times faster than the speed of light (going 4.3 light years distance in three weeks of time!)**. Einstein made clear that NO such violation was ever possible! You will notice below that this (correct) description requires the traveler to take, at best, around 4.5 years to travel the 4.3 light years distance, in other words, with no perception by anyone of ever violating the speed of light.

However, the Earth is not a Special Reference Frame! If it had been that you lived on that other planet (Earth2), and saw the Earth moving toward you or away from you at constant velocity, you would see everything on the Earth appear to be moving and aging more slowly than yourself. **The interesting fact is that both observers would certainly see the other as moving more slowly and aging more slowly than he personally experiences.** No one in Physics seems to have noticed this obvious and unavoidable fact! (blunder!)

So you have two observers watching each other where they both observe what is called Time Dilation. This sounds pretty bizarre, but it is a certain fact! The presentation below explains how this can be possible, and even that it is required in order for the Universe to be logical to everyone! The math equations to support this peculiar situation are also presented below.

This situation is even true if the two planets are moving toward each other or away from each other at a velocity near the speed of light, where each might clearly see the other as aging 1/2 or 1/10 as fast as himself! Both might watch the other celebrate ten birthdays while he only celebrated one! This probably has you doubting Physics or me or both, but if you read and understand the following presentation, you will see why this has to happen, and you will even see why it is beautifully logical in every detail!

Consider this situation: You, in your laboratory on Earth, have a tremendous telescope, which you train on a man in a laboratory on a different planet (Earth2), which you have determined to be moving away from Earth at very high (constant) speed. Your telescope is so excellent that you can even see the second hand on the clock on the wall next to that other scientist, and you certainly see that his clock's second hand appears to be moving more slowly than the clock which is on your wall in your laboratory. You can even calculate the difference in the rates of the two clocks, based on a simple formula (below) and it IS the correct effect of Special Relativity which is called Time Dilation. This is the basis on which the Twins Paradox had been built. It is correct in as far as it goes, but it is extremely incomplete and horrible science!

What those 1960s Physicists neglected to ever consider is the view from that man you are observing! HE also has an excellent telescope and he has it trained on you! He has no sensation of velocity on his planet (Earth2), but he certainly sees the Earth receding from him at extremely high velocity. He also has that same simple formula, with which he calculates the effect of Time Dilation which he would see on the rapidly receding Earth, with his excellent telescope. He then confirms that he sees the second hand on the clock on your wall appear to be moving more slowly than his own clock is moving.

Where those Physicists of the 1960s had only considered one-half of the actual situation, you now see the complete situation, where **both of the two scientists are observing the Time Dilation effect at the same time! They both can see the other as moving and aging more slowly than himself!**

I realize that this sounds impossible, but we will show below at both how and why it actually occurs, and even that simple formula that both scientists use to calculate the slowing effect they each see!

The people who dreamed up the Twins Paradox had not considered an entire planet but instead a small spacecraft. Apparently, their lack of knowledge of Physics caused them to think that the Laws of Physics

sometimes do not apply for small spacecraft!!

In other words, if those Physicists of around 1960 happened to be in such a spacecraft (which had no sensation of any movement due to the constant velocity of whichever one was actually moving) and they looked toward a rapidly receding Earth, they might have made the same error they did, **but from the (single again) opposite perspective!** Where the traditional Twins Paradox story has the youthful traveler meeting an elderly (Earth) twin brother at the end of the story, in this case they would have had an elderly twin in the spacecraft meeting a youthful twin brother who stayed on Earth! YOU CAN'T HAVE BOTH OF THEM BE OLDER THAN THEIR TWIN WHEN THEY WOULD MEET!

Neither the traveler nor anyone on the Earth would have any sensation of velocity! (After all, we are presently spinning at roughly 1000 mph, orbiting around the Sun at around 66,000 mph and being carried through the Galaxy with the Sun at around 45,000 mph, and you have never been aware of any of those movements!) **And so both viewers will certainly consider themselves as stationary! They each see the other as moving away at high speed and therefore we have a bizarre situation where two people watching each other must both see the other as aging more slowly than he is aging himself! This would actually be the truth!**

The correct description of the Twins story is quite different than has always been incorrectly assumed to be true. More than that, an extremely important lesson comes out of the correct analysis, which has implications throughout modern Physics.

There is an obvious example to use to show how wrong the Twins Paradox is, and you don't even need to be a Physicist to understand it! Say that both of the twin brothers fell into comas at the restaurant on Earth, where they each were not aware of whatever was going on. One stayed on Earth while aberrant Doctors decided to put the other in a spacecraft and aim it at a planet near Alpha Centauri (a star). Both remain in their comas while the spaceship is accelerating, but after the engines shut off and it then will continue to coast at constant velocity, they both wake up. They each remember nothing of previous events, due to their comas, but each is obviously concerned about his brother, and they get their telescopes out and point them at each other! The Earth brother sees that the spaceship brother is traveling away from him at very high constant speed, and due to the well-proven phenomenon of Special Relativity, he notices a Time Dilation, where his brother appears to be aging only 4/5 as fast as himself. His telescope is so good that he can even see the clock in the spaceship which appears to be clearly running at exactly 4/5 as fast as his own clock is running. Being a good scientist, he determines how fast the spacecraft is receding and finds it to be exactly 3/5 of the velocity of the speed of light (which we shall call 0.6c here).

$\sqrt{1-\frac{v^2}{c^2}}$ (Time Dilation factor for Special Relativity and Constant Velocity)

He gets out his pen and paper and does the simple calculation (shown here) regarding the Time Dilation effect and determines that he should see the spaceship's clocks to be running at exactly 4/5 as fast as his clock on Earth shows. This is the standard story of the Twins Paradox. It IS true! (However, this is only one side of the story, and then only briefly true, since it only considers the view from the Earth and only considers the situation during the constant velocity portion of the trip!)

Now consider what the spaceship brother sees. **He feels no acceleration, so he rightfully assumes that he is stationary**. (Just like us on Earth regarding all those high velocities that the Earth is doing now). In other words, he has no reason to believe that he has ever moved or accelerated (due to his lack of memory due to the coma.) He looks out and sees the Earth hurtling away from him at a very high constant velocity of 0.6c. His telescope is as good as his brother's, and he can clearly see that the clock next to his brother (on Earth) appears to be running at exactly 4/5 as fast as his own clock is running, and he also notices that his brother seems to be moving in slow motion. (There is nothing different in describing his perceptions than for describing his brother's perceptions). He gets out his pen and paper and calculates that due to Time Dilation, he should see his Earth brother appear to be moving in slow motion, and he mathematically confirms what he is seeing, that the second hand on the Earth clock is moving at exactly 4/5 as fast as on the clock on his spaceship shows him!

They both see the other brother as seeming to be living in slow motion, at exactly 4/5 as fast as he knows is true for himself! As weird as that sounds, (Special) Relativity requires that to be true. And, below, we will see the proof of why that can and is true, for **both** of them, and even the math to show it!

The people who dreamed up the Twins Paradox neglected to even consider the situation of the twin on the spaceship, and by doing that, absolutely fouled up everything! They had also made some poor assumptions regarding some very difficult math problems, which we will see cause to correct here. **The popular conclusion is dead wrong!** And you even see why that is true! The Twins Paradox breaks a basic Law of Relativity, that there can be no preferred perspective! How could Physicists have made such a bonehead error? And how could all the hundreds of thousands of Physicists since then have simply accepted the claimed statements, without noting that a bonehead assumption was so obvious? (As a Physicist, I am ashamed for all of us.)

A critically important fact is that such views of each other cannot be forever and are in fact only temporary. This will be explained below. (That happens to be another incorrect assumption of the Twins Paradox!)

The popular Twins Paradox totally contradicts this and requires (wrongly!) that when the traveler looked back at Earth, he would see everything on Earth going faster, exactly the opposite of what he must actually see, according to Special Relativity! (That was instrumental in why they claimed that the Earth brother would be older when they later met.)

Both of them necessarily have to see the same effect (known as Time Dilation) (but only during constant relative velocity portion of the trip), where the other one appears to be moving in slow motion, because neither can possibly know who is actually moving (at constant speed) and who is motionless!

This might seem impossible, as much of Relativity often does, but it is not. This will be clarified and fully explained below. **As peculiar as it sounds, when the Twins would be looking at each other during the constant velocity travel of the spaceship, they truly both see the other as appearing to move and age more slowly than he does himself!**. Actually, that is a basic requirement of Special Relativity, which was ignored when the Twins Paradox was dreamed up!

The correct resolution of this odd situation is that an entire trip of constant velocity is impossible if they are to ever meet again! **There must be periods when the spaceship is accelerating and later decelerating.** A complete trip therefore needs to be examined as three separate stages. The early part of the trip involves heavy acceleration, during which **General Relativity** necessarily applies. Once the acceleration ends, then the familiar constant velocity portion of the trip occurs, where very different **Special Relativity** circumstances necessarily apply. Finally, there must be a portion of heavy deceleration, during which **General Relativity** again necessarily applies.

To have assumed that Time Dilation occurs during all three stages was another horrific error by those 1960s Physicists, and it was not even based on any actual calculations! Einstein's actual equations of

General Relativity are so complex that no one has yet fully solved them! Those 1960s Physicists simply guessed that Time Dilation must also occur then, which turns out to be another error on their parts!

The necessary reality is that an opposite effect of Time "speeding" must occur during those General Relativity portions of the trip. Importantly, during those acceleration and deceleration portions of the trip, **they must both see their brother appear to live faster than themselves!** The well publicized effect seen from Earth during constant velocity is certainly true, but only during the Special Relativity constant velocity part of the trip. For an entire round trip, there are times of views of faster living which each will see that exactly counteracts the slower living that everyone knows about!

The specific views of the two twins who spend the entire trip duration staring at each other are rather strange and different, but, for each, the total effect of an entire trip is such that the faster and slower perceptions of clocks and living exactly cancel each other out, when the entire round trip is considered.

This result is required because the two could only ever again actually meet if they have no relative velocity in what is called an Inertial Rest Frame of Reference. If either should neglect the necessary acceleration or deceleration, they might be able to whiz past each other at enormous speed, and under such conditions, they would not share an Inertial Rest Frame to actually visit, and their ages might then seem bizarre. But as long as a complete trip is examined, it is easy to see that they are the exact same age once they again meet (and also when the traveler is in the cafe on the planet near Alpha Centauri which shares our (Earth's) Inertial Reference Frame of Reference.

So, not only is the Twins Paradox wrong regarding the cumulative effect as seen from Earth, but when the two brothers again meet back on Earth, they are both exactly the same age and they are exactly the age that everyone would have expected them to be! (and that they would both be if the one had never left Earth) Even an observer on some other planet (which shares our Inertial Reference Frame of Reference) would agree about that.

All Physicists have long known that there are necessarily two extremely different Relativistic effects which occur during the entire trip. The spaceship starts out accelerating from Earth, so General Relativity effects apply. Eventually he shuts off the rocket engine and then constant velocity travel would occur, and the well known Special Relativity effects would then apply. Finally, he would have to decelerate in order to be able to actually visit on Alpha Centauri's planet. And the same three stages occur on the return trip. Actually, there are only three brief moments during the entire round trip when the twin brothers could correctly say that they were of the exact same age (plus at the end of the trip when they are back together)! Other than that, they would each have portions of the trip where each was definitely older than his brother, as well as other portions where each was definitely younger. Their wristwatches and clocks would show this. Relativity has some strange effects, and this certainly seems peculiar, but the central point of Relativity is that it always has to be ultimately logical for each of them and both of them.

This actually points out another major error of assumption that was involved in the speculating on a Twins Paradox! That assumption was that time dilation occurs in both Special Relativity and General Relativity. The GR mathematical equations of Einstein are immensely complex, and no one has yet fully solved them, in more than 90 years of trying! But around 1960, many assumptions were speculated and applied to those equations, to make them far simpler to solve, and as a result, it was assumed that time dilation occurs under those conditions, where the reality is exactly the opposite!

This error is extremely obvious, as described above, and if Einstein had not died several years before the Twins Paradox was suggested, he would certainly have quickly provided the correct explanation. **In any case, no**

matter who would make such a trip, when they would meet again, they would be exactly the same age! While they were separated, yes, some very strange things would seem to be seen to occur regarding time! **At various times during a complete trip, each of them would sometimes believe they are older than their brother and sometimes believe they are younger than their twin brother!** But Einstein was right after all! When the trip was entirely done and they were back together again, they would certainly be exactly the same age!

It is disappointing just how many logical errors were, and still are, made regarding the time-rate effects of Relativity. In the discussion and explanation of another one of these, I provide the entire precise math which proves the errors and their correct understandings.

That example is perhaps an even more important error, which has amazingly still not been corrected more than fifty years later, that of the (incorrect) assumption that we on Earth live in a (non-accelerating) Inertial Rest Frame of Reference. Several entire fields of modern Physics are totally based on this incorrect assumption. For the precise math of the proof regarding that, please see http://mb-soft.com/public4/dilation.html for the Article about a General Relativity Time Dilation Logical Error.

That Article discusses the amazingly superficial thinking of NASA where they recognized that Special Relativity and its Time Dilation certainly exists for us on Earth, due to our rapid daily spinning of the Earth. NASA even decided to try to perform a rather famous (but wrong) experiment in October 1971 to try to prove that Time Dilation assumption that they had wrongly assumed, by sending sets of four identical Cesium clocks both ways around the Earth on conventional airliners, in the **Hafele-Keating experiment**. That experiment wound up with results which were worthless, well within the Experimental Margin of Error.

However, everyone in NASA was apparently ignorant that we also "ride in a daily circle" in that same process, which means we constantly accelerate (radially downward), so that **Einstein's General Relativity also applies.** (We call it centripetal acceleration!) **These effects are both easy to calculate and it turns out that their time-rate consequences are exactly the same net effect, but are opposite each other!** Therefore, they always exactly cancel each other's net effects out for us! **That statement is equally true for people in their homes, for Astronauts who orbit the Earth in the International Space Station, and even in airliners which circle the Earth.**

Math Example for anyone on the ISS

For anyone in the ISS (International Space Station) which orbits the Earth, the Time Dilation Effect (which is due to Special Relativity and the high speed with which it is orbiting) can easily be calculated to be a time-rate factor of 0.999 999 999 669 (less than 1.000 and therefore, a time slowing effect).

The (General Relativity) time-rate effect due to the orbital acceleration of the ISS is a time-rate factor of 1.000 000 000 330 (more than 1.000 and therefore, a time speeding effect).

Since both of these Relativistic effects apply continuously, we must multiply the two time-rate factors to find the actual Relativistic time-rate effect on us, where the product exactly 1.000 000 000 (actually, 0.999 999 999 998 999 999). **Please note that this is proof that the two Relativistic time-rate effects exactly cancel each other out (for the ISS), within any conceivable error factor.**

Math Example for a Person Standing at the Equator on Earth

For anyone standing at the Equator on Earth who "orbits" the Earth, the Time Dilation time-rate Effect factor (which is due to Special Relativity and the high speed with which he is "orbiting") can easily be calculated to be a time-rate factor of **0.999 999 999 998 796 560** (again, less than 1.000 and therefore a time-slowing effect.)

The (General Relativity) time-rate effect due to the centripetal acceleration of the person at the Equator is a time-rate factor of **1.000 000 000 001 203 440** (again, more than 1.000 and therefore a time-speeding effect.)

Since both of these Relativistic effects apply continuously, we must multiply the two time-rate factors to find the actual Relativistic time-rate effect on us, where the product exactly 1.000 000 000 000 000 (actually, 0.999 999 999 999 999 999 99). **Please note that this is mathematical proof that the two Relativistic time-rate effects exactly cancel each other out (for the person at the Equator), within any conceivable error factor.**

The complete math for the examples referred to above is all presented in the Article

at [General Relativity Time Dilation Logical Error] http://mb-soft.com/public4/dilation.html

Considering again an actual high speed space trip

IF the rocket engine was incredibly powerful, and the two stared at each other for the entire 4.5 year trip to A.C.(and the Traveling twin could survive the extreme acceleration, which he could not), the Earth brother would see maybe a week go by (Earth time) during the acceleration, but during that Earth week, he would see the accelerating twin celebrate two birthdays! In other words, he would watch his spaceship brother age ferociously **faster** than he lives here on Earth! Then during the next 4.3 years of watching the constant velocity portion of the trip, he would see no Birthdays! And in the final week of extreme deceleration, he would see another two birthdays celebrated, so he would see the spaceship brother celebrate the correct number of four birthdays during the trip. Just in a very odd way, two really fast, then none for an apparent long time and then two at the very end.

The Journal of the spaceship twin would look vaguely similar, but he would spend more than two years accelerating (probably at a constant rate) and during that acceleration, he would therefore obviously celebrate his two birthdays. He would also witness his Earth brother celebrate two birthdays, but a few days different (earlier) than his. Since he is a very careful scientist, he notes that the Earth brother appears to be living slightly faster than he is (during the entire two years of watching and accelerating). This results in an interesting consequence that, as the acceleration ends, they both see their brother as appearing to be older than himself! The Earth brother thinks more than two years older, and the spaceship brother thinks just a few days older.

Recapping: At this point of the trip, as the rocket engine is shut off from the accelerating portion, the Earth brother sees his twin appear roughly two years older than himself. This is at the same time the spaceship brother sees his Earth twin appear a few days older than himself. They both see the other as having aged faster and is now older than himself.

Continuing the spaceship brother's Log Book: After the rocket engine is shut off (after more than two years of acceleration) they both have the Special Relativity situation of Time Dilation, so they both see the other appear to live more slowly than himself! The Earth brother watches this happen for more than four years, while the spaceship brother only actually coasts for a couple weeks! (This is why no birthdays were seen being celebrated on the spacecraft during the four years that the Earth brother was watching, because the traveler actually only aged by a few weeks!)

Recapping again: At this point, the Earth brother has seen the spaceship brother barely age at all (a few weeks) while he ages roughly four years. So now the Earth brother sees the spaceship brother appear to be two years younger than himself (exactly the opposite as at the earlier recapping! The spaceship brother only spends a few actual weeks in this coasting portion of the trip, but he clearly sees his brother on Earth appear to have aged more slowly than himself, but only by a few days. The spaceship brother now sees his Earth twin as appearing a few days younger than himself. In other words, they both have watched the brother seem to age more slowly than himself, during the constant velocity portion of the trip. **This is the resolution to the strange statement made above where they both see the other aging more slowly than himself** (but only during the period of the constant velocity.)

He then turns the spaceship around and fires the engine for another two years in severe deceleration. So HE only sees the Time Dilation effect for those few weeks of coasting at constant velocity. He would watch as his Earth brother aged a few days less than he did during those few weeks, but they both therefore watch the other aging more slowly than himself.

The result of all this is that only at the exact half-way point of the trip, they would both see them as being exactly the same age. (Remember that they had each seen the brother age faster, first, during the acceleration, and then slower during the constant velocity part of the trip, and they exactly cancel out at that half-way point.)

You can see how and why the second half of the trip has the slower then faster perception of the other, so that after the spaceship has slowed down to be able to stop on that planet at Alpha Centauri, they are again exactly the same age. (for the second time since the start of the trip)

There can be no doubt about this fact! The silly ideas that are rampant in modern Astrophysics where they talk about time travel and goofy things like wormholes, are all based on the wrong assumptions back in the early 1960s when the Twins Paradox was dreamed up! And so those alleged phenomena have no actual basis at all!

The wrong assumptions and erroneous logic used in coming up with the Twins Paradox has endured! There are several complete fields of Astrophysics which are based on that wrong reasoning! Even famous Physicists (including Kip Thorne) believe that the Twins Paradox is true and that there are therefore things like wormholes, and many other alleged effects on black holes and quasars and more. Those fields cannot be valid!

A series of TV programs from NOVA (in 2011) still repeated the wrong assumption regarding Time Dilation occurring during General Relativity! Even without good logic, exciting ideas seem to die hard! That series, by the otherwise intelligent Brian Greene, contains hundreds of wrong assumptions, even including things that Greene knows to be bad assumptions! I find that very sad.

I have a different web-page regarding a relatively simple and inexpensive test which I have tried to encourage NASA to do for ten years, which can and will provide an absolute experimental proof of General Relativity and whether there is Time Dilation or Time speeding as a result. The **General Relativity - A Moon Experiment to Confirm It** simply has a set of standard Cesium atomic clocks softly landed on the surface of the Moon, and a set of identical Cesium clocks in a laboratory here on Earth. We know the precise frequency of the Cesium atoms on earth-based atomic clocks to be 9,192,631,770 cycles per second.

The gravitational field on the Moon's surface is only about 1/6 of the gravitational field we experience here on Earth. In Physics, there is an Equivalence Principle which is broadly accepted as being an expression of Einstein's claim that a gravitational field is indistinguishable from an acceleration. The tiny difference in the strength of the gravitational fields on the surface of the Earth and Moon is such that, every second, the atomic clocks on the Moon should be counting numbers of oscillations of the Cesium atoms which are several different from the exact number presented above. **Every hour, the Earth atomic clock should count about 10,976**

more ticks, a really obvious experimental result. Over a period of an entire year, the clocks should be different by an obvious amount, a good portion of a second. I am certain that the Earth clocks will be running faster, in agreement with a Time Speeding effect, but even if that 1960s assumption of Time Dilation occurring turned out to be correct, the clocks would still be easily measurably different in the rate of time passage. General Relativity would finally actually be experimentally confirmed!

The correct logic contained here is a confirmation of some of Einstein's Thought Experiments, specifically those which related to a stationary rocket sitting on the Earth's surface with an identical rocket in deep space which is accelerating at 32 ft/sec/sec. Einstein pointed out that the residents of both would experience exactly identical environments, where one was due to acceleration due to a rocket's motor and the other one was due to gravitation of the planet Earth.

Above, we gave the exact math for a person standing at the Equator of the Earth, where the Relativistic time-rate effect of Special Relativity and the Relativistic time-effect of General Relativity were calculated to be exactly the same amplitude, but in exactly opposite time-rate directions. That was proof that the two Relativistic time-rate effects are opposite each other.

Somehow, Physicists discarded all of that logic in creating the Twins Paradox! **But clearly, the rate of time passage is being affected by General Relativity, which means that it is also affected by the gravitational field of any planet.** The linked page above has suggested to NASA for several years to send some precise atomic clock up to soft-land on the surface of the Moon, while an identical atomic clock would remain here on the surface of the Earth. The two would be regularly checked regarding whether they were keeping the same time! They would not, due to GR!

That simple experiment would prove Einstein's General Relativity, and even give specific precise numbers to the effects, as we have for the effects of Special Relativity! My linked page includes my calculations of Einstein's set of General Relativity equations, where I find that we are all older than we would be if we had lived our lives on the surface of the Moon. In my personal case, as an old man now, I am probably only by about 0.73 second older having lived my life here on the surface of the Earth! General Relativity - A Moon Experiment to Confirm It.

The basic logic of the reasoning below is very basic and simple, but the complexity of nearly any Relativistic subject can make full understanding somewhat more difficult. This presentation was composed with the intention of providing as much clarity as is possible.

A set of simple equations are provided which can predict the accurate experiences and viewings of either or both of the two brothers, and for any maximum velocity trip, of any length, and of any power rocket engine. Just those three variables establish all the accelerations, velocities, and locations at all instants during a trip.

Frighteningly, there is such universal acceptance of this very wrong concept of the Twins Paradox that many fields of modern Astrophysics are entirely dependent on it being valid, and so those fields are in grave doubt regarding them maintaining any credibility!

This Research and analysis was done during 1997 through 2004. This presentation was first placed on the Internet in August 2004.

The Twins Paradox (or Clock Paradox) was first suggested based on the Time Dilation consequence of Special Relativity. No problem there! During the SR portion of such a trip, the commonly accepted description is correct. It was actually only presented in regarding the Special Relativity part of a trip, for which it is entirely true. The GR portions of the trip where acceleration occurs, was simply ignored! However, when the entire Twins Paradox trip is considered, it is easily seen that the Twins Paradox story and conclusions cannot be true, even though SR and TD are absolutely true!

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When Einstein first proposed Relativity, he gave several pre-conditions, which required Relativity in order for them to be true. They are:

- (1) that anyone in the Universe who does the same experiment, in an (inertial) non-accelerating environment, must get the identical results of any identical experiment of any other inertial environment;
- (2) that no one could ever experience any discontinuity of time;
- (3) that no one could ever experience any discontinuity of space;
- (4) that no one could ever get the experience of traveling faster than the speed of light; and
- (5) the sum of this is that the Universe must be able to "make logical sense" to any person in any environment.

The Twins Paradox story violates at least one of these!

The easiest way to see this is to temporarily set aside Physics and Relativity, and simply consider the **actual experiences of the traveling twin**. Here is the standard Twins Paradox story, with the addition of a single introductory sentence!

(the added sentence)

Twin brothers have lunch together on Earth, while carefully determining the actual distance to Alpha Centauri, where **they each get a result of a distance of 4.3 light years away**.

(now the traditional twins paradox story)

One of the twins immediately gets in a spacecraft and accelerates extremely rapidly. He has a forward window in the spacecraft, and **he sees that Alpha Centauri is a distance of three light weeks away from him.** So, it then makes complete sense to him that his entire trip takes only three weeks of his life! Once on a planet around Alpha Centauri, he is then about 4.2 years younger than his twin on Earth. He says hello and goodbye, and travels back to Earth. Again, he "gains" another 4.2 years, so when he re-meets his twin brother, he is now 8.4 years younger than his twin!

That story seems very believable, mostly because the story makes clear that distance he would see was only 3 light-weeks (the distance shortening effect of SR), and so it would "make sense" to him that he could make the trip in around 3 weeks of time, without violating the limitation of the speed of light. This Twins Paradox is apparently SO convincing that 100% of Physicists simply accept it as absolutely true, and even most school textbooks describe it as a solid fact! But even that seemingly obvious statement that A.C. would appear only 3 light-weeks away, is not correct!

Did you notice the huge flaw in the reasoning?

He and his brother carefully measured the distance to A.C. as being 4.3 light years, but then an hour later, HE saw A.C. as being only 0.06 light year (3 light-weeks) away! That is not possible! It represents what Einstein called a discontinuity in space, and such things violate Physics and Relativity. It also requires the traveler to have the personal experience of having traveled nearly 4.3 light years of actual distance in just a three-week trip, meaning that he could allegedly then go into Court to Testify that he had just personally traveled around 75 times faster than light travels! In fact, Relativity was developed specifically so that no person could ever experience such a discontinuity of space, or of time, or of believing that he/she was traveling faster than the speed of light. The Twins Paradox involves a required assumption, where at least one of these is violated. Therefore, even though Relativity, including Special Relativity and General Relativity, and Time Dilation and all the other consequent effects are true, the Twins Paradox definitely is not true!

There are many "explanations" of the Twins Paradox story commonly presented, but they each manage to contain incorrect assumptions! For example, one popular version entirely neglects that there is any acceleration ever necessary, and simply considers the (SR) constant velocity part of the trip. (The traveler gets in the rocket and travels at constant velocity to some destination). If that could actually be true, the Twins Paradox could be true. But the part left out is that he first had to accelerate from being in Earth's inertial frame up to his cruising speed and then back down to the inertial frame at the other end. Those "details" entirely change everything! It is interesting that many such "explanations" confidently state that both brothers could not be experiencing the Special Relativity consequence of Time Dilation, "because of previous accelerations." But they really do, and SR says they have to! It is unbelievable that educated Physicists would claim that previous accelerations somehow alter a current situation! When the Earth was first being formed, if there was some acceleration that happened, do we really need to know about it now to solve the equations of motion? In this "explanation" just mentioned, no acceleration is ever mentioned, which establishes that the twin in the spacecraft can certainly consider himself to be in an inertial rest frame, and therefore he would see Time Dilation occurring to his brother on Earth, which appears to be rapidly receding from him. (The current presentation explains how they really can each be experiencing the SR effects of Time Dilation, watching each other age more slowly than themselves, without there being any actual paradox!)

Some of the attempted explanations invoke some very peculiar ideas! One claims that the Twins traveler actually would be 8.6 years younger than his brother when them meet again but that all of his body processes would still have gotten "older" and he would die just as if before! Where could someone come up with such a silly idea? Such things are easily shown to be silly if a trip to a star 100 light years away was involved. His earth brother would therefore have to be over 200 years old when he arrived back on Earth, while he might only be 25. Is he supposed to instantly die of old age at 25 on returning? Silly!

A major reason for such errors is that it seems often true that the SR and GR portions of the trip are freely interchanged, and that results in the wrong conclusions. One popular claim is that the two twins do not both experience the effects of Time Dilation because they are "actually not in symmetrical situations, because the one had gone through accelerations". That statement is foolish, because if only the constant velocity portion of the trip is considered, as though there is no "memory", the two actually are in perfectly symmetrical situations, each feeling that he is in an inertial rest frame with the other rapidly moving. **It is an error to invoke that an acceleration that occurred at some previous time could or would alter experiences during SR!** (The very first example presented here shows that. It would not matter whatever accelerations those two planets experienced prior to the babies' births, only their SR lifetimes have effect.)

There have been countless experiments, such as the muon experiments at CERN in 1966, which confirm that Time Dilation occurs for constant velocity motion near the speed of light. Time Dilation is certainly true for SR conditions. But those muons disintegrated while still at that relativistic velocity, and not after the muons were slowed to non-relativistic velocities. So no conclusions regarding GR can be gleaned from such experiments, only regarding SR. I must admit, though, that the fact that those muons were traveling in circular paths means that they actually were under constant (lateral) acceleration seems to me to indicate that an additional complication must have existed for those analyses.

If the above is not sufficient, a simple variation could be added! Using eyedrops, so the traveling twin would never have to blink, he faces Alpha Centauri from the moment that he leaves his brother. He clearly sees that it is then 4.3 light years away. He never takes his eyes (or instruments) off of A.C., but, somehow, an hour later, he sees it as being very close, only 3 light-weeks away. A fair question would be, did the distance reduce from 4.3 light years to 0.06 light year, instantly, or did it happen gradually over that hour? It obviously had to happen, if the Twins Paradox is then to be able to have the usual story! Every Physicist alive would love to hear how someone could be constantly staring at a distant star, to have it, immediately or quickly, appear extremely close! Relativity cannot explain bizarre things like that!

Notice that no assumptions have been applied here, and only the personal experiences of the individuals have been considered. When Physicists have neglected that first sentence (which I added), then they always immediately start citing equations on why the Twins Paradox is true. But they invariably neglect to consider the discontinuity in space that would therefore be required, and which my added paragraph makes clear. Then it is appropriate to start doing the math!

I have recently been told by a man who informed me that he is one of the foremost experts on Special Relativity, that he sees nothing wrong in what is described in the paragraph above! He even told me that if he measured the distance to A.C. at 4.3 light years, and then an hour (of his experience) later, saw that it was 3 light-weeks away, he would see nothing wrong with that! He then explained to me that I am simply too stupid to understand any of Relativity, rather insulting the University of Chicago which gave me my Degree in Physics! But I guess he is free to have his own opinions, including about my native intelligence! But I wonder if he might someday be walking down the street in Kansas City and suddenly be in front of the Eiffel Tower in Paris! He apparently would see nothing odd in that! By the way, he chose never to identify who he is, only that he is a "foremost expert on Special Relativity"!

There is a resolution of all this, and it definitely includes well-proven Time Dilation during the constant-velocity (Special Relativity) part of the trip. **Even more, it shows how, during that SR part of the trip, both brothers would see the other as apparently aging more slowly!** (which is the actual main paradox that exists, but it is not actually a paradox at all!)

This certainly sounds very peculiar! How could two people be looking at each other and both see that the other has clocks that are advancing more slowly than his own? But it is certainly a reality of the situation. That is actually pretty easy to see, too. The "symmetric situation" that this presentation started with certainly shows it to be an unavoidable fact.

In Special Relativity, we have a situation where one person (our traveler) is moving at very high speed, away from or toward the other. The Twins Paradox proponents have always considered the Earthbound twin as experiencing "normal time" and all descriptions are based from that perspective. However, that is not the only available perspective! Say the Twins Paradox traveler does not have any memory and simply wakes up, or is born (on an extremely long trip) and looks out the window, to see the Earth hurtling away at a constant extremely high speed. **From his perspective, and his experience, he is "experiencing normal time"**. But he sees his brother and the Earth receding at very high speed, so his view of his brother clearly shows (by Special Relativity) that his brother (and everything else on the Earth) is experiencing "slower time". Since the two brothers have been constantly staring at each other for the whole trip, that means that they each must see the other as aging more slowly than he does, during the entire constant velocity, Special Relativity portion of the trip. This has to be true! Otherwise, he would be required to have experiences that violate Relativity.

This is required because neither twin is then experiencing any acceleration. They each therefore see themselves as being in the "Inertial Rest Frame", while the other is therefore rapidly moving away from or toward them.

As odd as it sounds, that does not actually violate anything, because when the entire trip is considered, there is a perfectly logical and mathematical explanation and description, from both viewpoints, and without having to invoke any weird assumptions!

The actuality of the situation is then necessarily that, yes, during the Special Relativity constant-velocity parts of the trip, there IS the Time Dilation that we all can easily calculate. **However, when the entire trip is considered, it turns out that he necessarily lives a total of exactly the same amount of time that his twin brother does on Earth.** (At different points of the trip, one or the other brother is older or younger, because of the differential aging effects of Time Dilation of Special Relativity and this "Time Speeding" effect of General Relativity, but whenever they are both in the same rest-reference frame, they are exactly the same age! **So, when he gets back to Earth, he and his brother meet and are exactly the same (correct) age!**

A basic premise, on which several fields of Astrophysics are based, is therefore incorrect! This is troublesome, but certainly true.

One central reason why such incorrect assumptions have been made regarding the GR aspects of the trip is that the equations of GR are immensely complex. A commonly known anecdote was about the famous British astronomer Sir Arthur Eddington, one of the first to fully understand Einstein's General Relativity theory in detail, who was once asked if it were true that only three people in the world understood general relativity. He is said to have replied, "who is the third?"

A Detailed Trip

We will consider an alleged Twins Paradox trip that would appear to him to take ten weeks, instead of the three used above. We will examine the trip from all four possible separate perspectives, of the Observed actions of the other person (traveler or Earth-bound) and of their own lives during the trip.

As an experienced traveler, the traveling twin carries a LogBook. While he is still with his twin brother on Earth, about to get in the spaceship, he makes the first Entry, where he and his brother each confirm that Alpha

Centauri is 4.3 light years away. For clarity and simplicity, I enable him to never need to sleep during the entire journey to A.C. The Twins Paradox would claim that he would arrive at A.C. maybe 10 weeks later (of his watch's time), the entire point of the Twins Paradox! So he would later write in his LogBook his arrival at A.C., ten weeks after leaving Earth. He has (allegedly) now arrived at a location 4.3 light years (225 light-weeks) from where he was 10 weeks earlier, and he has not slept, so nothing weird could have happened to him. **In his personal experience, he could then confirm that he just covered that distance at around 22.5 times the speed of light! And he even has a LogBook to prove it!** If he was taken into Court, he could even testify to those facts! And he could even submit his LogBook as evidence! He (allegedly) experienced ten weeks of life (due to the Special Relativity effect of Time Dilation) and is now, provably, is over 22 times as far away as even light could have gotten! (**This is obviously impossible,** and is another proof of why the Twins Paradox story is wrong, even though the Time Dilation on which it is based is absolutely true.)

Physicists seem to want to completely ignore the parts of the trip other than the Special Relativity, constant-velocity part! And, if only that part is considered, yes, he would essentially experience what the Twins Paradox would claim. But that is not the whole trip! There is also another assumption that Physicists seem to ready to make, regarding whether the Time Dilation of SR also applies to GR (General Relativity) during acceleration. That assumption is clearly wrong, as demonstrated in the examples above, where the exact opposite effect is seen.

An interesting consequence of this is that there must always therefore be an identifiable inter-relationship between rate of acceleration, the interval of that acceleration, and the maximum relative velocity, such that an SR effect of Time Dilation is always exactly canceled out by an equal and opposite GR effect of "Time Speeding" during the necessary acceleration and deceleration. A strict mathematical treatment identifies exactly what that relationship between SR velocity and GR acceleration is. g, the gravitational constant, appears to be significant in it, as somehow causing the rate that we see time pass!

About ten years ago, I did some Research to consider all the details involved in various possible trips from here on Earth to Proxima Centauri. I first published the results in August 2004.

Once I realized that "cruising" causes Einstein's Special Relativity and its consequence of Time Dilation and that "accelerating " causes Einstein's other form, of General Relativity and its "time speeding" effect, I spent several months deriving the math.

Then I speculated that if I had "unlimited technology" and I tried to consider various ways to get to Proxima Centauri. The following presents a few of the obvious possibilities.

(1) I imagined I had a "sports car" with unlimited gasoline, where I could almost immediately get up to exactly 100 mph (airtight, etc). The distance to Proxima is 4.22 light years which is 24.8 trillion miles. Such a trip would take 248 billion hours of driving or 28,300,000 years, quite a trip.

A microscopic and brief "time speeding" effect due to General Realativity would occur during the initial few seconds of accelerating up to 100 mph. During that brief acceleration, the General Relativity effect of time speeding would occur, where 0.001383229 second would be altered.

After that, the following 28 million years of "cruising", at a constant speed of 100 mph, would have Special Relativity's effect of Time Dilation occur which is easily calculated by the familiar formula which would create Time Dilation to slow time down by a factor of 0.999 999 999 999 988 848 or about 0.002766458 total extra second during that 28 million years of cruising.

At the end of the trip, a decelerating is necessary to slow down and stop at Proxima Centauri, where another 0.001383229 second of GR would be affected. For the entire trip, the total "time speeding" due to General Relativity is EXACTLY THE SAME as the total "time dilation", each 0.002766458 second in the entire 28 million year trip. Both Relativity effects always exist, but for such a slow velocity trip, both are only around a thousandth of a second for the entire trip. Still, they DO exactly cancel out the opposing Relativity time-rate effects of velocity and acceleration, such that NO NET RELATIVITY would apply for the entire trip. As long as I would wind up in a Non-Inertial Euclidean Rest Frame, absolutely not even a fraction of a second of time would be gained or lost during that whole trip. That is actually true of ANY trip, including any of those mentioned below, where NO "time travel" of any sort would or could ever occur.

Even such a trip, when I added up the precise effects of all three phases of the trip (acceleration, cruising, and deceleration), the net trip would have had EXACTLY ZERO Relativity effects. NO TIME TRAVEL. Yes, a miniscule Time Dilation would occur during the 28 million years of constant velocity cruising, but that time-rate effect is exactly canceled out during the brief acceleration and deceleration at the ends of the trip.

(2) Another choice for that trip might be a ferociously powerful rocket engine, where an Earth observer would see me getting up to 99.9% of the speed of light in a single day of incredible acceleration (which my body would not survive). That initial ferocious acceleration would result in General Relativity and its Time Speeding where I would actually experience 2.11 years of ACTUAL acceleration during that "one day" that the Earth observer saw. I would only TRAVEL about half of a light day or 0.00137 light year distance during that acceleration. The specific TS effect here is about a time factor of 770. Then I would CRUISE for what would seem to me to be "69 days" but the Earth observer would see as TD and 4.23 years of constant velocity cruising. The specific TD effect here is about a time factor of 22. Note that the Earth observer would see me travel 4.22 light years distance during 4.23 years of watching, which would confirm that I seemed to spend nearly all the trip at a velocity which was slightly less than the speed of light, which would not violate any Laws of science such as the speed of light. Aboard, I would experience 2.11 years of ACTUAL acceleration to get UP to that velocity as fast as could be possible, followed by "cruising" and Time Dilation of a factor of 0.0447, I would EXPERIENCE 69 days of cruising, which would be watched on Earth as taking 4.22 years. Again, both observers would not see anything which violated the speed of light or any other laws of science. MY actual trip would involve 736 days of accelerating, followed by 69 days of constant velocity cruising, followed by 736 days of deceleration, where I would arrive at Proxima 4.43 years after I had left Earth. The Earth observer would seee something quite different, where there was just a single day of intense acceleration, followed by 4.43 years of "cruising" followed by a single day of intense deceleration. The Earth observer would also see that the entire trip takes 4.43 years to get to Proxima. I would actually get up to a maximum velocity of 0.999 c

The precise values of these durations are actually fractionally different, where the actual Summations of both Time Dilation and Time Speeding need to be Calculus Integrated as velocity constantly changed during every moment of the trip. There is a small amount of Time Dilation which occurs during that "first day of acceleration", since the instantaneous velocity is constantly changing, but that only occurs for a few hours and so the net effect is minimal.

THIS method would get me there in about 4.4 years of travel, which is about the FASTEST way to get there. But the ferocious initial acceleration would consume spectacular amounts of fuel, even though no fuel would be used during the cruising portion.

It is possible to accelerate even faster to start with, up to 99.999% of the speed of light. The result of this would be to minimize the "cruising" portion of the middle of the trip, and get the acceleration and deceleration to occur in just a few earth minutes rather than a whole day. The Time effects are even more intense, where the Earth observer would see me accelerate for just a few minutes, and then "cruise" for 4.2 years and then decelerate for just a few minutes. In reality, I would accelerate for 2.11 years, "cruise" momentarily while I turned the rocket around, and then decelerate for 2.11 years. THAT is actually the truly fastest way to get to Proxima (if we could survive such a trip with tens of thousands of Gs acceleration). Such a trip would take about 4.22 years. My fastest velocity would be 0.99999 c

(3) Another choice for that trip might be a less powerful rocket engine, where an Earth observer would see me gradually getting up to exactly 50% of the speed of light (0.5 c) in an interval of exactly half the total trip or 8.44 years so the acceleration would be somewhat less, or around 1.8411 f/s2. My actual average trip velocity is exactly half of that or 0.25 c. Passengers on such a trip would see that it takes four times as long as the distance indicated, or 16.88 years.

That extended acceleration would result in General Relativity and its Time Speeding where I would experience 8.44 years of ACTUAL acceleration during that 8.36 years of rocket firing that the Earth observer saw. I would TRAVEL exactly half of the 4.22 light year distance or 2.11 light-years during that acceleration. The specific TS effect here is minimal, only around a 1% effect. Then I would IMMEDIATELY turn the rocket around and begin to decelerate. I would then experience another 8.44 years of deceleration. The entire trip for me would take 16.88 years. This discussion did not include the constantly varying effect of the increasing velocity and Time Dilation, regarding what the Earth observer would see. It is a fairly simple Integral Calculus problem to see that the Earth observer would see another time-rate effect due to this TD, of a total of 0.16 year. When I would again decelerate into an Inertial Rest Frame at Proxima, everyone would agree that the entire trip took 16.88 years before ETA at Proxima.

Again, both observers would not see anything which violated the speed of light or any other laws of science. I would actually get up to a maximum velocity of 0.5 c

(4) Another choice for that trip might be an even less powerful rocket engine, such as ion propulsion, where an Earth observer would see me gradually getting up to exactly 25% of the speed of light (0.25 c) in an interval of exactly half the total trip or 16.88 years so the acceleration would be somewhat less, or around 0.4603 f/s2. My actual average trip velocity is exactly half of that or 0.125 c. Passengers on such a trip would see that it takes eight times as long as the distance indicated, or 33.76 years.

That extended acceleration would result in General Relativity and its Time Speeding where I would experience 16.88 years of ACTUAL acceleration during that 16.75 years of rocket firing that the Earth observer saw. I would TRAVEL exactly half of the 4.22 light year distance or 2.11 light-years during that acceleration. The specific TS effect here is minimal, only a fraction of 1% effect. Then I would IMMEDIATELY turn the rocket around and begin to decelerate. I would then experience another 16.88 years of deceleration. The entire trip for me would take 33.76 years. This discussion did not include the constantly varying effect of the increasing velocity and Time Dilation, regarding what the Earth observer would see. It is a fairly simple Integral Calculus problem to see that the Earth observer would see another time-rate effect due to this TD, of a total of 0.08 year. When I would again decelerate into an Inertial Rest Frame at Proxima, everyone would agree that the entire trip took 33.76 years before ETA at Proxima.

Again, both observers would not see anything which violated the speed of light or any other laws of science. I would actually get up to a maximum velocity of 0.25 c

(5) An "efficient" way to make the trip requires some simple Integral Calculus in the scheduling. It took me months to finally figure that out. The DISTANCE of the trip and the TIME FOR ARRIVAL are involved. Actually, you would set the rocket to accelerate so that you achieved some maximum velocity exactly halfway through the trip, where you would IMMEDIATELY turn your rocket around and then decelerate at exactly the

same rate for the other half of the trip. NO cruising at all but the constantly varying velocity would have various rates of TD due to Special Relativity (as the traveler experienced it) and the "maximum velocity" is calculated regarding the distance of the trip. This example has the example immediately above as being a "special case".

(6) Oddly, by applying Integral Calculus regarding the cumulative effects of all the Time Dilation and Time Speeding, it is possible to determine the ultimate most efficient possible trip to any destination, the very most "efficient" trip possible, forever accelerating and then decelerating, but at a much slower acceleration to a very specific slower maximum velocity at the exact midpoint of the trip. THIS is the calculation which first introduced me to a peculiar (average trip) velocity of a little over 12 km/s. All such trips would have a "sawtooth" or "pyramid" shape of the trip velocity curve. The slower maximum velocity would take "more years" of traveling but would require less total fuel for the trip.

That math, after calculating HUNDREDS of various possible trips to Proxima, showed a gradual improvement in total trip fuel efficiency down to a specific (average trip) velocity where the overall trip efficiency then again dropped when the average trip speed is less than that. In each such case, the MAXIMUM trip velocity (at the center point of any trip) is always twice that average trip velocity.

After another year of trying to understand what I had derived, I came to the conclusion that what I had found was that the competing time-rate effects of Special Relativity and General Relativity result in a "unique velocity in the Universe" where in environments at SLOWER velocities (like we are in) then the TINY effects of SR tend to dominate, while at velocities which are faster or actually which fluctuate a lot, the GR effects (and time speeding) dominate. I came to believe that this unique speed was "a constant of the Universe" possibly as important or even more important as the speed of light.

By the way, BOTH types of Relativity are nearly always present in all phases of travel, and the Integral Calculus in the reference above is to CONSTANTLY monitor the instantaneous velocity at every moment of the trip so that the cumulative constant changes during the acceleration and deceleration and cruising can be integrated. It really is awesome that the ENTIRE trip, of ANY distance, of any rocket power and acceleration, even of variable rocket power, always accumulates precisely the same total TD and TS for any trip. They ALWAYS cumulatively cancel out each other's time-rate effects, although DURING most trips, very peculiar time oddities occur. At the exact halfway point and at the end point of any trip, are the only two instants where Earth clock time actually precisely matches the spaceship clock time.

That "interesting velocity" seems to show up all over the place! But a more specific practical velocity is the center point velocity, which is twice as fast, or around 25 km/sec. This and the time interval for half the trip, establishes the necessary power of the rocket engine. The AVERAGE TRIP VELOCITY, which is exactly half that maximum velocity, would be of interest to passengers as it establishes the ETA (estimated time of arrival).

But until someone duplicates my calculations, I doubt that anyone will really grasp WHY that velocity might have such an overwhelming importance. By the way, my calculations derived that unique velocity to the nearest thousandth of a meter per second, about eight digit precision. This was accomplished by a combination of both Integral Calculus and Differential Calculus.

When the world comes to value that velocity, I can show them a REALLY ACCURATE value of it!

The implications and consequences of these findings seem to be huge, regarding modern Physics and Math. It might even be that this velocity is even more important than the speed of light. It might even be a basis a THEORETICAL REASON for WHY the speed of light is what it is. The Relativity formulas might provide that result. We have never had a TRUE THEORETICAL BASIS for the exact value of the speed of light, and now we might be able to calculate it.

More analysis:

Trip to Alpha Centauri, maximum velocity 0.6c

Taking about seven years, with maximum speed just above half the speed of light.

Trip with Minimal Rocket Motor - 0.15 g acceleration

	Accelerate	Cruise	Decelerate	Total
Traveler Lives	1308.8 Days Accel=1.6 m/s^2 Distance=2.15 ly	**0 Days** Accel=0.0 m/s^2 Distance=0.000 ly	**1308.8 Days** Accel=-1.6 m/s^2 Distance=2.15 ly	2617.6 Days Dist=4.3 ly
Earth Watches	1308.8 Days Accel=1.6 m/s^2 Distance=2.15 ly	**0 Days** Accel=0.0 m/s^2 Distance=0.000 ly	**1308.8 Days** Accel=-1.6 m/s^2 Distance=2.15 ly	2617.6 Days Dist=4.3 ly

Trip with Stronger Rocket Motor - 0.5 g acceleration

	Accelerate	Cruise	Decelerate	Total
Traveler Lives	425.1 Days Accel=4.9 m/s^2 Distance=0.698 ly	**1767.4 Days** Accel=0.0 m/s^2 Distance=2.903 ly	**425.1 Days** Accel=-4.9 m/s^2 Distance=0.698 ly	2617.6 Days Dist=4.3 ly
Earth Watches	204.2 Days Accel=10.2 m/s^2 Distance=0.335 ly	**2209.3 Days** Accel=0.0 m/s^2 Distance=3.629 ly	**204.2 Days** Accel=-10.2 m/s^2 Distance=0.335 ly	2617.6 Days Dist=4.3 ly

Trip with Powerful Rocket Motor - 0.8 g acceleration

	Accelerate	Cruise	Decelerate	Total
Traveler Lives	262.8 Days Accel=7.9 m/s^2 Distance=0.432 ly	**2092.0 Days** Accel=0.0 m/s^2 Distance=3.437 ly	**262.8 Days** Accel=-7.9 m/s^2 Distance=0.432 ly	2617.6 Days Dist=4.3 ly
Earth Watches	1.3 Days Accel=1591 m/s^2 Distance=0.002 ly	**2615.0 Days** Accel=0.0 m/s^2 Distance=4.296 ly	**1.3 Days** Accel=-1591 m/s^2 Distance=0.002 ly	2617.6 Days Dist=4.3 ly

Notice that the Earth observer would see apparent accelerations that no human could withstand, but that the Traveler actually experiences very reasonable accelerations. Notice also that the Earth observer would see the entire acceleration occur in just over one day, while the Traveler would actually experience nearly nine months of acceleration.

Trip with Extreme Rocket Motor - 0.8 g acceleration

	Accelerate	Cruise	Decelerate	Total
Traveler Lives	261.7 Days Accel=7.95 m/s^2 Distance=0.430 ly	**2094.0 Days** Accel=0.0 m/s^2 Distance=3.440 ly	**261.7 Days** Accel=-7.95 m/s^2 Distance=0.430 ly	2617.6 Days Dist=4.3 ly
Earth Watches	0.01 Day Accel=159100 m/s^2 Distance=0.000 ly	**2617.6 Days** Accel=0.0 m/s^2 Distance=4.300 ly	**0.01 Day** Accel=-159100 m/s^2 Distance=0.000 ly	2617.6 Days Dist=4.3 ly

Slow Trip to Alpha Centauri, maximum velocity 0.1c

Forty years, with maximum velocity around 30,000 km/second

Trip with Minimal Rocket Motor - 0.04 g acceleration

	Accelerate	Cruise	Decelerate	Total
Traveler Lives	7853 Days Accel=0.04 m/s^2 Distance=2.15 ly	**0 Days** Accel=0.0 m/s^2 Distance=0.000 ly	**7853 Days** Accel=-0.04 m/s^2 Distance=2.15 ly	15,706 Days Dist=4.3 ly
Earth Watches	7853 Days Accel=0.04 m/s^2 Distance=2.15 ly	**0 Days** Accel=0.0 m/s^2 Distance=0.000 ly	**7853 Days** Accel=-0.04 m/s^2 Distance=2.15 ly	15,706 Days Dist=4.3 ly

Trip with Stronger Rocket Motor - 0.4 g acceleration

	Accelerate	Cruise	Decelerate	Total
Traveler Lives	81.2 Days Accel=4.3 m/s^2 Distance=0.022 ly	**15,544 Days** Accel=0.0 m/s^2 Distance=4.256 ly	**81.2 Days** Accel=-4.3 m/s^2 Distance=0.022 ly	15706 Dist=4.3 ly
Earth Watches	42.0 Days Accel=8.3 m/s^2 Distance=0.011 ly	**15,622 Days** Accel=0.0 m/s^2 Distance=4.277 ly	**42.0 Days** Accel=-8.3 m/s^2 Distance=0.011 ly	15706 Days Dist=4.3 ly

Fast Trip to Alpha Centauri, maximum velocity 0.9999c

Taking about 4.3 years, with extreme maximum velocity!

Trip with Minimal Rocket Motor - 0.4 g acceleration

	Accelerate	Cruise	Decelerate	Total
Traveler Lives	785.4 Days Accel=4.4 m/s^2 Distance=2.15 ly	**0 Days** Accel=0.0 m/s^2 Distance=0.000 ly	**785.4 Days** Accel=-4.4 m/s^2 Distance=2.15 ly	1570.7 Days Dist=4.3 ly
Earth Watches	785.4 Days Accel=4.4 m/s^2 Distance=2.15 ly	**0 Days** Accel=0.0 m/s^2 Distance=0.000 ly	**785.4 Days** Accel=-4.4 m/s^2 Distance=2.15 ly	1570.7 Days Dist=4.3 ly

Trip with Extreme Rocket Motor - 0.5 g acceleration

	Accelerate	Cruise	Decelerate	Total
Traveler Lives	774.3 Days Accel=4.48 m/s^2 Distance=2.119 ly	**22.1 Days** Accel=0.0 m/s^2 Distance=0.061 ly	**774.3 Days** Accel=-4.48 m/s^2 Distance=2.119 ly	1570.7 Dist=4.3 ly
Earth Watches	0.01 Day Accel=442000 m/s^2 Distance=0.000 ly	**1570.7 Days** Accel=0.0 m/s^2 Distance=4.300 ly	**0.01 Day** Accel=-442000 m/s^2 Distance=0.000 ly	1570.7 Dist=4.3 ly

Notice that in only around 10 minutes of watching, the Earth observer would see two birthday parties!

We can see during the usual long Cruising phase, that we on Earth would see him appear to age noticeably slower than we were (sometimes more than a year gain!) That is simply the effect of the Time Dilation effect of Special Relativity, and the fact that our likely designed Cruising is at 0.6 of the speed of light, which gives a Time Dilation factor of 0.8. During both the acceleration and deceleration, we would see him appear to age faster by around half a year each. **The result is that the total number of days that the Earth sees the trip take (such as 2618, or around 7 years) is exactly the same as the number of days that he personally experienced and recorded on board the spaceship.** This is true since Alpha Centauri and its planet are not moving at any significant velocity from us on Earth.

He would record more of the trip as having occurred during acceleration and deceleration, while the Earth observer would record more of it as having occurred during the cruising phase.

We can also see that he arrives at Alpha Centauri 2617.6 days after leaving Earth, which is easily predicted by using the maximum velocity as though it was always the velocity, or 1567 light-days (same as 4.3 light-years) divided by 0.6, getting 2617.6 days for the trip.

The implications of all this are even more interesting! It means that the rate of passage of time, as we understand it, may be unique to us on Earth!

There appears to be a "basic acceleration" which is 4.42968 meters/second^2, which is somehow the basis for all other accelerations! Motion at that acceleration may somehow cause time to pass at a basic rate! Equivalently, per Einstein, being in a gravitational field which has that value for the gravitational acceleration might somehow provide a basic rate of time passage. **The fact that Earth has an acceleration due to gravity of more than double that might mean that time passes for us at a rate different, and calculable!**

On planets with stronger or weaker g, the intrinsic rate of time passage might be different than for us! The implications of that seem somewhat frightening! But continuing the theme, it might suggest that SR and GR happen to be "special cases" of a single larger set of equations! This seems to have potential importance regarding Minkowski's space-time concepts. The traditional Minkowski description is not compatible with the existence of gravitational attractions, and this might enable some future compatibility there. I find that intriguing!

I composed a separate presentation which suggests that NASA send an atomic clock to be placed on the surface of the Moon (or Mars). Atomic clocks have been in orbit many times, but apparently none have ever been placed on the surface of either the Moon or Mars. It seems like a very important experiment to do. **Einstein emphasized the equivalency of the acceleration due to gravitation and the acceleration due to rocket propulsion.** Therefore, whatever the effect of General Relativity on the rate of passage of time, there should be clear and measurable differences between the surface of the Earth and the surface of the Moon, due to a factor of about six in the surface gravity. In fact, calculations seem to show that the rate of time should be significantly different on the Moon or on Mars than on Earth, by about 1/13 of a second difference per year! It is difficult to comprehend the implications of such findings!

Interestingly, those simplifications were primarily initiated in the early 1960s, virtually concurrently with the rise in popularity of the Twins Paradox story! Many alternative Metrics have been presented since Einstein presented his, and I am unaware if any have ever been carefully examined regarding whether they could have opposite consequences from Time Dilation during General Relativity.

I have determined that, for a full trip where the initial and final velocities are identical, the equations used above, for both Special and General Relativity are given by the following equations:

Three basic parameters must be chosen for them:

- **trip** is the actual distance of the trip, in light years
- **vmm** is the maximum velocity during the entire trip, in meters/second
- **proportion** is the portion of the trip which is during acceleration

The equations:

- Earth seen acceleration time: trip * 365.25 / vmm * proportion / 2
- Earth seen distance during acceleration: trip * proportion / 2
- Earth seen acceleration measured: (vmm^2 * c) / (trip * 365.25 * 86400 * proportion / 2)
-
- Earth seen cruise time: trip * 365.25 / vmm * (1 - proportion)
- Earth seen cruise distance: trip * (1 - proportion)
- Earth seen cruise (maximum) velocity: vmm
- Traveler measured acceleration time: trip * 365.25 / vmm * (1 - (1 - proportion) * SQR(1 - vmm ^ 2)) / 2
- Traveler measured acceleration distance: (trip * (1 - (1 - proportion) * SQR(1 - vmm ^ 2))) / 2
- Traveler measured acceleration rate: (vmm * c) / (trip * 365.25 * 86400 / vmm * ((1 - (1 - proportion) * SQR(1 - vmm ^ 2)) / 2)

-
- Traveler measured cruise time: trip * 365.25 / vmm * (1 - proportion) * SQR(1 - vmm ^ 2)
- Traveler measured cruise distance: (trip * (1 - proportion)) * SQR(1 - vmm ^ 2)
- Traveler measured cruise (maximum) velocity: vmm
-
- Total Trip time: trip * 365.25 / vmm
- Total trip distance: trip

These equations are all simplified versions of the Integral Calculus equations which actually apply. Their forms are obvious, and would be needed for any situations where the rate of acceleration changes during a trip. These simplified forms are given here because most real future space journeys are likely to have constant acceleration during powered portions of a trip.

These analyses are all based on complete trips, where an observer begins with no significant velocity or acceleration from an observed object, then there is a period of acceleration, followed by a period of coasting/cruising, followed by a period of deceleration down to the initial conditions of velocity and acceleration. Most phenomena detected tend to only have had the Special Relativity, constant velocity portion of such movement analyzed. These equations can be applied to a particle that began (as far as we knew) with massive velocity or acceleration, but then the treatment of the analysis has to be somewhat different.

Reasons for the Previous Errors regarding GR and Time Dilation

Human experience does not involve any situations where General Relativity has noticeable time rate effects, and rarely even has any interactions with phenomena that have Special Relativity Time Dilation effects. So it might have been reasonable to assume things which were not true. Specifically, we see things like muons which are CREATED in the high Earth atmosphere from cosmic rays which we see arrive at surface laboratories while we know that their rest-lifetime is so short that they could not travel even a kilometer before decaying. It might be that the muon experiences extremely severe Time Speeding effects as it is accelerated by the cosmic ray which created it in the atmosphere, where it "aged" by extreme amounts, prior to our awareness. So the General Relativity effect of Time Speeding might never have come to our attention. Many other phenomena that we are aware of are similar to that in that we do not have any awareness of much of what had happened before the particle decays and shows the effects of Time Dilation.

$TS_{Factor} = v_{max} / c + 4.42968 * (v_{max} / c)^2$

Implications

The implications of this might be huge in Astrophysics. Consider that this presentation started off with a non-accelerating observer possibly aging one hour of his life, as he watched the accelerating one appear to age 12 years. Such an example represents a perceived time rate about 100,000 times faster than he was personally experiencing. This would only occur under the conditions of General Relativity, where there was acceleration involved. We saw that in the most extreme (last) of the calculation examples given, where the Traveler lived 774.3 days while the Earth observer would have only aged around ten minutes. That is a factor of more than 80,000 as a time factor. You might also notice that the situation presented there was not even a very extreme one. In a situation discussed below of material which is falling into an immensely strong gravity well, the acceleration would constantly increase, and the Time Speeding factor would continue to rise at immensely quick rates.

Pulsars and other very rapidly perceived phenomena

It is not absolutely clear whether the GR effects apply when the Relativistic acceleration is a (radial) central acceleration. But if they do, that means the same effects would occur when we on Earth observe rapidly (Relativistic) rotating objects in space. Say we look at a (rapidly rotating) pulsar, or a quasar or an accretion disk. We see that it seems to be rotating one hundred times per second. And so Physicists devise all kinds of peculiar ideas and speculations regarding how to explain this ultra-rapid rotation. However, if this "TC" effect applies for circular motion and central Relativistic acceleration, it seems credible that the reality is that the object may be actually be rotating only 1/100,000 as fast as it appears to us! A rotation of once per thousand seconds is still really fast, but it then does not require all the exotic logic currently being applied to try to explain lightning fast rotation!

Black Holes, Accretion Disks, etc

The reasoning presented here might even show that such a concept as a black hole might not even be very possible! The general assumption is that an object which would fall into a black hole would accelerate due to the pull of gravity, and have ever increasing acceleration. Fine, that means that GR would apply. Consider now the perception of time! Shortly above, we discussed how a non-accelerating observer might see an accelerating space traveler appear to age 12 years during a single hour of observing. Now consider that the acceleration associated with a black hole would ever increase. An hour of observing might quickly include a thousand years, or a million years or a billion years of actual time experienced by the object that was being accelerated. The point being made here is that IF there are actual black holes, the forever accelerating situation that we assume might mean that the object has been actually falling in for millions or billions of years, not yet to have even reached the actual location of the black hole itself! Yes, we might see (in our non-accelerating rest-frame) something appear to fall inward to an unseen destination very quickly, but the reality might be extremely different than we think we see!

Perceived Brightness

Note also that there would have been 12 years worth of radiated energy that would have arrived here in a period of one hour! This suggests that the object would appear to us to be 100,000 times brighter than it actually is.

Possibly some of the great difficulties of Physics dealing with Quasars, Pulsars and the like might turn out to be far simpler to resolve. We have generally assumed that if an object sends us the radiation equivalent to 10 million stars, it must be quite huge, but when we see it have brightness variations on the period of months, we see a great dilemma because that implies that it is small. If the actual object was actually only 1/100,000 as bright as we perceive it to be and if the months we see during a variation are actually many years, many of the serious problems of Astrophysics might find some fairly simple resolutions.

But, of course, that would depend on whether GR effects actually apply for Relativistic radial acceleration. It is merely mentioned here as one of many possible implications of this new perspective.

Relativity has many aspects which are hard to understand or to see where logic exists. I see one that seems especially troublesome.

Imagine that there were two planets near opposite sides of the Universe, each headed toward the other at extremely high constant speed. That means that Special Relativity should apply and therefore Time Dilation. Say within two meters per second of the speed of light, where the Time Speeding effect would be more than a thousand trillion to one in both directions. There is an accurate atomic clock on both planets and they each have amazing telescopes to be able to see the clock on the other planet at any time. See the problem? While planet 1 sees exactly one year pass on planet 2, planet 1 actually would experience a thousand trillion years, longer than anything has ever existed. This then requires that planet 1 is immensely old. Now look from planet 2, and see the similar situation, where only one year on planet 1 would pass while planet 2 experiences a thousand trillion years, but we just saw that planet 1 necessarily existed a thousand trillion years, each of which would have to match up with a thousand trillion years on planet 2. As Special Relativity and Time Dilation is currently understood, both planets would have to exist for impossible periods of time. That indicates that the current theory must somehow be wrong. But Time Dilation is considered to be a simple and obvious consequence of Special Relativity.

The explanation of this bizarre situation is equally bizarre! In order that two objects get to a relative constant velocity of just two m/s less than the velocity of light requires the one which had done all that accelerating to have "aged" astoundingly fast, due to the Time Speeding effect of acceleration (in General Relativity). In other words, the one that did the acceleration would have to have already experienced those thousands of trillions of years of acceleration, before the situation that we now are considering. The point being made here is that, since the Universe appears to be about 13 billion years old, neither object had enough time to accelerate to that great a relative constant velocity, which means that the example we have been speculating about could not have been possible! Even though Relativity often seems very peculiar, it still has to comply with the Laws of science!

The equations above make clear that there is an intimate relationship between the Time Dilation of Special Relativity and the Time Speeding of General Relativity. A trip can only make sense once it is completed, that is that the observer and traveler are both again in the same inertial reference frame.

That indicates that acceleration is a necessary pre-condition for Time Dilation as an earlier Time Speeding due to acceleration, at least for any Static Reference Frame. More, whatever the total cumulative effect of that (previous) Time Speeding might then become available for a later Time Dilation effect being witnessed. Actually, both the Time Speeding of the acceleration and then the later deceleration, must necessarily exactly match the total observed Time Dilation. The final result is that the trip always takes the "correct" amount of total time, from both of their perspectives as well as from the perspective of any other observer of their interactions. No matter who is watching, when they get back to the same Static Reference Frame, they will be exactly the same total age (and will again appear as Twins!)

This presentation was first placed on the Internet in August 2004.

Advanced Physics-related presentations in this Domain:

Astro-Physics Related Subjects:

Conservation of Angular Momentum - An Exception or Violation (Sept 2006)
Galaxy Spiral Arms Stability and Dynamics A purely Newtonian gravitational explanation (Nov 1997, Aug 1998)
Twins Paradox of Relativity Is Absolutely Wrong (research 1997-2004, published Aug 2004)
Perturbation Theory. Gravitational Theory and Resonance (Aug 2001, Dec 2001)

Origin of the Earth. **Planetary Gravitational Resonances** (Dec 2001)
Rotation of the Sun (Jan 2000)
Origin of the Universe. Cosmogony - Cosmology (more logical than the Big Bang) (devised 1960, internet 1998)
Time Passes Faster Here on Earth than on the Moon (but only a fraction of a second per year!) (Jan 2009)

Globular Clusters. All Globulars Must Regularly Pass Through the cluttered Galaxy Plane, which would be very disruptive to their pristine form. (Nov 1997, Aug 1998)
Existence of Photons. A Hubble Experiment to Confirm the Existence of Individual Photons (experimental proof of quanta) (Feb 2000)
Origin of the Moon - A New Theory (June 2000)
Planetary Rotation of Jupiter, Saturn, and the Earth (Jupiter has a lot of gaseous turbulence which should have slowed down its rapid rotation over billions of years) (March 1998)
Cepheid Variable Stars. Velocity Graph Analysis (Feb 2003)
Compton Effect of Astrophysics. A Possible New Compton Effect (Mar 2003)
Olbers Paradox Regarding Neutrinos (Oct 2004)
Kepler and Newton. Calculations (2006)
Pulsars. Pulsars May Be Quite Different than we have Assumed (June 2008)
Sun and Stars - How the Sun Works - Nuclear Fusion in Creating Light and Heat (Aug 2006)
Stars - How They Work - Nuclear Fusion. Lives of Stars and You (Aug 2004)
Sundial Time Correction - Equation of Time. Sundial to Clock-Time Correction Factor (Jan 2009)
General Relativity - A Moon Experiment to Confirm It. Confirming General Relativity with a simple experiment. (Jan 2009)
General Relativity and Time Dilation. Does Time Dilation Result? (Jan 2009)
Geysers on Io. Source of Driving Energy (June 1998)
Mass Extinction, a New Explanation. A New Explanation for Apparent Periodicity of Mass Extinctions (May 1998, August 2001)
Precession of Gyroscopes and of the Earth. **Gyroscope Precession and Precession of the Earth's Equinoxes** (Apr 1998)
Ocean Tides - The Physics and Logic. Mathematical Explanation of Tides (Jan 2002)
Earth's Spinning - Perfect Energy Source (1990, Dec. 2009)
Earth's Magnetic Field - Source and Logic. Complex nature of the magnetic field and its source (March 1996)
Earth Spinning Energy - Perfect Energy Source From the Earth's Spinning (1990, Nov. 2002)

Nuclear or Atomic Physics Related Subjects:

Nuclear Physics - Statistical Analysis of Isotope Masses Nuclear Structure. (research 1996-2003, published Nov 2003)
Quantum Defect is NOT a Mathematical Defect- It Can Be Calculated **The Quantum Defect is a Physical Quantity and not a Fudge Factor**(July 2007)
Atomic Physics - NIST Atomic Ionization Data Patterns **Surprising Patterns in the NIST Data Regarding Atomic Ionization** (June 2007)
Nuclear Physics - Logical Inconsistencies (August 2007)
Neutrinos - Where Did they all Come From? (August 2004)
Neutrinos - Olbers Paradox Means Neutrinos from Everywhere (Oct 2004)
Quantum Nuclear Physics. A Possible Alternative (Aug 2001, Dec 2001, Jan 2004)
Quantum Physics - Quantum Dynamics. A Potential Improvement (2006)

Quantum Physics is Compatible with the Standard Model (2002, Sept 2006, Oct 2010)
Quantum Dynamics (March 2008)
Ionization Potential - NIST Data Patterns. Surprising patterns among different elements (March 2003)

Mass Defect Chart. (calculation, formula) (research 1996-2003, published Nov 2003)

Assorted other Physics Subjects:

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This subject presentation was last updated on - - 05/24/2019 08:39:05 Carl Johnson
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