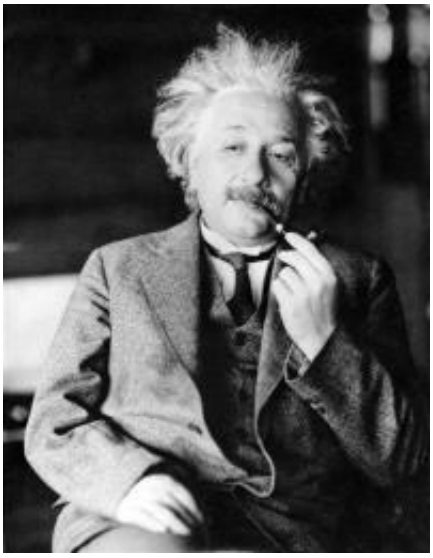
Roll over Einstein: Law of physics challenged (Update 3)

September 22 2011, By FRANK JORDANS and SETH BORENSTEIN , Associated Press



This undated file photo shows famed physicist Albert Einstein. Scientists at the European Organization for Nuclear Research, or CERN, the world's largest physics lab, say they have clocked subatomic particles, called neutrinos, traveling faster than light, a feat that, if true, would break a fundamental pillar of science, the idea that nothing is supposed to move faster than light, at least according to Einstein's special theory of relativity: The famous E (equals) mc2 equation. That stands for energy equals mass times the speed of light squared. The readings have so astounded researchers that they are asking others to independently verify the measurements before claiming an actual discovery. (AP Photo)

One of the very pillars of physics and Einstein's theory of relativity - that

nothing can go faster than the speed of light - was rocked Thursday by new findings from one of the world's foremost laboratories.

European researchers said they clocked an oddball type of subatomic particle called a neutrino going faster than the 186,282 miles per second that has long been considered the cosmic speed limit.

The claim was met with skepticism, with one outside physicist calling it the equivalent of saying you have a flying carpet. In fact, the researchers themselves are not ready to proclaim a discovery and are asking other physicists to independently try to verify their findings.

"The feeling that most people have is this can't be right, this can't be real," said James Gillies, a spokesman for the European Organization for Nuclear Research, or CERN, which provided the particle accelerator that sent neutrinos on their breakneck 454-mile trip underground from Geneva to Italy.

Going faster than light is something that is just not supposed to happen according to Einstein's 1905 special theory of relativity - the one made famous by the equation E equals mc2. But no one is rushing out to rewrite the science books just yet.

It is "a revolutionary discovery if confirmed," said Indiana University theoretical physicist Alan Kostelecky, who has worked on this concept for a quarter of a century.

Stephen Parke, who is head theoretician at the Fermilab near Chicago and was not part of the research, said: "It's a shock. It's going to cause us problems, no doubt about that - if it's true."

Even if these results are confirmed, they won't change at all the way we live or the way the world works. After all, these particles have

presumably been speed demons for billions of years. But the finding will fundamentally alter our understanding of how the universe operates, physicists said.

Einstein's special relativity theory, which says that energy equals mass times the speed of light squared, underlies "pretty much everything in modern physics," said John Ellis, a theoretical physicist at CERN who was not involved in the experiment. "It has worked perfectly up until now."

France's National Institute for Nuclear and Particle Physics Research collaborated with Italy's Gran Sasso National Laboratory on the experiment at CERN.

CERN reported that a neutrino beam fired from a particle accelerator near Geneva to a lab 454 miles (730 kilometers) away in Italy traveled 60 nanoseconds faster than the speed of light. Scientists calculated the margin of error at just 10 nanoseconds. (A nanosecond is one-billionth of a second.)

Given the enormous implications of the find, the researchers spent months checking and rechecking their results to make sure there were no flaws in the experiment.

A team at Fermilab had similar faster-than-light results in 2007, but a large margin of error undercut its scientific significance.

If anything is going to throw a cosmic twist into Einstein's theories, it's not surprising that it's the strange particles known as neutrinos. These are odd slivers of an atom that have confounded physicists for about 80 years.

The neutrino has almost no mass, comes in three different "flavors," may

have its own antiparticle and has been seen shifting from one flavor to another while shooting out from our sun, said physicist Phillip Schewe, communications director at the Joint Quantum Institute in Maryland.

Columbia University physicist Brian Greene, author of the book "Fabric of the Cosmos," said neutrinos theoretically can travel at different speeds depending on how much energy they have. And some mysterious particles whose existence is still only theorized could be similarly speedy, he said.

Fermilab team spokeswoman Jenny Thomas, a physics professor at the University College of London, said there must be a "more mundane explanation" for the European findings. She said Fermilab's experience showed how hard it is to measure accurately the distance, time and angles required for such a claim.

Nevertheless, Fermilab, which shoots neutrinos from Chicago to Minnesota, has already begun working to try to verify or knock down the new findings.

And that's exactly what the team in Geneva wants.

Gillies told The Associated Press that the readings have so astounded researchers that "they are inviting the broader physics community to look at what they've done and really scrutinize it in great detail, and ideally for someone elsewhere in the world to repeat the measurements."

Only two labs elsewhere in the world can try to replicate the work: Fermilab and a Japanese installation that has been slowed by the tsunami and earthquake. And Fermilab's measuring systems aren't nearly as precise as the Europeans' and won't be upgraded for a while, said Fermilab scientist Rob Plunkett.

Drew Baden, chairman of the physics department at the University of Maryland, said it is far more likely that the CERN findings are the result of measurement errors or some kind of fluke. Tracking neutrinos is very difficult, he said.

"This is ridiculous what they're putting out," Baden said. "Until this is verified by another group, it's flying carpets. It's cool, but ..."

So if the neutrinos are pulling this fast one on Einstein, how can it happen?

Parke said there could be a cosmic shortcut through another dimension - physics theory is full of unseen dimensions - that allows the neutrinos to beat the speed of light.

Indiana's Kostelecky theorizes that there are situations when the background is different in the universe, not perfectly symmetrical as Einstein says. Those changes in background may alter both the speed of light and the speed of neutrinos.

But that doesn't mean Einstein's theory is ready for the trash heap, he said.

"I don't think you're going to ever kill Einstein's theory. You can't. It works," Kostelecky said. There are just times when an additional explanation is needed, he said.

If the European findings are correct, "this would change the idea of how the universe is put together," Columbia's Greene said. But he added: "I would bet just about everything I hold dear that this won't hold up to scrutiny."

More information: The results are pre-published on ArXiv:

arxiv.org/abs/1109.4897

Measurement of the neutrino velocity with the OPERA detector in the CNGS beam, arXiv:1109.4897v1 [hep-ex]

Abstract
The OPERA neutrino experiment at the underground Gran Sasso Laboratory has measured the velocity of neutrinos from the CERN CNGS beam over a baseline of about 730 km with much higher accuracy than previous studies conducted with accelerator neutrinos. The measurement is based on high-statistics data taken by OPERA in the years 2009, 2010 and 2011. Dedicated upgrades of the CNGS timing system and of the OPERA detector, as well as a high precision geodesy campaign for the measurement of the neutrino baseline, allowed reaching comparable systematic and statistical accuracies. An early arrival time of CNGS muon neutrinos with respect to the one computed assuming the speed of light in vacuum of (60.7 pm 6.9 (stat.) pm 7.4 (sys.)) ns was measured. This anomaly corresponds to a relative difference of the muon neutrino velocity with respect to the speed of light (v-c)/c = (2.48 pm 0.28 (stat.) pm 0.30 (sys.)) times 10-5.