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What Causes Gravitational Time Dilation? A Physical Explanation.

Co způsobuje gravitační dilataci času? Fyzikální vysvětlení.

Dialect

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Clocks in a gravitational field tick more slowly -- but why? What causes their rates to be slowed by the precise amount that they are? According to modern physics, such answers can only be extracted from within the abstract and insuperably mathematical depths of the infamous Einstein equation... but what if there were a simpler route? Join us as we take a single daring leap of physical intuition that may just change how we understand gravity g
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Clocks in a gravitational field tick slower – but why? 61,907 views >6. 7. 2025<. Clocks in a gravitational field tick slower – but why? Clocks, wherever they are in the Universe, must not tick faster or slower anywhere, **clocks must tick the same everywhere!!!** Time can tick slower or faster, but clocks never. What causes their >speed to slow down< by exactly the same amount as it is slowed down? ? According to modern physics, such answers can only be obtained from the abstract and insurmountably mathematical depths of the infamous Einstein equation ... but what if there was an easier way? Join us and together we will take one bold leap of physical intuition that could change our understanding of gravity forever ...

0:00

(01)- it's a well-known experimental fact that clocks closer to a body of mass will tick more slowly than those farther out a phenomenon known as gravitational time dilation but what actually determines the precise rates of such ticking that is what causes this time dilation well to know that modern physics requires that you know the actual amount by which a body of mass warps space and time in its vicinity this in turn requires solving one of the most difficult and advanced mathematical expressions known to man the formidable Einstein equation but what if there were a simpler route one that could get you the exact same answers and even deeper insights without requiring years of mathematical study this is dialect with the true cause of gravitational time dilation

The Schwarzschild Time Dilation Factor

1:08

if you're familiar with relativity you may have come across this particular solution to the Einstein equation before called the **Schwart Shield** ? solution this expression corresponding to the Schwartz shield space-time metric is pretty lengthy and intimidating but for the moment all we care about is this particular factor in front of the cdt ^ squ infantesimal which when we take its square root gives us the precise rate by which clocks in a gravitational field will tick more slowly that is this expression tells us that a clock situated at a distance r out from a

central mass will tick more slowly than a clock very far out in deep space by a factor of the square of 1 - 2 gm over c ^2 * r here G is the gravitational constant C ; $1 – 2GM/c^2x$
2:00
the speed of light and M the mass of the body which is assumed to be uncharged and negligibly rotating as an example if we consider a clock on the surface of the earth then after plugging in all the respective values this expression tells us that our clock runs 0.7 nonds slower than it would if it were out in deep space obviously the effect of gravitational time dilation is very slight in most cases indeed if we wanted our Earth clocks to run say half as fast as deep space ones then we'd have to increase the mass of the Earth by 540 million times its original amount or should we instead keep Earth's mass constant we'd have to shrink its radius down to 1.18 cm about the size of a grape to achieve the same level of
3:01
time dilation shrink it down a little further and you'd hit the spart shield radius corresponding to the mass of the Earth but we'll circle back to that so where does this expression actually come from well modern physics would claim there's only one route to it that being through Einstein's famous field equation relating the curvature of spaceime to its momentum energy density now it took Einstein nearly a decade to formulate this equation and even after that the math was still so difficult he was unable to solve it himself indeed the simplest solution the spark shield solution requires numerous complicated assumptions before it even gets off the ground and then it's pages and pages of dizzying calculations until the metric is arrived at so it may seem then that an understanding of where gravitational time dilation comes from is hopelessly out of reach to the ordinary lay person well don't give up hope just yet because this expression can be derived in about 5 minutes without any reference to Einstein's equation using rather just basic high school math and some solid physical intuition but how is this possible well good science hinges on a

Time Dilation Equivalence Hypothesis

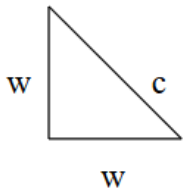
good hypothesis and the hypothesis we're going to make here regards the cause of gravitational time dilation that is we will assert that gravitational time dilation is caused by the exact same thing which causes regular i.e relativistic time dilation now flashing back to special relativity for a minute the cause of relativistic time dilation is quite simple when a clock is set into motion the light signals traversing it have a
5:00
farther distance to travel to reach their destination consequently the clock's ticking is slowed for a clock moving at some constant velocity V the degree of this dilation can be calculated via the basic Pythagorean theorem and takes the form of the square of 1 - V ^2 / C^2 now right away we can notice something extremely curious the expression for gravitational time dilation and relativistic time dilation have very similar forms both have a square root with a one minus beneath it as well as a c^ squ in the denominator of the subtracted term this similarity in structure now motivates us to make a sudden but intriguing conceptual leap what if we interpreted the remaining quantity in the gravitational expression
6:00
as being equal to some velocity squared if we do this then we could claim that just as a clock
……

(01)- it is a well-known experimental fact that clocks closer to a material body tick slower → First mistake of this article. Clocks do not change the rate of time, clocks may not change the rate of time. Physical time yes, it can change the rate, but clocks cannot. Clocks are

mechanisms set to a certain rate of time, by which changes in the rate of real physical time can be measured, not vice versa,…; than those further away from it, which is a phenomenon known as gravitational time dilation, but what actually determines the exact ¨speed¨, please use the word “speed”, because **speed is a given physical quantity for x/t**, such ticking, is that what causes this time dilation? *The ticking rate* does not cause time dilation, but the curvature of dimensions does, https://www.hypothesis-of-universe.com/docs/c/c_478.jpg ; https://www.hypothesis-of-universe.com/docs/c/c_430.jpg ; We know well that modern physics requires you to know the actual amount by which a material body deforms space and time in its surroundings. This in turn requires solving one of the most difficult and advanced mathematical expressions known to mankind - Einstein's formidable equations. But what if there was an easier way that could give you exactly the same answers and even deeper insights without requiring years of mathematical study? That is the dialect with the real cause of gravitational time dilation.

Schwarzschild time dilation factor $\gamma = 1 / \sqrt{1 - v^2/c^2}$, the gamma factor will be from an isosceles triangle

podle Pythagora) :



$$c^2 = w^2 + w^2$$

$$c^2 - w^2 = w^2$$

$$\frac{c^2 - w^2}{c^2} = \frac{w^2}{c^2}$$

$$1 - \frac{w^2}{c^2} = \frac{w^2}{c^2}$$

$$\frac{1}{1 - \frac{w^2}{c^2}} = \frac{c^2}{w^2}$$

$$\frac{1}{\sqrt{1 - \frac{w^2}{c^2}}} = \frac{c}{w} = \gamma$$

1:08

If you're familiar with relativity, you may have come across this particular solution to Einstein's equation before, called the ~~Schwartz~~ Schwarzschild shield solution. This expression corresponding to the Schwartz shield spacetime metric is quite lengthy and intimidating, but for now we're only interested in this particular factor before the infinitesimal cdt ^ sq, which, when taken to the square of. The square root gives us the exact rate at which a clock ticks slower in a gravitational field, and that's a misreading... i.e., this expression tells us that a clock placed at a distance r from a central mass will tick slower than a clock very far away in deep space by a factor of 1 - 2 gm over c ^2 * r squared, where G is the gravitational constant, C

2:00

the speed of light, and M the mass of the body, $1 - 2GM/c^2x$ which is assumed to be uncharged and rotating negligibly. For example, if we consider a clock on the surface of the Earth, then after plugging in all the relevant values, this expression tells us that our clock runs

0.7 seconds slower than it would in deep space. https://www.hypothesis-of-universe.com/docs/c/c_430.jpg ; The effect of gravitational time dilation is clearly very small in most cases. If we wanted our terrestrial clock to run, say, half as fast as a clock in deep space, we would have to increase the mass of the Earth to 540 million times its original value, or instead we should keep the mass of the Earth constant. We would have to reduce its radius to 1.18 cm, which is about the size of a grape, to achieve... the same level
3:01
time dilation shrink it a little further and you get a spartan shield radius equal to the mass of the Earth, but we'll come back to that in a circle, so where does this term actually come from? https://www.hypothesis-of-universe.com/index.php?nav=f ; Modern physics would argue that there's only one way to do this, and that's via Einstein's famous field equation, which relates the curvature of space-time to its momentum-energy density. It took Einstein almost a decade to formulate this equation, and even then the math was still so difficult that he couldn't solve it himself. The simplest solution, the spark shield solution, requires numerous complex assumptions before it even takes shape, and then it's pages and pages of dizzying calculations before the metric is reached. So it may seem that understanding the origin of gravitational time dilation is hopelessly out of reach for the average layperson. Don't give up hope yet, because this expression can be derived in about 5 minutes without any reference to Einstein's equation using only basic high school math and solid physics intuition, and the gamma expression can be obtained in 3 minutes from an isosceles triangle https://www.hypothesis-of-universe.com/docs/d/d_004.pdf ; https://www.hypothesis-of-universe.com/docs/f/f_041.pdf ; https://www.hypothesis-of-universe.com/docs/f/f_073.pdf ; but how is that possible? Good science depends on the Time Dilation Equivalence Hypothesis a good hypothesis and the Hypothesis we will make here regarding the cause of gravitational time dilation, that is, we will claim that gravitational time dilation is caused by exactly the same thing that causes regular, i.e. relativistic time dilation, which now returns for a minute to special relativity. The cause of relativistic time dilation is relatively simple. O.K. The cause is the rotation of the systems, i.e. the system of the object (rocket) in motion relative to the system of the Observer, whose system is/was brought to rest. And the cause of the rotation of the system of the rocket in motion is the curvature of the dimensions "around the rocket", i.e. the curvature of space-time = the environment in which the rocket flies. When the clock is set in motion, which is the same as if the clock were lying on a table in the rocket…(the clock will still tick at the same rate, but time will not, time will stretch its intervals…, several standard intervals from the Observer's system will fit into the stretched interval) … the light signals passing through them must travel a longer distance to reach their destination. As a result the ticking of the clock slows down, the ticking of the clock must not slow down!!! if the clock moves at a certain constant speed "v". The degree of this dilation can be calculated using the basic Pythagorean theorem and has the form of the square of $1 – v^2 / c^2$. Now we can immediately notice something extremely strange: the expression for gravitational time dilation and relativistic time dilation have very similar forms. Both have a square root with a minus one below it and also c^ sq in the denominator of the subtracted term. This similarity in structure now motivates us to make a sudden but interesting conceptual leap: what if we interpret the remaining quantity in the gravitational expression? ??? I don't get it yet
6:00
As equal to some square of the velocity, if we do that, then we could argue that just like clocks

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(02)- in special relativity ticks more slowly because it is traveling at some particular velocity V through space a clock in a gravitational field will also tick more slowly because it is traveling at a particular velocity through space a velocity equal to the square roo of 2gm / r at first glance this might sound

Capture Velocity / The Gravitational Flow Field

absurd clocks in a gravitational field clearly aren't in motion they're stationary but this isn't quite true because in order to remain at a stationary distance from a gravitational mass these clocks must all be continually combating the pole of gravity meaning they must be accelerating down near the surface of the mass this acceleration would have to be fairly substantial since the gravitational pull

7:01

there is correspondingly strong as we move farther away from the mass the gravitational pull falls off and the required acceleration falls off with it eventually when we reach very great distances there is negligible gravitational pull and our clocks would not be required to accelerate at all okay so our clocks are accelerating but they still clearly have no velocity right well they have zero velocity with respect to the central mass but that doesn't mean they couldn't have velocity with respect to something else indeed here is where we make note of another extremely intriguing coincidence the expression the square root of 2gm / r our hypothetical guess for the velocity of these accelerating clocks isn't just some random assemblage of values it's actually already a well-known velocity expression that

8:01

incredibly enough comes from classical Newtonian physics as it happens this velocity expression corresponds to what's called escape velocity the velocity at which you'd have to outwardly launch an object in order for it to completely escape the gravitational pole of a given body of mass now this is very strange escape velocity is derived from the classical expression for gravitational force so what is it doing lodged in the heart of a fully relativistic solution to Einstein's equation general relativity doesn't really offer an answer to that question indeed this fact if it even ever receives mention at all is considered to be a coincidence within the context of modern physics but of course good science doesn't rely on coincidence and so we ought to ask just what then is the connection here

9:02

well digging a little deeper one can find that in addition to escape velocity there's a second physical meaning to the expression the square root of 2gm / r something one might term capture velocity this is essentially escape velocity but in reverse the velocity acquired by an object released at a very great distance from a mass now this provides the final clue to the puzzle for imagine a steady stream of tiny neutral particles being released a very far distance away from your central mass as gravity captures and accelerates these particles inwards they pick up speed giving rise to a steady flow field about the mass the speed of this flow at any distance r out becomes precisely the capture velocity value the square root of 2gm /

10:05

r so if we want to extend our hypothesis that relativistic time dilation and gravitational time dilation are one in the same thing then we can do so by asserting that our clocks have a velocity V with respect to this particular flow field a velocity which they maintain via their constant outward acceleration with respect to the mass now of course there aren't really fields

of particles flowing into gravitational masses so this leaves us with the allimportant question just what is flowing

The River Model

here well the answer to that question is space space is what is flowing but not some abstract coordinative space rather the physical space through which light and other causal information propagates as a wave for this is precisely what the

11:01

equivalence of relativistic and gravitational time dilation implies clocks tick more slowly when moving faster with respect to such space hence clocks which are ticking more slowly lower down in a gravitational field must be moving faster through this space than those higher up ergo the entirety of space surrounding a mass must be steadily flowing inwards carrying objects matter and even light along with the current of its flow gravity can then be supposed to be a force acting not on traditional matter but rather on this space itself accelerating it inwards at the traditional Newtonian gravitational rate GM over R 2 this onlogical conception of gravity is known as flowing space or the river model and surprisingly it's not at all new in fact its roots extend as far back as

12:02

Isaac Newton who first tentatively proposed the idea in a private letter to a colleague now regardless of how it strikes your fancy it should be apparent just how easily this model allows us to derive gravitational time dilation for all that we need to posit is that space very far out

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(02)- in special relativity, clocks tick slower because they are moving through space at a certain speed V. Clocks in a gravitational field will won't also tick slower because they are moving through space at a certain speed, a speed equal to the square of roo 2gm/r. What kind of nonsense is this? Shouldn't it be the square root of 2gm/r = v… At first glance, it might seem so. Capture velocity / Gravitational flow field (*_) Absurd clocks in a gravitational field are apparently not moving, they are stationary, but that's not entirely true, because in order to stay at a stationary distance from the gravitational mass, all these clocks have to constantly fight the pole of gravity, and that's what?, which means they have to accelerate downwards near the surface of the mass. This acceleration would have to be quite significant, because the gravitational pull

7:01

is correspondingly strong, as we move away from the mass, the gravitational pull decreases and with it the required acceleration decreases. Eventually, when we reach very large distances, the gravitational pull is negligible and our clocks wouldn't have to accelerate at all. Okay, so our clocks are accelerating, but they still clearly have no velocity, well, zero velocity relative to the central mass, but that... doesn't mean they can't have velocity relative to something else, and it's here that we notice another extremely interesting coincidence - the square root of 2gm/r expression - our hypothetical estimate of the velocity of this accelerating clock is not just some random set of values, but is actually a well-known expression for velocity, which

8:01

incredibly comes from classical Newtonian physics, because this expression for velocity corresponds to the so-called escape velocity - the speed at which you would have to shoot an object out to completely escape the gravitational pole of a given body. This is very strange -

escape velocity is derived from the classical expression for the gravitational force, so what is it doing at the heart of a fully relativistic solution to Einstein's equations? General relativity doesn't really offer an answer to this question. This fact, if it is ever mentioned at all, is considered a coincidence in the context of modern physics, but of course good science doesn't rely on coincidences, so we should ask what the connection is.
9:02
well, digging... A little deeper, we can see that besides escape velocity, there is a second physical meaning of the expression square root of 2gm/r, something that could be called the capture velocity. It is essentially escape velocity, but in reverse, the velocity that an object released at a very great distance from the mass will acquire. This provides us with the final clue to the puzzle. Imagine a steady stream of tiny neutral particles that are released at a very great distance from your central mass, as gravity captures these particles and accelerates them inward. They increase in speed, which leads to the formation of a steady flow field around the mass. The speed of this flow at any distance r becomes exactly the capture velocity, square root of 2gm/r ; or: $v^2 = 2GM/x$ …. O.K. That's Newton.
10:05
, so if we want to extend our hypothesis that relativistic time dilation and gravitational time dilation are the same, O.K. because both are based on dimensional warping with system rotations… we can do this by saying that our clocks have a velocity V with respect to this particular flow field, a velocity that they maintain through their constant acceleration outwards with respect to matter. Now of course there are no real fields of particles flowing into gravitational masses, so that leaves us with the important question of what is actually flowing. Well that is a bad question because nothing flows. The fundamental phenomenon is the rotation of systems in curved spacetime.

The River Model

here is the answer to this question space, space is what flows, but not some abstract coordination space, rather the physical space through which light and other causal information propagate as a wave, because that is exactly what
11:01
Equivalence of relativistic and gravitational time dilation means that the clock ticks slower when it moves faster relative to such a space, the clock does not tick slower, but the object on which the clock "lies" rotates and thus the "basic Observer" sees=reads deformed or distorted data from the rocket... therefore the clocks that tick slower lower in the gravitational field must move faster through this space than those higher up. Therefore, the entire space surrounding the matter must flow steadily inward, carrying objects, matter, and even light along with the flow of its flow. Gravity can then be considered a force acting not on traditional matter, but rather on this space itself, which accelerates it inward at the traditional Newtonian gravitational velocity GM divided by R^2. O.K., but that is a wrong view=judgment "of the thing". According to STR, the dilation (or contraction) on an object increases as the speed “v” of that object increases…, but in order for the speed value to increase, a force (gravitational) must be “added”, which is “added”-increasing the curvature of space-time “around the rocket”. In simple terms, “v” can increase using the acceleration “a” (or “g”) and this is then the cause of the curvature of space-time around the flying body. It is the environment for the rotation of the system of the flying object and thus for changing the size of the time (or length) standard. On paper! And it is then sensed by the Observer, who evaluates the time extension as dilation on paper (length shortening as contraction)…., while nothing on the rocket itself is extended (shortened). The dilation (or contraction) is only an

illusion in the observatory, which is at rest for the object in motion. This ontological conception of gravity is known as the flowing space ?? or river model and surprisingly it is not new at all, its roots go back to the past.
12:02
Isaac Newton, who first tentatively proposed this idea, in a private letter to a colleague, now, no matter how you think it, it should be obvious that how easily this model allows us to derive gravitational time dilation for all we need to postulate is that space is very far away
…….

(03)- from a mass is slowly captured by gravity and accelerated inwards at the traditional Newtonian rate then a little high school calculus shows that this space eventually acquires a speed of the square root of 2gm / r with respect to the mass as it flows radially in clocks stationary with respect to this mass are therefore traveling through space at this velocity and hence their dilation amount can be calculated using the normal relativistic factor now hindsight is always 2020 but let's
13:00
stop and take a moment to marvel at the incredible fact that it took Einstein and others 10 years to derive an expression that they might have discovered far more swiftly if they'd simply chosen to favor physical intuition over mathematical abstraction indeed notice how we didn't utilize any complicated mathematics to get to our answer no differential geometry no four vectors no tensors and best of all absolutely no space-time curvature such a derivation shouldn't even be possible according to modern physics yet here it is completed with nothing further than basic physical principles Newton himself might have advocated for now as we've discussed in a prior video the river model offers a number of other powerful insights into general relativity which are not accessible via the standard geometric interpretation insights such as the
14:00
meaning of the equivalence principle or the nature of tidal forces but most notably this model tells us that the infamous Schwartz shield radius of a black hole simply corresponds to setting our capture velocity equal to the speed of light implying that the event horizon of a black hole is nothing more than a place where space is flowing inwards towards a mass at the speed of light C light and other causal signals are thereby constrained by this horizon unable to swim upstream fast enough to escape the current of space there meanwhile clocks accelerating in place near this horizon will tick so slowly as to appear to be

Future Considerations

frozen but does all this mean space is really flowing into large bodies of mass if so why where does this space come from and where does it go what other properties might it have
15:04
those are all important questions to parahhelion and the nature of black holes well the answer to that is yes yes it can and it can do so all without any reference to space-time curvature meaning we're in some brand new ontological territory indeed in future videos we'll be showing that this model offers us not only heightened conceptual clarity and greater mathematical simplicity over geometric general relativity but also that it incorporates causal mechanisms for its phenomena in a way which general relativity cannot hence opening pathways to deeper and newer theories indeed it's clear that modern
16:00

physics is about to hit a major turning point that the old ways of abstract mathematical thinking aren't going to suffice for much longer and it's for this very reason that we've called together a conference for physical and mathematical ontology to take place in a few weeks in Munich Germany there we're bringing together a number of astute independent thinkers in order to start sincerely probing the deeper nature of our physical reality and while mainstream physics isn't likely to part with its cherished abstractions anytime soon you'll find these and other thinkers exploring a variety of new and alternative approaches to modern physics so check back soon to see what interesting revelations may be in store and as always this has been Dialect thanks for
16:49
Watching
……..

(03)- of matter is slowly captured by gravity and accelerated inward at the traditional Newtonian velocity, then a little high school calculus shows that this space eventually acquires a velocity (why doesn't the m-object acquire a velocity??) of the square root of 2gm/r relative to the matter, when flowing radially in stationary clocks, that "space" flows in clocks?? relative to this matter, which therefore moves through space at this velocity, and therefore their dilation amount can be calculated using the normal relativistic factor. https://www.hypothesis-of-universe.com/docs/d/d_003.pdf ; Now, retroactively, it's always 2020, but let's
13:00
stop for a moment and think about the incredible fact that it took Einstein and others 10 years to derive an expression that they could have discovered much faster if they had simply decided to prioritize physical intuition over mathematical abstraction. ?? Notice how we didn't use any complex math in our answer. No differential geometry, no four vectors, !! no tensors !! **and best of all →**, absolutely no spacetime curvature. Which is wrong. Changing a constant velocity "v" to v_1, then v_2, then v_3, then vn can only be done with "a" (acceleration), and this acceleration can only be obtained by curving spacetime ... and only matter can do that curvature. Where there is no matter, there is no 3+3D curvature either. And such a state is before the big bang. What I don't know is how the "a" turns into "v_n".** Such a derivation should not even be possible according to modern physics, but here it is, completed with nothing more than basic physical principles that Newton himself could have argued, as we discussed in the previous video, the river model offers. A number of other powerful insights into general relativity that are not accessible through standard geometric interpretation, such as
14:00
the meaning of the equivalence principle or the nature of tidal forces, but most notably, this model tells us that the infamous Schwartz ? radius of a black hole shield simply corresponds to setting our capture velocity equal to the speed of light, which means that the event horizon of a black hole is nothing more than a place where space flows inwards towards matter at the speed of light C, light and other causal signals are confined by this horizon, unable to swim upstream fast enough to escape the flow of space. Meanwhile, clocks accelerating at a location near this horizon will tick so slowly that they will appear to be Future Considerations frozen, but does all this mean that space is actually flowing into large material bodies? And

wasn't that space in the black hole before? If so, why, where did this space come from and where is it headed? What other properties might it have?
15:04
These are all important questions about perihelion ? and the nature of black holes. The answer to that is: yes, yes, it can and does, and all without any reference to spacetime. The curvature means that we are in entirely new ontological territory. In future videos, we will show that this model offers us not only increased conceptual clarity and greater mathematical simplicity over geometric general relativity, but also that it includes the causal mechanisms of its phenomena in a way that general relativity cannot, thereby opening the way ? to deeper and newer theories. It is clear that modern
16:00
physics is about to reach a major tipping point where the old ways of abstract mathematical thinking will no longer hold. It is for this reason that we have convened a conference on physical and mathematical ontology to be held in Munich, Germany, in a few weeks. We'll gather a number of bright independent thinkers to begin an honest exploration of the deeper nature of our physical reality. While mainstream physics is unlikely to part with its beloved abstractions anytime soon, you'll find these and other thinkers exploring a range of new and alternative approaches to modern physics. So come back soon and see what exciting discoveries await you. As always, this was Dialect, ? thanks for watching. What causes gravitational time dilation? The author asked the question himself, but…, **I didn't find out here either**.
16:49
……..
JN, 12. 06. 2025