Supplementary Information for Photon acceleration of high-intensity vector vortex beams into the extreme ultraviolet

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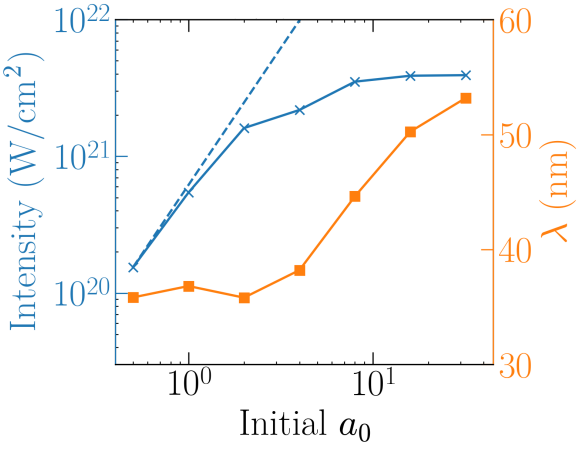
1 Supplementary Note 1: scaling test for linearly polarized Gaussian pulse

Here, we report on a similar scaling test as shown in Fig. 5 of the main text, but for a linearly polarized Gaussian pulse. The data is displayed in Fig. 1, which shows that the ideal intensity scaling is followed up to $a_0 \approx 2$. The linearly polarized Gaussian pulse experiences ideal acceleration up to higher pulse amplitudes due to its narrower radial extent compared to the radially polarized pulse of the same spot size w_0.



Supplementary figure 1: Robustness of the photon accelerator to relativistically intense pulses. The final maximum intensity and average wavelength of the linearly polarized Gaussian pulse near the end of the accelerator as a function of the initial a_0. The dashed line shows the ideal intensity scaling, $I \propto a_0^2$. The beam-driven plasma wave is resilient to the relativistic amplitude of the accelerated pulse up to $a_0 \approx 2$. Beyond this threshold, the ponderomotive force of the pulse deforms the electron density gradient enough to disrupt the acceleration.