The Theory of Time

by neo

Time is an inherent property of the universe (as are the laws of mathematics, for example). Humans have discovered some of these inherent properties, and we now use them as tools to measure and analyze the universe around us. Time provides us with a snapshot of the location of all matter and energy in the universe at any given moment.

Although there is no evidence that time can be broken down into discrete packets, let's look at the smallest unit of time that can be measured: Planck time (10-43 seconds). This is the time it takes light to travel one Planck length in a vacuum (10-35 meters).

Now imagine a conceptual clock that ticks off Planck time units.

Assign T-1 to be any Planck moment.

Assign T-2 to be one Planck moment later.

During the time that it takes the clock to go from T-1 to T-2, countless changes have occurred in our universe: nearly every photon has moved one Planck length (except those that have been absorbed); most neutrinos have moved nearly as far; but every particle has moved some distance because there is nothing in our universe that does not move. Every moment that passes sees a change in the configuration of the universe.

Observational Support

Light travels 299,792,458 meters in the time it takes the caesium 133 atom to bounce 9,192,631,770 times. We define that as one second. This hasn't changed in 13.8 billion years, and is true everywhere in the universe.

Now let our conceptual clock measure seconds. At T1, a photon will be at point A. One second later, at T2, that photon will be at point B (photons usually travel in straight lines, but due to gravity and scattering, its path could be bent or reflected in other directions). By T2 every photon in the universe will have travelled about 300 million meters from where it had been one second ago.

Einstein's Relativity

Misunderstanding the nature of time and its relationship to Einstein's relativity has caused much confusion. When time is properly understood, the two are quite compatible.

Relativity has nothing to do with the passage of time in the universe. What relativity explains, is how our perception of time is affected by our reference frame (which itself is influenced by gravity and velocity) as compared to objects traveling in different reference frames.

The fact that an object experiences time differently than objects in its surroundings in different reference frames, has no effect on the configuration changes occurring throughout the universe which continue to dance to the beat of the Universal Conceptual Clock.

Time Dilation

The famous experiment at Mt. Washington where muons (heavy electrons) surprised scientists by surviving in greater numbers than expected, demonstrated how particles travelling near the speed of light, experience time in slow motion. But those muons had no effect on other particles in the universe which continued to advance through space at a constant rate.

In a related thought experiment, an astronaut travels through space at a considerable fraction of the speed of light, and returns to Earth 100 years later. The astronaut appears much younger than her twin sister who had remained on Earth, but it isn't because time slowed down, it is because the astronaut was experiencing time differently than her sister. The proof is in the fact that in each case, 100 years had passed in the universe.

A clock aboard the twin's spacecraft ran slower than a clock on Earth. If you have seen a video of this, you probably remember the explanation showing the clock's Caesium atoms having to travel farther to make the same trip back and forth inside the clock. The distance that the atoms travelled, increased, causing the clock to run slower. That clock, and objects travelling with it in that reference frame, experienced time differently than objects back on Earth.

Gravitational Time Dilation

The same is true around a gravity well. Photons do not travel at any speed other than C. It takes longer for the light to travel, not because time slows down, but because gravity warps space and forces light to travel a longer distance to reach a point, that without the gravity well, would have been a straight line.

For the GPS system to function properly, the discrepancy between the speed and altitude of the spacecraft, and the speed and altitude of a spot on the Earth's surface (a different reference frame), must be taken into account. But that has no effect on the passage of time anywhere else in the universe.

Implications for "Time Travel"

Understanding the true nature of time (assuming I am correct above), proves that time travel, is not only impossible, but ... nonsensical.

In order to travel back in time, every particle in the universe would have to return to its specific location at that time; otherwise, you wouldn't be in the same "time."

Time travel into the future is prohibited by the simple fact that you would have to find a way to make all light go faster than C in order to get it to go, to where you need it to be.

Epilogue

The past and the future only exist as concepts; they are not places. But these concepts can be very useful to us, as when we use the past to plan for the future.

So enjoy the present. It's where you've spent your entire life ...

and where you'll be spending the rest of your life as well.