TECHNOLOGY

Method to Create an Optical Waveguide out of Nothing but Air

OVERVIEW

Background
Lasers are abundant in modern science and culture and have applications in many different fields. Yet the power level delivered by a laser pulse is severely limited by the medium – in many cases, air itself. Both peak power and average power are limited. Peak power is limited by a number of processes including ionization of the air: ionized air strongly disrupts and spreads the beam, greatly dropping its peak power. Average power is limited by 'thermal blooming': the laser heats up the air, causing it to expand. Expansion reduces the air density, defocusing the beam and reducing its average power. Ultrashort laser pulses are unique in that they create their own lensing in air, allowing the pulses to travel long distances while staying in focus. However, these pulses generally use small amounts of energy because higher energy pulses break up into many randomly occurring lenses, which in turn defocuses the beam.

Innovative technology
Researchers at the University of Maryland have developed a new technique that uses the long-distance self-lensing property of ultrashort laser pulses of modest energy to imprint extremely long lasting and robust waveguides in the atmosphere. These waveguides can persist for several milliseconds, can extend for a kilometer or more, and can resist thermal blooming to channel extremely high power laser beams up to megawatt levels, far beyond what can be done today. The air waveguide can also act as a collection optic for remote sensing or for optical communications. Imagine instantaneously reeling an optical fibre out to kilometers away to deliver or to collect a weak signal—that's what these air waveguides can do, but without the reel.

Advantages
- Long distance, long lived, and robust waveguide out of air
- Delivers much higher energy pulse than can be currently delivered
- Ability to modify the atmosphere at long distance

Applications
- Laser based weapons systems
- LIDAR (Light Detection and Ranging)
- Atmospheric monitoring
- Light-based communications
- Astronomy

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Additional Information

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Pending

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CATEGORIES

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EXTERNAL RESOURCES

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