

# Researchers develop way to control speed of light, send it backward

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Credit: Petr Kratochvil/public domain

University of Central Florida researchers have developed a way to control the speed of light. Not only can they speed up a pulse of light and slow it down, they can also make it travel backward.

The results were published recently in the journal *Nature Communications*.

This achievement is a major step in research that could one day lead to more efficient optical communication, as the technique could be used to alleviate data congestion and prevent information loss. And with more and more devices coming online and data transfer rates becoming higher, this sort of control will be necessary.

Previous attempts at controlling the [speed of light](#) have included passing light through various materials to adjust its speed. The new technique, however, allows the speed to be adjusted for the first time in the open, without using any pass-through material to speed it up or slow it down.

"This is the first clear demonstration of controlling the speed of a [pulse](#) light in [free space](#)," said study

co-author Ayman Abouraddy, a professor in UCF's College of Optics and Photonics. "And it opens up doors for many applications, an optical buffer being just one of them, but most importantly it's done in a simple way, that's repeatable and reliable."

Abouraddy and study co-author Esat Kondakci demonstrated they could speed a pulse of light up to 30 times the speed of light, slow it down to half the speed of light, and also make the pulse travel backward.

The researchers were able to develop the technique by using a special device known as a [spatial light modulator](#) to mix the space and time properties of light, thereby allowing them to control the velocity of the pulse of [light](#). The mixing of the two properties was key to the technique's success.

"We're able to control the [speed](#) of the pulse by going into the pulse itself and reorganizing its energy such that its space and time degrees of freedom are mixed in with each other," Abouraddy said.

"We're very happy with these results, and we're very hopeful it's just the starting point of future research," he said.

**More information:** H. Esat Kondakci et al. Optical space-time wave packets having arbitrary group velocities in free space, *Nature Communications* (2019). DOI: 10.1038/s41467-019-08735-8 , [www.nature.com/articles/s41467-019-08735-8](http://www.nature.com/articles/s41467-019-08735-8)

Provided by University of Central Florida

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