Light Speed: A Measure of Ocular Phototransduction Using a High Peak Power Pulsed Laser

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During the late 1980s to early 1990s, while working on President Reagan's Strategic Defense Initiative Brilliant Pebbles laser, researchers noticed they could see what they described as the laser pulse moving through the atmosphere. Although the researchers did not believe they would be able to see actual beam movement, all were able to clearly perceive it. In an effort to understand this phenomenon, last year's, project used an array of LEDs to simulate a laser. It was demonstrated that the human eye was able to perceive LED pulse separations of about 1 millisecond. The purpose of this year's experimentation was to determine how the human eye responds to atmospheric scattering of a much higher peak power laser pulse, similar to that used in the SDI experiments. A Q-switched, frequency doubled, Nd:YAG laser operating at 532 nm with a pulse duration of 4 ns was used. All observers were able to perceive movement of the scattered laser pulse under optimum conditions. Standing perpendicular to the beam path, the observers perceived movement of the laser beam over a short distance, approximately six meters. When the observers were downfield, but out of the laser beam path, they perceived the pulse moving towards them. Multiple experiments were conducted in which conditions, such as the viewing angles and propagation distances, were varied. Several theories of the visualization of a moving laser light pulse, such as the saccade effect and binocular vs monocular vision cues, were disproven during the experimentation.

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