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Do Time Travelers Tweet?

By Teresa Wilson

*We live in four dimensions: three spatial dimensions plus a fourth dimension, time.*

Teresa, time is not a dimension in the same sense that length, width, and height are dimensions. Length, width, and height are properties of all matter in our universe. Time is not a property of any matter in our universe. Time is a property of the universe itself. We have learned to conceptualize this property, and we use time to describe the location of all matter and energy in the universe at any given instant.

*Of these, time is the most fluid, the one that is most influenced by personal experience.*

Teresa, since time is a property of the universe, and is neither matter nor energy, it cannot be influenced by anything; especially by personal experience.

*It goes too fast, or not fast enough.*

Teresa, time - by definition - only "goes" at one speed.

*Time gets to the very heart of what it means to be human since our experiences, which take place in time, are what shape our lives and decisions in the present and the future.*

Teresa, the future is a concept; it never actually comes into existence - reality only exists in the present; and even then, "the present" is a moving target, nearly impossible to pin down.

*And yet it is the only dimension in which we are restricted to moving in only one direction: forward. Or are we?*

Teresa, you should have quit while you were behind. I have a feeling this essay is about to get ... a lot worse.

*And if we can move backward in time, how would we prove it?*

Teresa, I knew it. You are driving full speed into fantasyland.

Okay, I'll play along, how would you prove it?

*These are the kinds of questions my research group and I were discussing one day over pizza and poker. Time travel: Literature and movies are full of references to it. The stories may be fictional, but much about the nature of time is still unknown,*

Teresa, if you understood the nature of time, there would be no unknowns. Every object in the universe is located at a certain place. An instant later ... they are all located somewhere else.

We call the difference between the two configurations ... time.

*and science thrives in these gaps in knowledge: as we try to fill the gaps, we discover how many more there are. Yet for as long as scientists and philosophers have been contemplating time travel, no one seems any closer to having an answer.*

Teresa, that might be because ... the concept is nonsensical.

*Since Einstein’s Theory of Relativity, time travel to the future has stood on firm scientific footing.*

No Teresa, it hasn't. Einstein's theories have nothing to do with time travel.

His theories explain how our perception of time is affected by our reference frame, as compared to objects traveling in different reference frames. These reference frames are influenced by gravity and velocity.

*To slow down the rate at which time passes, all you must do is travel close to the speed of light.*

Teresa, traveling, even at the speed of light, has no effect on time. Time proceeds along at the same rate it always has for 13.8 billion years throughout the entire universe. But objects that travel at or near the speed of light experience time differently than objects that do not.

*This phenomenon, called time dilation, is famously illustrated by the Twin Paradox, in which a space-traveling astronaut returns to Earth to find that her homebody twin sister has aged decades while she’s aged only a year.*

Teresa, the twins experienced the passage of time differently because they each were subjected to different velocities and gravitational influences. But time advanced throughout the universe at the same rate it always has. Time did not slow down.

*It is possible to test and confirm this effect even without the aid of a near-light-speed journey into interstellar space: You just need a pair of very precise clocks and an airplane. Indeed, time dilation has been tested by placing one such clock on a plane and leaving another on the ground. When the flying clock landed, it showed a time that was about 107 seconds behind the other clock.*

*That discrepancy includes the effect of a second, competing “time travel” phenomenon: time dilation due to gravity. Time slows down in the presence of a gravitational field,*

Teresa, time continues to tick at the same rate it always has throughout the entire universe. It is objects that experience a slowdown of time in the presence of gravitational fields, as viewed from a different reference frame, because, in the case of photons for example, they must travel a longer distance to reach a given point than they would have, if space were not being warped by a large gravitational field.

So there was no slowdown of time.

*so a clock on an airplane, at the top of a mountain, or on the top floor of a skyscraper will run just a bit faster than a clock closer to the Earth’s surface.*

Teresa, the clocks are experiencing time differently because of their velocity and the pull of gravity within their particular reference frames. Time doesn't change at all. Everywhere else in the universe time continues to advance at the rate of one second per second just like it always has.

*Even just a meter off the ground, time runs measurably faster.*

Teresa, at one meter above the ground an object will experience less gravitational pull, and therefore the object will experience time as running faster than an object on the ground. The effects that these two objects are experiencing have no effect on the passage of time in the universe.

*While these are very small differences, they prove a point: Time travel is well within our grasp.*

Teresa, it is about as much in our grasp ... as the return of Jesus.

*Of course, here we are discussing extraordinary time travel.*

Teresa, I would swap out the word "extraordinary" with "imaginary," because that is what time travel is.

*Technically, we all travel to the future every day at the rate of one second per second. We are interested in what happens when that number is greater or less than one.*

Teresa, you are confusing the present with the concept of "the future." It is not possible to travel to a concept. The future is not a physical place you can go to.

We exist in the present. That is all there is. And even the present is hard to define since it appears as though, no matter how small a time slice we choose, including even the smallest unit, Planck Time, we could still probably slice it down even more. So our universe is in constant motion, and the present is simply what we have agreed to call, what we perceive at any given instant.

*But that’s only half of the story. Traveling back to the past is where things start to get interesting, and the science starts to become more speculative.*

Teresa, "starts to become?" So all that future travel stuff, wasn't speculation?

I think I need an aspirin.

*Special Relativity allows travel into the past—but only if you move faster than the speed of light.*

Teresa, since relativity *doesn't* allow for speed faster than light, it appears as though it does *not* allow travel into the past.

Teresa, that sentence was self-contradictory.

*Though this is traditionally forbidden, some theorists have found mathematical solutions in General Relativity that allow faster-than-light travel.*

Teresa, since when does mathematical masturbation trump the laws of physics?

*The mathematician Kurt Gödel devised one such solution to Einstein’s field equations, and theorists have conjured scenarios in which time-travelers might use wormholes and black holes to exceed the universal speed limit.*

Teresa, that stuff makes for interesting movies ... but not science.

*However, these solutions all involve what physicists call “closed time-like loops,” anomalies in space-time in which, instead of continuing into the future, one always returns to the same starting point in time. Most scientists consider these to be unphysical, meaning that they do not accurately describe reality and lead to philosophical and historical problems like the so-called Grandfather Paradox: What would happen if you went back in time and killed one of your grandparents before you or your parents were born? Would you still be alive to travel through time and commit the crime?*

Teresa, perhaps "masturbation" wasn't the right word. Maybe "mutilation" is a more accurate description of what you are doing to physics.

*Finding the right search term was the first order of business. It had to be a word or phrase that was “born” on a specific date, before which it had never been used, and which would continue to be significant into the distant future. We decided on two such terms, one historical and one astronomical: “Pope Francis” and “Comet Ison.” We then began to methodically search for evidence of prescient mentions of these events in search engines and on social media sites. Many of our attempts to scour search engines were futile. Google searches yielded results that turned out to be ads on random pages and Google+ was generally unreliable. Facebook was too easily tampered with, as it allows users to pre-date their posts as far back as the day the account was opened.*

*Twitter, however, turned out to be a practical venue, though our search came up with nothing we could identify as a time travelers’ post. We also searched through the log files of a popular astronomy site (apod.nasa.gov) to see if anyone had presciently searched for our terms, but to no avail. We decided to try a more direct appeal, and broadcast a request on a popular astronomy forum that any time-travelers in the audience transmit an email sent before we made the post, but no email arrived. Not that we were expecting one. We were really more interested in the process: As far as we know, no one has carried out a search this extensive, verifiable and reproducible.*

Teresa, since, by your own admission, nothing happened, what exactly is it that you are claiming is reproducible?

*So do our results mean that there are no time-travelers in our midst? Not necessarily. Our results verify the general consensus that time-travel does not exist, but do not rule out the possibility.*

Teresa, you could say the same thing about Thor.

*We only searched for two terms, neither of which may hold any interest for time-travelers. Maybe they do not want to be discovered and have covered their tracks. Or perhaps it isn’t backwards time travel that is prohibited, but the discovery of such a phenomenon. Maybe some law of physics makes finding time travelers impossible.*

Teresa, the laws of physics don't just make time travel impossible; they make it nonsensical.

*Our exercise in time travel is over,*

Well Teresa, I sure hope it was better for you ... than it was for me.

*but there are plenty of other ways one could look for evidence of time-travelers: uncanny lottery picks and eerily accurate March Madness brackets, just to name a few. It may sound like a ridiculous idea, but you’ll never find anything if you don’t look!*

Teresa, your failure to find what you were looking for reminded me of this comment that appeared on the web site below your story:

"all righty then - milk that grant for all it is worth."

Teresa, in addition to being unfair and hurtful, that comment was quite ignorant in that it displayed a complete lack of understanding about how science works.

When scientists make discoveries they are rewarded with prizes, prestige, and positions. Those that fail undoubtedly feel as though they have wasted their time and effort. But nothing could be further from the truth.

For every success there may be dozens of failures. One example is Isaac Newton, himself, who devoted a great deal of his time to Alchemy. Yet it is only due to the efforts of those scientists who have failed, that future scientists are freed from having to explore tunnels that lead nowhere.

Humans aren't given the answers ... we must find them ourselves.

Not only successes, but failures as well, contribute to the advance of science.

Pay no attention to ignorant comments. While it is true that I believe that if you understood time in the same way that I do, that you would abandon your quest, I fully support your attempts to find proof for your beliefs. Even if your quest fails, your research could result in discoveries unrelated to your original hypothesis.

String Theorists are another example of this: if they are right, they will be celebrated as heroes. If they are never proven to be right, or even proven wrong, they will still have contributed to the advance of science, which requires not only the discovery of new tunnels, but also the shutting down of tunnels that are dead-ends.

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THE SCIENCE SEGMENT

Exploding stars prove that Newton's law of gravity

is unchanged over cosmic time

Australian astronomers have combined all observations of supernovae ever made, to determine that the strength of gravity has remained unchanged over the last nine billion years.

Newton's gravitational constant, known as G, describes the attractive force between two objects, together with the separation between them and their masses. It has been previously suggested that G could have been slowly changing over the 13.8 billion years since the Big Bang.

If G had been decreasing over time, for example, this would mean that Earth's distance to the Sun was slightly larger in the past, meaning that we would experience longer seasons now compared to much earlier points in Earth's history.

But researchers have now analysed the light given off by 580 supernova explosions in the nearby and far Universe and have shown that the strength of gravity has not changed.

Looking back in cosmic time to find out how the laws of physics may have changed is not new, but supernova cosmology now allows us to do this with gravity.

A Type 1a supernova marks the violent death of a star called a white dwarf, which is as massive as our Sun but packed into a ball the size of Earth. Our telescopes can detect the light from this explosion and use its brightness as a 'standard candle' to measure distances in the Universe.

Scientists assumed that these supernova explosions happen when a white dwarf reaches a critical mass, or after colliding with other stars to tip it over the edge.

This critical mass depends on Newton's gravitational constant G and allows astronomers to monitor it over billions of years of cosmic time -- instead of only decades, as was the case in previous studies.

Despite these vastly different time spans, their results agree with findings from the Lunar Laser Ranging Experiment that has been measuring the distance between Earth and the Moon since NASA's Apollo missions in the 1960's and has been able to monitor possible variations in G at very high precision. Scientists were able to set an upper limit on the change in Newton's gravitational constant of 1 part in 10 billion / year over the past 9 billion years.

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FAMOUS QUOTES

Anonymous

"Give a man a fish and he will eat for a day;

teach a man to fish and he will eat for a lifetime;

give a man religion and he will die praying for a fish."