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**High-brightness, high-energy radiation generation from non-linear Thomson scattering of laser wakefield accelerated electrons** W. SCHUMAKER[1], Z. ZHAO, A.G.R. THOMAS, K. KRUSHELNICK, University of Michigan, G. SARRI, D. CORVAN, M. ZEPF, Queen's University of Belfast, J. COLE, S.P.D. MANGLES, Z. NAJMUDIN, Imperial College London — To date, all-optical sources of high-energy ($> MeV$) photons have only been reported in the linear ($a_0 < 1$) regime of Thomson scattering using laser wakefield acceleration (LWFA). We present novel results of high-brightness, high-energy photons generated via non-linear Thomson scattering using the two-beam Astra-Gemini laser facility. With one 300 $TW$ beam, electrons were first accelerated to 500 $MeV$ energies inside gas cells through the process of LWFA. A second 300 $TW$ laser pulse focused to $a_0 = 2$ was subsequently scattered off these electrons, resulting in a highly directional, small source size, and short pulse beam of photons with >10 $MeV$ energies. The photon beam was propagated through a low-$Z$ converter and produced Compton-scattered electrons that were spectrally measured by magnetic deflection and correlated with the incident photons. The measured photon yield at 15 $MeV$ was $2 \times 10^6$ photons/$MeV$ and, when coupled with the small source size, divergence, and pulse duration, results in a record peak brightness of $2 \times 10^{19}$ photons/s/mm$^2$/mrad$^2$/0.1%bandwidth at 15 $MeV$ photon energy.

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