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Three-dimensional theory of Compton scattering FRED HARTEMANN, SCOTT ANDERSON, DAVE GIBSON, MIRO SHVERDIN, LLNL, ARTHUR KERMAN, MIT — Compton scattering is studied theoretically both in the time and frequency-domain, using the Lorentz-boosted Klein-Nishina cross-section for unpolarized electrons. Both spatially and temporally Fourier transform-limited and chirped laser pulses are considered, as well as higher-order Hermite-Gaussian modes. Laser propagation is realistically modeled by Fresnel integrals, and recoil is included as well. Such a highly detailed model is required for the design of next-generation, narrow-band, tunable x-ray and γ-ray sources based on TW-class lasers and high-brightness electron linacs, where a number of spectral broadening mechanisms play a significant role, including laser bandwidth, laser diffraction (effective bandwidth), electron beam energy spread, electron beam emittance, three-dimensional nonlinear effects, radiation reaction (soft recoil), and hard recoil. This work was performed under the auspices of the U.S. Department of Energy by University of California Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

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