

Abstract Submitted  
for the DPP10 Meeting of  
The American Physical Society

**Generation of uniform relativistic electron layer and linear and nonlinear coherent Thomson scattering**<sup>1</sup> HUI-CHUN WU, LANL, J. MEYER-TER-VEHN, MPQ, J.C. FERNANDEZ, B.M. HEGELICH, LANL — A novel, multi-layer target [H.-C. Wu *et al.*, PRL 104, 234801 (2010)] is proposed to generate uniform relativistic electron layers for coherent Thomson backscattering (CTS). A few-cycle laser pulse produces an electron layer from an ultrathin foil and then a second foil reflects the laser pulse, but lets the electrons pass through unperturbed. 2D-PIC simulations show that after interacting with the drive and reflected laser pulses, the electrons form a very uniform flyer that propagates in the direction of laser propagation. Such a flyer backscatters light with a full Doppler shift factor of  $4\gamma^2$ . Nonlinear CTS theory for relativistic laser intensity shows that compared with linear CTS, a relativistically intense laser induces transverse motion of the electron layer and decreases the linear Doppler shift by a factor  $1 + a_0^2$ . Consequently, in order to obtain the same x-ray photon energy as linear CTS, the nonlinear case needs higher electron energy. Theory also shows that CTS efficiency reaches saturation when laser amplitude  $a_0 > 2$ . PIC simulations show that a powerful x-ray pulse (1 keV, 10 attoseconds, and GW power) can be generated and that diffraction-limited focusing may boost the intensity to of order  $10^{24}\text{W}/\text{cm}^2$ .

<sup>1</sup>Supported by the LDRD Program 20110341ER.

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Date submitted: 16 Jul 2010

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