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Improving Self-Guiding of an Ultra-Intense Laser by Tailoring the Longitudinal Profile of the Leading Edge WARREN MORI, MICHAIL TZOUFRAS, FRANK TSUNG, UCLA, AAKASH SAHAI, Duke — Self-guiding of an ultra-intense laser pulse requires the refractive index to build up rapidly to a sufficient value before the main body of the pulse passes by. For short single-frequency pulses this occurs within a plasma period and a large portion of the leading edge is subject to diffraction. Nevertheless, if the body of the pulse survives long enough, the concomitant changes in its spectral content result in highly localized absorption, such that a large amount of the energy of the leading edge of the pulse is absorbed before it can diffract. To illustrate these mechanisms and optimize laser wakefield accelerators we propose a pulse profile with a "bulbous bow," that is a lower-intensity low-energy precursor, that can produce the necessary buildup for the index of refraction to guide the body of the laser. The wake-field behind such a pulse is more stable, contains more energy, is sustained longer, and the corresponding de-phasing length is extended.

Warren Mori
UCLA

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