Particle smasher might also act as time machine, scientists say

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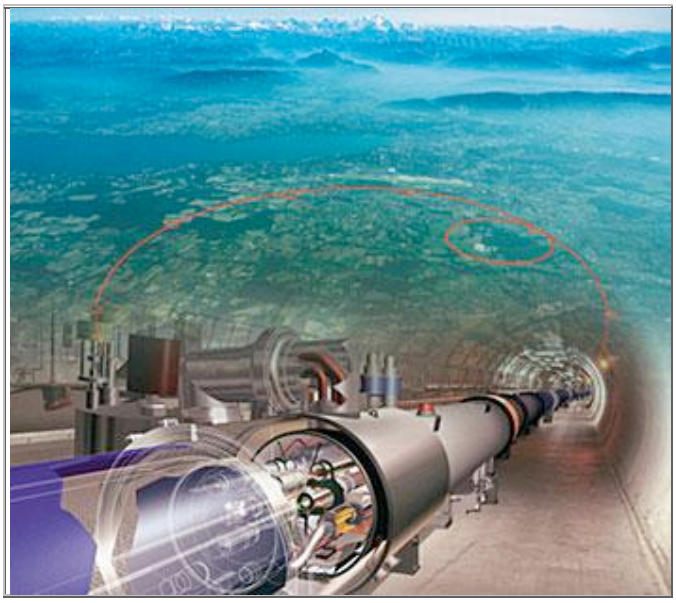
The world's largest particle collider may also be the first machine that can make things travel backwards in time, two scientists say.

"Our theory is a long shot," admits Tom Weiler, a physicist at Vanderbilt University in Nashville, Tenn., "but it doesn't violate any laws of physics or experimental constraints."



A composite illustration of the Large Hadron Collider, the world's most powerful particle accelerator. Shown in the background is the landscape on the French-Swiss border where the accelerator lies underground. (Courtesy CERN)

Particle colliders are designed to smash atoms or subatomic particles to find out what components make them up. The world's largest such device, the Switzerland-based Large Hadron Collider, went into operation in 2009 and is also intended to possibly reveal the existence of a subatomic particle called the Higgs boson. This is an entity that physicists invoke to explain why other components of atoms have mass, or in plainer terms, weight.

If the collider succeeds in producing the Higgs boson, some scientists predict it will also create a second particle, called the Higgs singlet. Weiler and colleague Chu Man Ho, also of Vanderbilt,

theorize that these singlets should be able to jump into an extra, fifth dimension where they can move either forward or backward in time and reappear in the future or past.

The theory "avoids all the big paradoxes" that normally come up with time travel, Weiler said. "Because time travel is limited to these special particles, it is not possible for a man to travel back in time and murder one of his parents before he himself is born, for example. However, if scientists could control the production of Higgs singlets, they might be able to send messages to the past or future."

The test of the researchers' theory will be whether the physicists monitoring the collider begin seeing Higgs singlet particles appearing spontaneously along with products of their own decay, or breakdown. If they do, Weiler and Ho believe that they will have been produced by particles that travel back in time to appear before the collisions that produced them.

Weiler and Ho's theory is based on a so-called "theory of everything" called M-theory. A small cadre of theoretical physicists have developed M-theory to the point that it can accommodate the properties of all the known subatomic particles and forces, including gravity, but it requires 10 or 11 dimensions instead of our familiar four. This has led to the suggestion that our universe may be like a four-dimensional membrane, called a "brane" floating in a multi-dimensional space-time called the "bulk."

According to this view, the basic building blocks of our universe are permanently stuck to the brane and so cannot travel in other dimensions. There are some exceptions, however. Some argue that gravity, for example, is weaker than other fundamental forces because it spreads out into other dimensions. Another possible exception is the proposed Higgs singlet, which responds to gravity but not to any of the other basic forces.

Weiler began looking at time travel six years ago to explain anomalies seen in several experiments with neutrinos. Neutrinos are nicknamed ghost particles because they react rarely with ordinary matter: Trillions of neutrinos hit our bodies every second, yet we don't notice them because they zip through without affecting us.

Weiler and colleagues Heinrich Päs and Sandip Pakvasa at the University of Hawaii devised an explanation of the anomalies based on the existence of a hypothetic particle called the sterile neutrino. In theory, sterile neutrinos are even less detectable than regular neutrinos because they interact only with gravitational force. As a result, sterile neutrinos are another particle unbound to the brane and thus theoretically capable of traveling through extra dimensions.

Weiler, Päs and Pakvasa proposed that sterile neutrinos travel faster than light by taking shortcuts through extra dimensions. According to Einstein's general theory of relativity, there are certain conditions in which traveling faster than the speed of light is equivalent to traveling backward in time.

Weiler and Ho described their new research in a paper posted March 7 on the research website arXiv.org.