

The Miracle of Jesus Walking on Water Through the Lens of Gravitational Time Dilation

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Abstract

Whether they are theologians, lay people, or non-believers, most have at least anecdotally heard of the miracle of Jesus walking on water. Many important lessons and insights can be gleaned from this important passage, including testimony to the identity of Jesus that bolsters belief in Him and His deity and a non-trivial display of Jesus' power over His creation. However, was God trying to convey more than just His ability to elude physics, and displaying His authority over the dimension of time and its creation? The dimension of time is an elusive and much debated dimension that is difficult to understand, and in the context of God and heaven, it is in many respects beyond human comprehension. However, as expressed by Albert Einstein, "the distinction between the past, present and future is only a stubbornly persistent illusion." This illusion can only be unlocked by God, and thus it was created by God. In this article, the miracle of Jesus walking on water is explored in relation to the phenomenon of gravitational time dilation; it is considered as an instance that reveals God's relation to time, as well as the complexity and awesomeness of creation in general. We show that the equations for time dilation around a massive body may serve as a model to show the independence of God from His creation of spacetime.

Key Words: Spacetime, time, gravitational time dilation, gravity

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Introduction

Whether Christian or non-Christian, most people have heard of the miracle of Jesus walking on water. This miracle, recorded in three of the four Gospels (Mt. 14:22–36; Mk. 6:45–56; Jn. 6:16–21, KJV), was the miracle that, above any other, convinced Jesus’ disciples that He was undeniably the Son of God (Mt. 14:32–33, KJV).

Many important lessons and insights can be gleaned from this important passage, including testimony to the identity of Jesus that bolsters belief in Him and His deity. Other lessons include Jesus’ sending us into the storms of life to build our faith; to not be driven by need or opportunity, but only by the will of God; the notion that sometimes Jesus shows up in our lives, but we do not recognize

Him; and the implication that we are to “see” with our heart and not just our eyes. However, was God trying to convey more than a miracle and its associated lessons, and displaying His authority over the dimension of time and its creation?

Several places in the Bible hint at God’s relationship to time. For instance, and most transparent, 2 Peter 3:8 (KJV) says, “But, beloved, be not ignorant of this one thing, that one day is with the Lord as a thousand years, and a thousand years as one day.” This verse appears to indicate that time does not restrict God. Likewise, Psalm 90:4 (KJV) states: “For a thousand years in thy sight are but as yesterday when it is past, and as a watch in the night,” indicating that—contrary to man’s feebleness and finitude, as posed in Psalm 90:3 (KJV)—God is not

subject to the constraints of time. Lastly, Isaiah 57:15 (KJV) says, “For thus saith the high and lofty One that inhabiteth eternity, whose name is Holy...” More succinctly, God dwells in eternity.

The dimension of time, however, is an elusive and much debated dimension that is difficult to understand. In the context of God and heaven, it is in many respects beyond human comprehension. While the words of the well-known hymn “Amazing Grace” express life in heaven in terms of a great expanse of time, the miracle of Jesus walking on water may shed light on the error of this understanding and the limitations on God it presupposes. Specifically, by walking on water, Jesus may have demonstrated His ability to overcome the force of gravity and, via the phenomenon of gravitational time dilation, exhibited His supremacy over the dimension of time, supporting the concept of His atemporal, “outside-time” existence.

God and Time

Every theistic worldview holds some view of how God is associated with the structure of our universe: that is, with space and time. If God is the creator of the universe, one might naturally question whether God created space and time as well, or whether space and time are merely aspects of the universe or something more fundamental. It turns out that a minority of philosophers and theologians believe that space is more fundamental than the universe. Many, conversely, believe that God brought space into existence (Wierenga, 1989). This view suggests that God is, to an extent, spaceless or “outside” space (Helm, 1988). Views of God’s association with time, however, are riddled with disagreement. From Augustine through Aquinas, the major thinkers of early Christianity contended that, like space, God is “outside” time. They thought of God as eternal, in the sense that He is timeless

or atemporal (Ganssle, 2001). On the other hand, a popular opinion among contemporary philosophers is that God is everlasting but temporal, experiencing some events before He experiences other events (Ganssle, 2001). If this is the case and God is temporal, His existence and His thoughts and actions have a specific location in time. He exists in the present moment, He has existed in every past moment, and He will exist in every future moment.

The miracle of Jesus walking on water may be able to shed light on this debate and the fuller extent of the complexity of creation by interpreting the relationship between gravity and time.

The Physics of Time and Gravity

Gravitational time dilation refers to the difference in the elapsed time as measured by two clocks. It was first described by Albert Einstein in 1907 as a consequence of special relativity in accelerated frames of reference (Schwartz, 1977). Gravitational time dilation is a phenomenon whereby time runs slower when in a higher gravitational potential. Put simply, the closer you

are to a massive object like the Earth, the slower time runs; thus, time runs more slowly for someone on the surface of the Earth than for someone in orbit around the Earth (Humphreys, 2017). This phenomenon, as described by Einstein, is inevitable if the two axioms of Einstein's relativity theory are accepted: (1) the speed of light is constant for all observers; and (2) the weight induced by acceleration is fundamentally the same as that induced by gravity: the so-called equivalence principle (Einstein and Lawson, 2005).

Logical consistency and experimental results (Marletto and Vedral, 2020) support the idea that gravity causes clocks to run more slowly. The existence of gravitational time dilation was first confirmed directly by the Pound–Rebka experiment in 1959 (Pound and Rebka, 1959) and later refined by Gravity Probe A in 1976, among other experiments (Vessot et al., 1980; Malykin, 2015). Intriguingly, according to this theory, gravity does not warp the flow of time. In fact, it is the other way around: the warping of time causes gravity (Allday, 2019).

How does time cause gravity? Imagine a body in space. Absent a gravitational field or any forces, if the body starts

motionless, it stays that way. At least, it stays motionless with respect to the three dimensions of space. Everything moves through the dimension of time.

Per Figure 1, space is displayed in two dimensions for simplicity, and time is displayed as a third dimension. Figure 1 shows the progression through time as the body moves up. It can be rationalized to have a positive velocity through time and zero velocity through space. When a second body is added, such as planet Earth—a massive object—it is understood that the presence of mass and energy warp spacetime. The most intense impact of that warping is to time, which produces gravitational time dilation (see Figure 2); again, bodies closer to Earth move through time more slowly (Rovelli, 2016).

A common equation used to explain gravitational time dilation is derived from the Schwarzschild metric, which describes spacetime in the vicinity of a non-rotating massive spherically symmetric object. In Einstein's theory of general relativity, the Schwarzschild metric is a solution to the Einstein field equations which relate the geometry of spacetime to the distribution of matter within it. The Schwarzschild metric

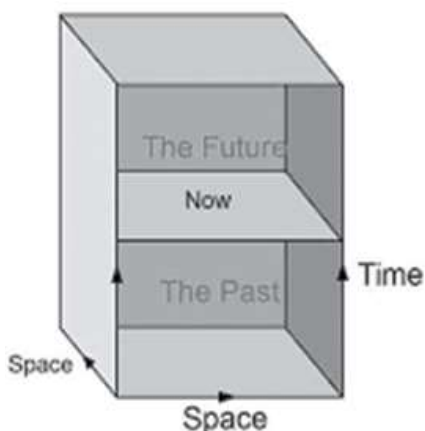


Figure 1. Einstein's block universe.

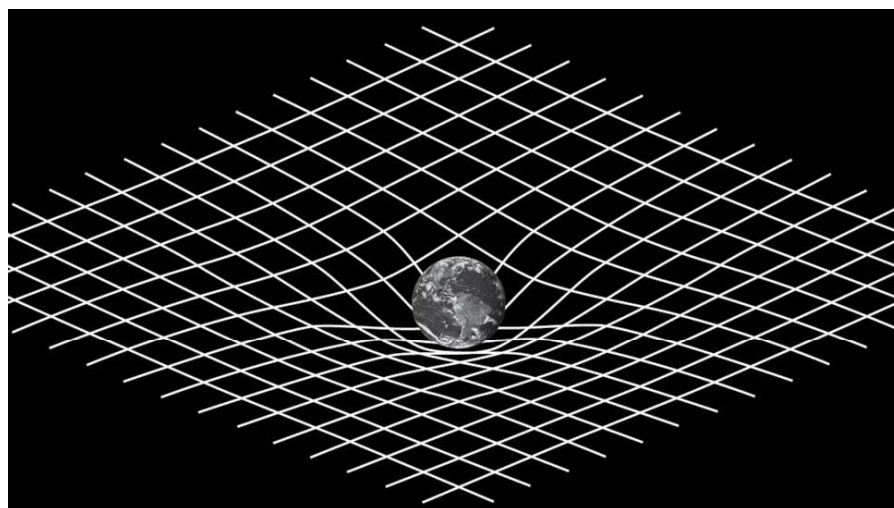


Figure 2. The warping of spacetime.

describes the gravitational field outside a spherical mass (such as Earth) on the assumption that the electric charge of the mass, the angular momentum of the mass, and the universal cosmological constant (the constant coefficient of a term that Einstein temporarily added to his field equations of general relativity, later reinterpreted as the energy density of space, or vacuum energy, that arises in quantum mechanics) are all zero. The solution is a useful approximation for explaining slowly rotating astronomical objects, such as Earth and the Earth's sun (Fromholz, Poisson, and Will, 2014). The equation is

$$t_0 = t_f \sqrt{1 - \frac{2GM}{rc^2}} \quad (1)$$

where

t_0 = time perceived between events for a body near a massive object (i.e., time inside the gravitational field);

t_f = time perceived by a body far away from the massive object not under the gravitational influence of any massive object, including the one under consideration (i.e., time outside the gravitational field);

c = speed of light;

G = gravitational constant;

M = mass of the object creating the gravitational field; and

r = radial distance from a person to the center of the massive object.

The Schwarzschild radius (r_0), the radius below which the gravitational attraction between the particles of a body must cause it to undergo irreversible gravitational collapse (Fromholz, Poisson, and Will, 2014), is defined as

$$r_0 = \sqrt{\frac{2GM}{c^2}} \quad (2)$$

Substituting Eqn. 2 into Eqn. 1 results in Eqn. 3, where t_0 can be expressed as

$$t_0 = t_f \sqrt{1 - \frac{r_0}{r}} \quad (3)$$

Note: If a mass collapses so that its surface lies at less than the radial coordinate r_0 , then the object exists within a black hole.

From Eqn. 3, as a body moves farther from a massive object (r increases; r_0 is constant), the difference between the time perceived by a body far away from the massive object (not under its gravitational influence), t_f , and the time perceived between events for a body near the massive object, t_0 , decreases (i.e., time moves faster as the body moves away from the massive object). That is, for a fixed time passage for a body close to the massive object, the corresponding time elapsed as perceived by a body far away is small. Furthermore, from the body that is close to the massive object's point of view, time will pass very quickly for the body far away from the massive object. So, from the warping of space-time, clocks closer to a massive object take longer to tick than distant clocks do.

Note: As the body approaches a distance of r_0 from the massive object (the event horizon), time will have appeared to have come to a standstill to a body observing from far away; hence, the body will never reach a distance of r_0 from the massive object from the viewpoint of the body far away.

Also, the formula to find escape velocity—i.e., the minimum velocity required for a free, non-propelled body to escape from the gravitational influence of a massive object, thus reaching an infinite distance from it—is a simple rearrangement of terms solving for velocity in an equation in which the kinetic energy of an object is equal to its gravitational potential energy (Blanco and Mungan, 2021). This yields

$$v_e = \sqrt{\frac{2GM}{r_i}} \quad (4)$$

where

r_i = radius from the center of gravity of the massive object, and

v_e = escape velocity.

Assuming r_i is the radius of Earth and a body is on Earth ($r = r_i$), substituting Eqn. 4 into Eqn. 1 results in a derivation of the Lorentz transformation (Einstein and Lawson, 2005, p. 42)

$$t_0 = t_f \sqrt{1 - \frac{v_e^2}{c^2}} \quad (5)$$

So, from Eqn. 4, the velocity needed to escape a massive object's gravitational field decreases as a body moves farther from the massive object because the force of gravity weakens as the body moves farther away from the center of Earth's mass. From Eqn. 5, if the escape velocity decreases (as a body moves farther from Earth), the difference between the time perceived by a body far away from the massive object (not under its gravitational influence), t_f , and the time perceived between events for a body near the massive object, t_0 , also decreases (i.e., time moves faster as the body moves away from the massive object). Because the force of gravity weakens as a body moves farther away from the center of Earth's mass, the velocity through time can be perceived as increasing the farther a body travels from Earth. If particles move through time according to those velocities, there is a sense of time flowing in a gradient: faster streams distant from the Earth, slower streams near to it. This is a similar concept to laminar flow of water in the center of a stream flowing more quickly than at the edge, where the shallower stream introduces friction on that flow (see Figure 3). It is as if Earth's mass creates a drag on the flow of time around it.

So, what happens to a body sitting in this stream of time? All bodies can be thought of as being made of many tiny clocks. Every atom, every subatomic particle is trying to tick at its own rate.

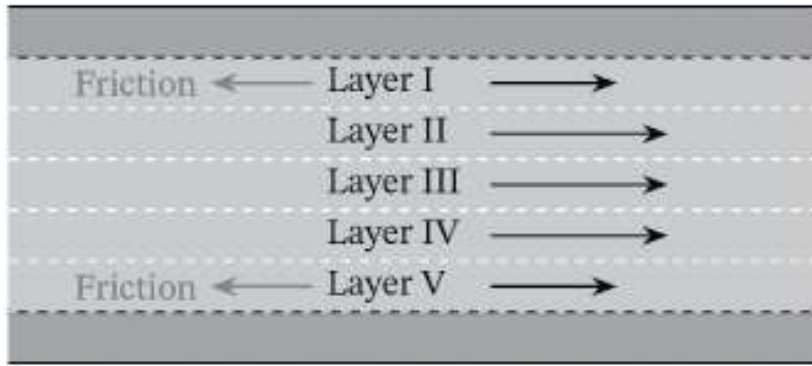


Figure 3. Laminar flow in a stream.

And each of those clocks has a velocity vector in time. So, what is the temporal velocity of the entire body? In Einstein's relativity, it must be remembered that time and space are not independent of each other. Objects do not just have a velocity through space or through time—they have a velocity through spacetime. This is referred to as their four-velocity (Einstein et al., 1952). All individual four-velocities begin purely in time, but the sum is rotated partially into space, and it is always rotated in the direction of decreasing flow, which, in a gravitational field, is downwards. The motion of any body in a gravitational field, then, is as follows: it gradually picks up velocity in the down direction via acceleration, and it pays for that acceleration by losing velocity (decelerating) in the time direction (Einstein et al., 1952).

There is a way of interpreting the math of relativity that states that everything travels at the speed of light. Light travels at the speed of light through space, and it is known that nothing with mass can reach that speed traveling through space. But if time is interpreted as a dimension like space, then a stationary mass really is moving at the fastest possible speed in the temporal direction. The four-velocity of a massive object is pointed almost entirely in the time direction. On the other

hand, light itself travels at the speed of light through space only, not through time. A photon's clock is frozen (Rovelli, 2016, p. 52). It can be envisioned that its four-velocity is entirely rotated out of the time direction into space; although, technically, photons and other massless particles do not have a four-velocity, which is defined according to the ticking of one's own clock (i.e., one's experienced time), which, for the timeless photon, is zero.

In this picture, a falling body trades some of its enormous velocity through time to pay for a small velocity through space. This exchange looks favorable for space; a body in space gains a rapid plummet to its doom for an imperceptible slowing of its clock. The same favorable exchange can be seen when converting mass into energy via Einstein's general theory of relativity equation, $E = mc^2$. The speed of light is the exchange rate, and the speed of light is very large (Einstein and Lawson, 2005).

Implication for God's Relation to Time

Building on the above discussion, from Eqn. 3, if $r = r_0$, then a body is at the event horizon, a boundary beyond which events cannot affect an observer, resulting in $t_0 = 0$; no time is perceived

between events for a body near a massive object. In this case, the four-velocity of a body would not rotate within the gradient of velocities resulting from warped time around a massive object. Thus, this body would not be subject to Einstein's relativity but would, in fact, be outside time. Barring the effect of black holes, if an object is not subject to time, then the object, in most circumstances, is not affected by the velocities and accelerations of an object constrained by time and thus would not experience four-velocity rotation. It would, therefore, not experience gravity. In the context of Jesus walking on water and the understanding of gravity and time in the above physics context, among other lessons and corollaries, Jesus may have expressed His ability to transcend the force of gravity, thus exhibiting His timelessness and His supremacy over the dimension of time. This supports the concept of His atemporal, outside-time existence, further bolstering the extent of the creation and His omnipotence in its manifestation.

Additionally, per Einstein's relativity, time and space are not independent of each other. An object outside time, therefore, must also be outside space. This supports the claim that God is outside both space and time and must have brought both into existence, supporting an *ex nihilo* creation concept (Whitcome, 2018).

This inference that God is outside time is a rejection of the claim that God is temporal. The claim of God's timelessness, as inferred by the miracle of Jesus walking on water, is that He exists not at any given time but beyond or outside time. In other words, rather than exist at particular points within time (i.e., temporal positions), God exists in eternity, where eternity is a non-temporal position (Craig, 2001). This also implies that God is not subject to temporal succession. God's relationship to each event in a temporal sequence is the same as His relationship to any other event. For

example, God does not experience 300 BC before he experiences AD 2022. Both years are experienced by God in eternity as one “timeless present.” So, as discussed in Daniel 10, while it is true that, in the 6th century BC, Daniel prayed and received a response from God, God’s response to his prayers did not occur only at that time. Daniel’s prayers were heard and answered by God in His eternal, timeless state of being. He did not listen to them first and then respond. He heard and responded in the same timeless instant: indeed, in the same timeless instant that He hears and responds to prayers in the present day.

Jesus’s act of walking on water may not have involved a local reduction of gravity. However, given the various other possibilities (an increase in the viscosity of water, an additional supernatural force on the soles of His feet to exactly balance His weight, etc.), overcoming gravity is a strong possibility, as the act is a powerful demonstration of Jesus’ direct control over natural law. His defiance of the law of gravity did not cancel, suspend, or alter this universal law. Instead, it was a manifestation of His stronger, divine power. Via analogy, Herbert Lockyer illuminates this principle:

The law of gravity is not set aside when the magnet collects iron filings; it is only that the superior force of magnetism has overcome gravitation. So what happened that stormy night was the exercise of Christ’s omnipotence, as He, the Creator of seas and winds revealed His authority over them, and they being His, He could use them as He desired. It was His will which bore Him triumphantly above those waters. (Lockyer, 1988)

Via this miracle, Jesus exercised His divine authority over the universal laws He created. In so doing, He conveyed much about Himself and His nature, for “it is the glory of God to conceal a thing; but the honor of kings is to search out a matter” (Prov. 25:2, KJV).

Jesus Exercises His Eternality

Christ walking on the water is discussed briefly in John 6:16–20. The details of the account are further elaborated upon in Mark, Chapter 6, and Matthew, Chapter 14; unlike Mark and Matthew, though, John ends this miraculous event with an interesting twist: “Then they willingly received him into the ship: and *immediately* the ship was at the land whither they went” (Jn. 6:21, KJV). Having exhibited His supremacy over the dimension of time by walking on water, Jesus ensures there is no ambiguity with this authority by lapsing time and “immediately” arriving at their intended destination some two or three-and-a-half miles away.

The Greek word used for “immediately” is *eutheōs* (εὐθέως), meaning *immediately, instantly, or at once*; it has 87 occurrences in the New Testament (Strong, 2007). While it does not always imply an instantaneous event—e.g., in Matthew 4:20, when the disciples “immediately” left their nets and followed Jesus—it clearly implies instantaneity in other cases. For instance, in Matthew 8:3: “Jesus stretched out his hand and touched him, saying, ‘I am willing; be made clean,’ and immediately (*eutheōs*) his leprosy was cleansed.” Further, in Revelation 4:2: “Immediately (*eutheōs*) I [John] was in the spirit, and behold, a throne was standing in heaven and one sitting on the throne!”

Additionally, in John 6:1–15 (Mt. 4:13–21, Mk. 6:30–44, and Lk. 9:10–17), Jesus miraculously multiplied five small loaves and two fishes into enough food to feed 5,000 men (the multitude that Jesus fed probably numbered more than 15,000 if women and children are included in the count), thus displaying His superiority over the law of conservation of mass. This law states that in any system closed to all transfers of matter and energy, the mass of the system must remain constant over time. Mass may be rearranged in space, or the entities associated it may change form, but it

can be neither created nor destroyed *by natural processes*. In this miracle, however, Jesus clearly added quantity, i.e., added mass from nothing; thus, he displayed His superiority over matter and thereby over the material world. It makes sense for the subsequent miracle discussed in the book of John to display His superiority over time, as He is the ultimate origin of both matter and time.

Implication for God’s Creation of the Universe

The inference of God’s timeless nature propagated by the miracle of Jesus walking on water derives from the perception that time itself is dependent. If time is dependent and God is not, the existence of time is predicated on God, but it is still possible for God to exist outside time. Either God created time, or He holds it in existence perpetually. If time was brought into being by God as a part of the creation of the universe, then it is important to understand whether the universe also had a beginning.

Jesus’ act of walking on water and overcoming the force of gravity displayed, in part, His authority over time. This authority suggests that, like the rest of creation, God brought time into existence. Thus, it can be inferred that the universe and time both had a beginning, as opposed to the past being infinite. If time came into existence with the universe—i.e., if the universe has a finite past—then time must have been created by God. God, then, would have to be timeless and remain timeless.

Conclusion

Just as most philosophers and theologians believed that God brought space into existence (Wierenga, 1989)—suggesting that God is spaceless or “outside” space (Helm, 1988)—so the major thinkers of early Christianity, such as Augustine, may have contended that God is “outside” time. To this end, Augustine

wrote, “You [O Lord] made that very time, and no time could pass by before you made those times. But if there was no time before heaven and earth, why do they ask what you did ‘then?’ There was no ‘then,’ where there was no time” (Augustine, 1960, p. 252). They thought of God as eternal in the sense of timeless or atemporal. This contention may be justified by Einstein’s gravitational time dilation evaluated against Jesus’ miracle of walking on the water. By walking on water, Jesus may have presented more than merely a miracle and sign of His Godhead; He may have displayed to the world His authority over the dimension of time, demonstrating atemporality, an “outside of time” essence. This implied atemporal timelessness of God gives us a clearer understanding of God’s omnipotence and omniscience, and ultimately the power He possesses compared to the feeble, constrained existence of man.

In the book of Genesis, God created the world in six days because, as suggested in Psalm 90:4 and as supported by this paper, the 24-hour day that humans experience does not restrict Him and all that He does, including His exclusive work of bringing the universe into existence. God’s eternality and timelessness is a facet of this absolute essence and perfect being. Further, Jeremiah 29:11 says, “For I know the thoughts that I think toward you, saith the Lord, thoughts of peace, and not of evil, to give you an expected end.” This indicates that God has a plan for all His children predicated on His absolute knowledge of the entire timeline of human existence: past, present, and future. This understanding conveys more supremacy to His kingdom, power, and glory. God has neither our need for time nor our time-associated limitations. This is abundant justification to trust Him with our short, temporal lives.

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