DENSE GAMMA-RAY AND PAIR CREATION USING 10^{21}W.CM^{-2} LASER

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We report results of gamma-ray and electron-positron pair creation experiments using ~100 Joule pulses of the Texas Petawatt Laser to irradiate gold and platinum targets, with intensities up to ~1.9×10^{21}W.cm^{-2} and pulse durations as short as ~130 fs. Positron to electron (e+/e-) ratios > 15% were observed for many thick disk and rod targets, with the highest e+/e- ratio reaching ~ 50% for a Pt rod. The maximum inferred emerging pair density was ~5×10^{14}/cm^3 so that the pair skin depth becomes < pair cloud size, marginally satisfying the "pair plasma" condition. Emerging gamma-ray density was estimated to be comparable to those expected in a cosmic gamma-ray burst, and the gamma-ray fluence was comparable to that irradiating the interstellar medium at a distance of 10-30 light years from a gamma-ray burst. Applications of these results to both astrophysics and medical physics will be discussed.