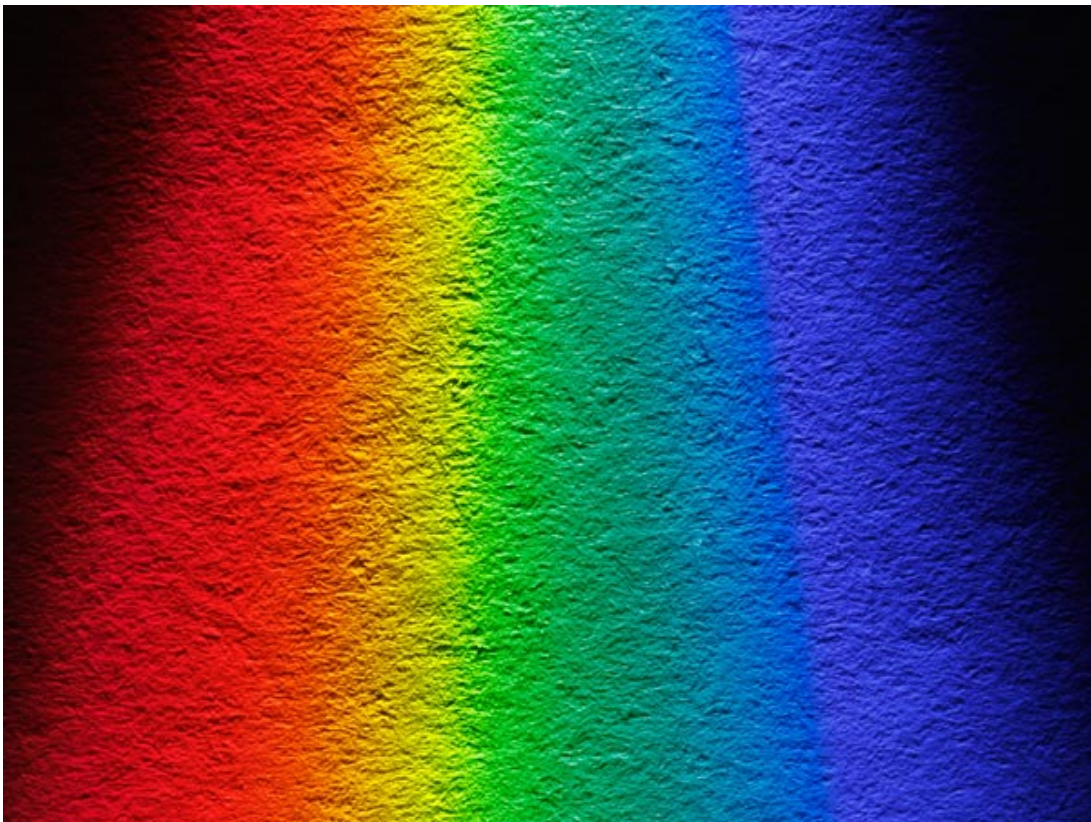


# "Time Cloak" Created; Can Make Events Disappear

Experiment is first to make a hole in time, expert says.



A time lens splits light into temporal components similar to a lens splitting white light into colors.

Photograph by GI Photo Stock X/Alamy

Brian Handwerk

for [National Geographic News](#)

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**Einstein's theories of relativity suggest that [gravity can cause time to slow down](#). Now scientists have demonstrated a way to stop time altogether—or at least, to give the appearance of time stopping by bending light to create a hole in time.**

The new research builds on [recent demonstrations of "invisibility cloaks"](#) that can make objects seem to disappear by bending waves of visible light.

The idea is that, if light moves around an object instead of striking it, that light doesn't get scattered and reflected back to an observer, making the object essentially invisible.

Now Cornell University scientists have used a similar concept to create a hole in time, albeit a very short one: The effect lasts around 40 trillionths of a second.

"Imagine that you could divert light in time—slow it down, speed it up—so that you create a gap in the light beam in time," said study co-author and Cornell physicist [Alex Gaeta](#).

"In this case, any event that occurs at that instant of time won't lead to scattering of light. It appears as if the event never occurred."

(Related: ["Space-Time Cloak Possible, Could Make Events Disappear?"](#))

For example, Gaeta said, think of laser beams crisscrossing a museum display to protect priceless works of art.

"You have a laser beam and a detector set up to detect when all of a sudden the beam is broken and there is no light. So if you pass through that beam, an alarm goes off," he said.

"But what if a device would perhaps speed up a portion of the beam and slow down another portion of it so that there is an instant of time with no beam. You could pass through, and then [on the other side of the event] the device would do the opposite—speed up the part that had been slowed and slow the part that had been sped up," he explained.

"That would put the beam of light back together, so to speak, so the detector would never recognize that anything had happened."

### **Making Time Stand Still**

To conduct their time-stopping experiment, described this week in the journal [Nature](#), Gaeta and colleagues aimed a laser beam at a probe and passed the beam through a device called a time lens.

While a conventional optical lens bends a beam of light in space, the time lens modifies the light's temporal—not spatial—distribution.

"It's a way of being able to really control the properties of a light beam in the time domain, and shape and distort and do funny things like this to light in the time domain," Gaeta said.

Study co-author Moti Fridman, also of [Cornell University's School of Applied and Engineering Physics](#), devised a method in which he crossed the laser beam aimed at the probe with a strong "pulse" laser inside specialized fiber optic glass.

"This changed the frequency and wavelength of the beam so it moved at a different velocity, and this is why a [time] gap was created," he explained.

A second pulse laser on the other side of the time hole reversed the changes, restoring the beam to its original properties.

In the experiment, an event that happened inside the time hole wasn't detected by the probe.

(Related: ["Time Will End in Five Billion Years, Physicists Predict."](#))

Zhimin Shi, of the [University of Rochester's Institute of Optics](#), said others have discussed the theoretical possibility of such a setup.

"But this is the first experimental realization of how you can actually create a time gap and hide something both in space and in time," said Shi, who was not involved in the research.

### **Time Cloak a Boon to Computing?**

Though the research is still in its very early stages, time manipulations could someday have a host of applications.

"I think people have not yet put too much thought on what we could do with such a capability," the University of Rochester's Shi said.

"The first thing people think of is trying to hide something from being detected or deliberately hiding events with a cloak, like Harry Potter," he said.

But a time lens might also allow someone to insert information into a continuous data stream without disrupting anything.

"I think that, if you could hide data that is going into fiber optics, that might be more valuable than anything you could steal from a museum," Cornell's Fridman said.

"Using the time lens, you might manipulate the data in almost any way you want and be able to reverse everything afterward," he said.

The technique could be used, for instance, in yet to be developed optical chips for faster data processing and streaming via the Internet or inside computers.

(Related: ["Nobel Prize in Physics Goes to 'Masters of Light'"](#) [2009].)

First, though, any applications are dependent on making the time hole much larger, the University of Rochester's Shi said. Researchers also need to apply the effect to three-dimensional light that hits an object from all directions rather than to a single beam, as in the current lab experiment.

But as an initial step, the Cornell experiment has real benefits, Shi said: "We can think of this as presenting a better understanding of the time and space we're living in."