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High-speed electrons prove Einstein was right about the speed of light



You'll never catch up
Niklas Stark/EyeEm/Getty

By Leah Crane

If you are driving a car and match your speed to the vehicle in front, it will appear to slow down, relative to you. Albert Einstein said the same isn't true of the photons emerging from your car headlights, however – they will always travel at light-speed.

This central tenet of Einstein's theory of special relativity – that the speed of light does not change because of the speed of the observer – has now been proved right more precisely than ever before.

Vahe Gurzadyan and Amur Margaryan at Yerevan State University in Armenia used data from two experiments at the European Synchrotron Radiation Facility in France to look for signs of a changing speed of light.

The first experiment measured the speed of a photon in a moving reference frame. A high-powered laser is fired at a beam of fast-moving electrons, bouncing off into a detector that measured their momentum to find the speed of light from the electrons' frame of reference – the equivalent of measuring the photons from your moving car's headlights.

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The second experiment measured light speed in a stationary frame of reference. In that test, a particle called an eta meson decays into two photons. The velocities of those photons give us the speed of light as measured from the meson's frame of reference, which is not moving.

“Both experiments are done very accurately, monitoring a lot of systematic effects and potential sources of uncertainty,” says Gurzadyan. They found that if the two measured light speeds are different, it's by a factor of less than seven trillionths.

That means that light has the same speed whether the observer is moving close to the speed of light, like the electrons, or not moving at all, like the eta mesons. “The improvement over past measurements is huge,” says Gurzadyan, so Einstein is still right.

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