High Energy, Relativistic Intensity Laser Channeling and Direct Laser Acceleration of Electrons from an Underdense Plasma*

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Direct Laser Acceleration (DLA) of electrons by a relativistically intense laser pulse is a dynamic and complex process. We perform experiments using the OMEGA EP laser and 2D particle-in-cell simulations to study the acceleration of electron beams from underdense plasma using high-energy, picosecond-duration laser pulses. Gas-jet targets were used to control and change the target density and the focusing conditions are altered by apodizing the beam near-field from having a square profile to a round profile. Proton radiography observes the evolution of the electromagnetic fields within the channel formed and magnetic spectrometers measure the electron spectra. 2-D Particle-in-cell simulations investigate how the plasma density and laser parameters, like energy and focusing conditions, affect the interaction and DLA mechanism to help optimize the experiment configuration.

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