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### Time Travel - Quantum Strangeness And Spacetime

From: Mark LeCuyer <[randydan@wavetech.net](mailto:randydan@wavetech.net)>  
Date: Sun, 12 Jul 1998 02:05:20 -0500  
Fwd Date: Sun, 12 Jul 1998 12:42:23 -0400  
Subject: Time Travel - Quantum Strangeness And Spacetime

From: Mark - Alien Astronomer  
<http://www.geocities.com/Area51/Shadowlands/6583>

Source: Strange Magazine  
QUANTUM STRANGENESS AND SPACETIME  
by Sherrill Roberts

There was a young lady named bright,  
Who traveled much faster than light.  
She started one day  
in a relative way,  
and returned on the previous night.  
A. H. Reginald Buller(1)

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(Fall, 1994).

While we are no longer so naive as to think that a mechanical device such as H.G. Wells's Time Machine could be easily built, the "new physics" offers us tantalizing glimpses of the possibility of time travel, possibly utilizing forces and entities which exist, at least theoretically, in our universe today. "The notion you can move forward and back in time is allowed by some of the new ideas in physics," says Jeffrey R. Kuhn, a physics and astronomy professor at Michigan State University.(2)

The scientific premises suggesting a theoretical time travel mechanism are Einstein's Theory of Relativity and its successor, quantum mechanics. Einstein's inclusion of time as simply another basic dimension of physical reality, like width and height, and his mathematical equations using the speed of light as a cosmic "speed limit," paved the way for quantum mechanics' description of the physical universe in terms of black holes, singularities, and "cosmic strings," concepts which at times defy "rationality."(3) MIT Professor Alan Guth has given us a concise summary of the Theory of Relativity: "Space tells matter how to move. Matter tells space how to curve."(4)

If we envision the concept of spacetime as a bedsheet held at the four corners, we can immediately see these implications of Relativity if we place a tennis ball in the center of the sheet; the flat sheet of spacetime is distorted into a curve with the ball at the center, matter telling space how to curve. If we place a second ball on the surface, the new ball rolls toward the indentation made by the first,

curved space telling matter how to move. If we place a bowling ball in the center of our flat spacetime, the indentation will be very deep, possibly tearing a hole in the fabric of our spacetime, a black hole. If we view spacetime from beneath the flat sheet, we will see the bowling ball as a protruding shape, the black hole has emerged on the "other side of time" as a white hole or possibly a wormhole.(5)

Keeping this scenario in mind, it becomes clear that what is needed for time travel is an object which is massive enough to create a significant distortion of spacetime, something larger and heavier than a ping-pong ball on the surface of our bedsheet.(6) A brief review of some of the current concepts in physics reveals several likely candidates.

Black holes occur when stars of a certain size use up all of their nuclear fuel. A star in such a situation begins to shrink and become very dense; the more dense it becomes, the greater its gravitational field, to the point that nothing, not even light, can escape. An additional effect is a distortion of spacetime (predicted by Einstein) with a resultant slowing of time itself. Theorists speculate that at its heart a black hole must contain a "singularity," a single point of infinite density where the laws of quantum mechanics no longer apply, an "edge" of the universe and of time itself. A person or object entering the singularity would be subjected to stretching and squeezing (literally squeezed out of existence), and would not survive to report the experience. However, there are those who speculate that a free-fall trajectory which takes a spacecraft close to the black hole, but not close enough to be swallowed by the singularity, would effectively be a one-way time machine.

"By choosing the right path around the black hole, such a journey, which might take a few hours according to the clocks on the falling spacecraft, could be made to take as long as you like according to the outside Universe. A hundred years, a thousand years, or longer," writes John Gribbin in his book *Unveiling the Edge of Time*.(7)

Physicist John Wheeler has theorized that a black hole produces a "wormhole" spewing vast amounts of energy into another, distant area of the universe or into another region of spacetime.(8) White holes are a similar concept, except that they are postulated to be the result of other universes' black holes, spilling matter and energy into our universe. In fact, what we call "the universe" may be a number of universes connected by wormholes. The time-travel aspects of wormholes were addressed by a consortium of Russian and American physicists; their scenario involves using gravitational attraction to "tow" one mouth of the wormhole until it rests alongside its opposite end, like laying the two ends of a garden hose together; since time is a physical property of each wormhole mouth, a traveler jumping into one mouth would emerge from the other mouth at the corresponding time in that mouth's region of spacetime. The difference could be a few hours or millennia, depending upon the disparity in spacetime between the two mouths.(9)

The most exotic theoretical cosmic "objects," and the most difficult to visualize, are the "strings" of energy which may be remnants of the original Big Bang. Strings are "thin loops of ultradense energy, far narrower than the nucleus of an atom, but stretching across vast distances."(10)

Princeton physicist J. Richard Gott has calculated that cosmic strings warp spacetime sufficiently for a spaceship to outrace a light ray, and that two strings moving past one another in opposite directions would change the shape of spacetime to such an extent that, "a spacecraft looping around the pair of strings could return to its starting point before it had left."(11)

"Time present and time past  
Are both perhaps present in time future."  
T.S. Eliot, "Burnt Norton"

Paradoxes inherent in time travel have provided inspiration for numerous science fiction tales. Assuming that a civilization has the technical capability to orbit black holes and move wormhole mouths, there is still the question of the time traveler's journey into the past and his possible influence on his own present existence. This issue has been called the "granny paradox," so named because a time traveler in the past could cause the demise of his/her own grandmother and would cease to exist in the present. One attempt to resolve the granny paradox is Hugh Everett's "many-worlds" interpretation of quantum mechanics.(12) Everett's hypothesis is

that, at the quantum level, all possible states potentially exist and that a universe confronted with a choice brings both realities into being.(13) Everett's theory is consistent with certain experimental findings that photons (light particles) exist simultaneously as particles and as waves, so the possibility of an infinite number of parallel universes is not as far-fetched as it may seem. Other speculations on the time-travel paradox hold that a person traveling back from the future would not be "allowed" by circumstances, to do anything which would jeopardize his or her future existence.(14) Given the massive distortions of spacetime involved in time travel, a person would need to think very carefully about the possibility of returning to find all his friends long dead, his apartment rented, and his job nonexistent. Perhaps Stephen Hawking is correct in assuming that the laws of quantum mechanics preclude time travel, as, "we have not been invaded by hordes of tourists from the future."(15)

FOOTNOTES:

- 1.Martin Gardner, The Relativity Explosion (NY: Vintage Books, 1976), p. 131.
- 2.Paul Overeiner, "Time Travel: It May Be Possible, But Don't Buy a Ticket Yet," Jackson Citizen Patriot, 4/1/92.
- 3.John Travis, "Could a Pair of Cosmic Strings Open a Route Into the Past?" Science 256, 4/10/92, p. 179.
- 4.John Gribbin, Unveiling the Edge of Time (NY: Crown, 1992), p. 219.
- 5.Gardner, pp.102, 173.
- 6.Hughey, op. cit.
- 7.Gribbin, pp. 147-149.
- 8.Ibid., p. 153.
- 9.Ibid., pp. 206-208.
- 10.Ibid., p. 230.
- 11.Travis, op. cit.
- 12.David Deutsch and Michael Lockwood, "The Quantum Physics of Time Travel," Scientific American, March 1994, p. 72.
- 13.Gribbin, p. 188.
- 14.Deutsch, p. 71.
- 15.Travis, p. 180.

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