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**High-Energy Scaling of Compton Scattering Sources** FREDERIC HARTEMANN, DAVID GIBSON, SCOTT ANDERSON, AARON TREMAINE, ED HARTOUNI, CHRIS BARTY, LLNL — No monochromatic, high-brightness, tunable light sources currently exist above 100 keV. Important applications that would benefit from such new hard x-ray sources include: nuclear resonance fluorescence spectroscopy, time-resolved positron annihilation spectroscopy, and MeV flash radiography. The peak brightness of Compton scattering light sources is derived for head-on collisions and found to scale with the electron beam brightness and the drive laser pulse energy. This $\gamma^2$-scaling shows that for low emittance electron beams (1 nC, 1 mm.mrad, $<$ 1 ps, $>$ 100 MeV), and tabletop laser systems (1-10 J, 5 ps) the x-ray peak brightness can exceed $10^{23}$ photons / mm$^2$ x mrad$^2$ x s x 0.1% bandwidth near 1 MeV; this is confirmed by 3D codes that have been benchmarked against Compton scattering experiments performed at LLNL. Important nonlinear effects, including spectral broadening, are also taken into account in our analysis; they show that there is an optimum laser pulse duration in this geometry, of the order of a few picoseconds, in sharp contrast with the initial approach to laser-driven Compton scattering sources where femtosecond laser systems were thought to be mandatory. This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

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