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Photo Emission from Large Electron Wave Packets in Strong Laser Fields[1]

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We report direct measurements of the single-photon-level light emitted from large electron wavepackets being driven by high-intensity laser pulses (10^{18} W/cm^2). The high intensities cause the electron wavepackets to drift forward at mildly relativistic speeds, red-shifting the single-photon scattered signal and allowing it to be distinguished from the 10^{18} photons in the driving field. We explore how the size of the electron wavepacket influence the strength of this scattered signal. A full description of the phenomenon requires Quantum Electrodynamics (QED), where both the electron and the photon are treated in a fully quantum mechanical framework. But the complexity of QED makes it intractable to describe even this simple situation. We discuss how our experimental, computational, and theoretical efforts can help guide intuition in these situations.

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