Lightning directed by laser beams

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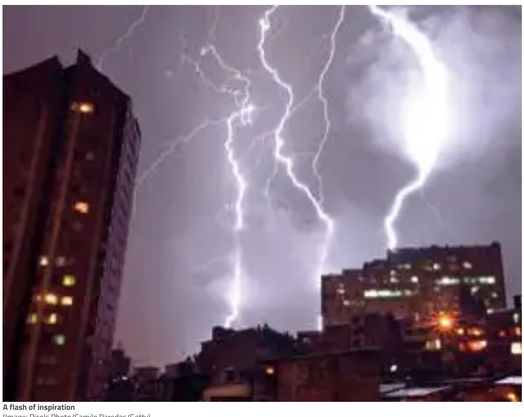

A flash of inspiration
(Image: Picols Photo/Camilo Paredes/Getty)

IT'S not quite Zeus, but at least it's not entirely myth. Lasers have been used for the first time to trigger and divert lightning bolts.

The idea of using a powerful laser to create a low-resistance path through the atmosphere – a virtual lightning rod – gained momentum in the 1990s. Lasers were developed that could generate terawatts (trillions of watts) of power for femtoseconds (millionths of billionths of a second). These created pulses so intense that they ripped electrons from air molecules, forming channels of ionised air along the beam path. These paths focused the laser light in high intensity zones called filaments, which kept the air ionised long after the laser passed through, but failed to trigger or direct lightning.

In 2008, a group led by André Mysyrowicz of the applied optics laboratory at ENSTA ParisTech in France took a trailer-sized laser to New Mexico for field experiments with clouds. The group found that its laser filaments increased electrical activity in storm clouds, but did not trigger lightning.

Now the group has reached two milestones on the road to practical lightning protection with a more compact laser. In one experiment in a military lab in Toulouse, France, they set up a high-voltage discharge with two possible targets about 2.5 metres away. With the laser off, the artificial lightning always hit the closer target. But with the laser on, generating a filament path to the farther target, the discharge went where it was directed.

In a second experiment, Mysyrowicz's team aimed the laser beam across 50 metres of a lab, passing 5 to 20 centimetres from a lightning-producing electrode and an oppositely charged electrode. Usually, lightning jumps straight from electrode to electrode, but with the laser on, the discharge jumped to the laser filament and followed it before jumping to the second electrode (*AIP Advances*, DOI: 10.1063/1.3690961).

Controlling the lightning without making contact with the electrodes makes this more like a real-world situation, says Jérôme Kasparian of the University of Geneva, Switzerland. "In the clouds you don't really have an electrode you can touch," he says. But in the real world, he adds, the targets are far more distant.

Mysyrowicz's group is planning more field experiments with the laser. Kasparian thinks success will require a more powerful laser, and the development of pulses shaped precisely for guiding lightning through the air.

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