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Third harmonic generation for two-color ionization injection in laser-plasma accelerators

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Laser plasma accelerators (LPAs) have promise to be the next generation accelerator for colliders, as well as drive a number of basic science, industry, security and medical applications. Many applications require high brightness electron beams enabled by low emittance. One proposal to achieve ultra-low emittance from an LPA is a two color laser configuration, where a long wavelength laser, with large ponderomotive force, is used to excite a plasma wakefield, while another trailing short wavelength laser is used to ionize inner shell electrons, injecting them in the accelerating phase of the wake [1]. The short wavelength allows for a high electric field for ionization, with low ponderomotive force. Most LPAs use Ti:Sapphire based lasers with central wavelength 0.8 μm. We will present experiments and simulations performed at the BELLA Center on generating the third harmonic of short (45 fs), high fluence (30 mJ/cm2), Ti:Sapphire based laser pulses for the purpose of ionization injection in a quasi-linear wake. Features and challenges unique to short pulse, high fluence harmonic generation and characterization as well as how those challenges were addressed will also be presented.

Acknowledgments

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