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Criss-crossing Laser Beams Zoom Electrons Along

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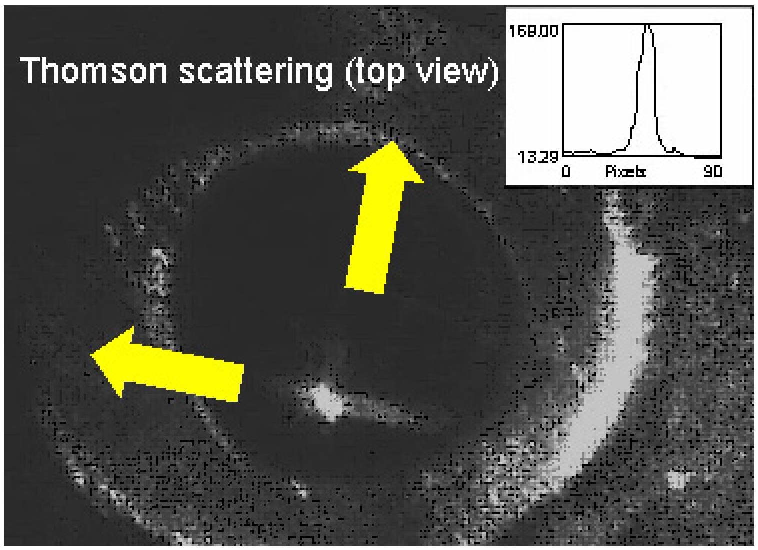
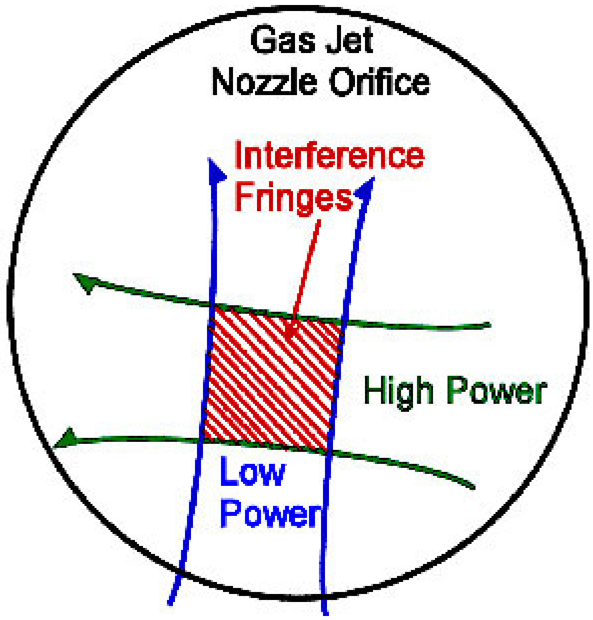


Crossing two high-intensity laser beams in a plasma (a collection of charged particles) can have some interesting effects. In a recent experiment performed by researchers at the University of Michigan and the Institute of Physics in China, energy from a higher-power laser pulse was transferred to a lower-power laser pulse. The lower-power pulse had been accelerating electrons with its "wakefield" (like a wave accelerating a surfer). The extra energy to this lower-power pulse enhanced the electron acceleration and decreased the divergence of the electron beam. These features are desirable for proposed "laser particle accelerators" that would be powered by relatively inexpensive and convenient laser light, which is much more powerful than conventional radio-frequency waves.



How does this effect come about? When the laser beams cross at right angles, an interference pattern forms. In the criss-cross zone (indicated by the bright light coming from the intersection region of the two beams in the photo), the interference pattern reflects light in much the same way as does a mirror, redirecting it perpendicular to its original travel. The interference also heats electrons.

In addition to enhancing laser accelerators, this optical beamsplitting effect is expected to play a role in experiments that use lasers to produce fusion energy. In those experiments, high-power laser beams cross each other when heating and compressing a capsule of fusion fuel (for example, solid deuterium). The effects of criss-crossing beams will unavoidably divert some of the laser energy from its original direction, and must be taken into account so as to maximize the effectiveness of using lasers to produce fusion energy.

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