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Hot stuff

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Researchers have used a plasma to ramp up a laser's intensity by an unprecedented 20,000 times.

Standard lasers produce orderly streams of light by pumping energy into a medium—usually a gas, liquid, or crystal—and then coaxing the medium's atoms to release the energy in the form of synchronized electromagnetic waves.

A laser can also be used to amplify the output of another laser. But amplifying an already highly concentrated pulse requires expensive optical components that spread the pulse's energy over a longer time and then recompress it after amplification. Without such equipment, the concentrated beam would damage the lasing medium. Such complex lasers can cost tens of millions of dollars, says Szymon Suckewer of Princeton University.

To create a lower-cost alternative, Suckewer and his team replaced the lasing medium with a plasma, the hot state of matter in which electrons and atoms move separately. A plasma can in principle withstand unlimited laser intensities. "You cannot break the plasma," Suckewer says.

In the team's device, which cost less than $1 million, an ultrashort pulse from an ordinary laser traveled into the plasma. Standing waves in the plasma, excited by another laser, transferred energy into the first laser pulse. At the same time, the plasma compressed the pulse down to a duration of 50 femtoseconds, or millionths of a billionth of a second. The resulting pulse was 20,000 times more intense than the original one, the researchers report in the October *Nature Physics*.

Plasma technology could improve laser-surgery tools or provide a relatively low-cost way of accelerating particles for high-energy physics experiments (SN: 10/2/04, p. 212).

References:

Ren, J. . . . and S. Suckewer. 2007. A new method for generating ultraintense and ultrashort laser pulses. *Nature Physics* 3(October):732-736. Abstract available at http://www.nature.com/nphys/journal/v3/n10/abs/nphys717.html.

Further Readings:

Weiss, P. 2004. Wake up, little surfers: Riding waves toward tabletop accelerators. *Science News* 166 (Oct. 2):212. Available to subscribers at http://www.sciencenews.org/articles/20041002/fob3.asp.

Sources:

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