Plasma channel undulator excited by high-order laser modes

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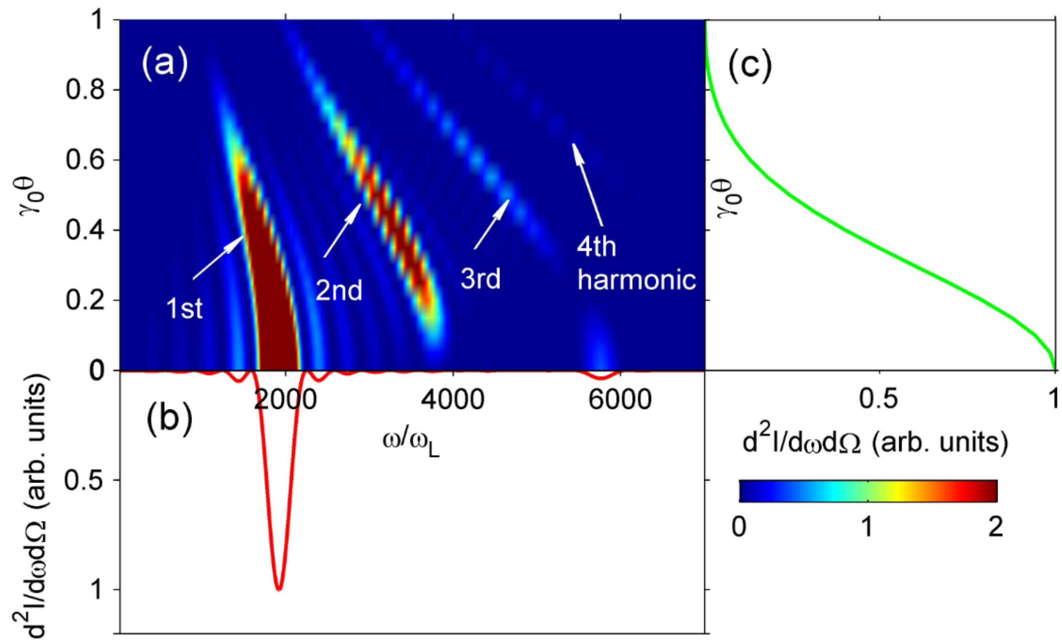
The spectrum and transverse distribution of the undulator radiation



Supplementary Figure 1. The spectrum and transverse distribution of the undulator radiation. (a) The radiation distribution in the space ($\omega/\omega_L, \gamma_0\theta$). The laser parameters of the laser pulses and plasma are the same as in Fig. 2 in the main manuscript. θ is the azimuthal angle with respect to the propagation direction of electrons. The color here represents the normalized brightness $d^2I/d\omega d\Omega$ (arb. units) of the radiation. (b) The spectrum of the on-axis radiation. On axis only the odd harmonics are observed with the frequencies $\omega_m = m\,2\gamma_0^2\omega_u/(1+K^2/2), m = 1,3,5,\ldots$, while both odd and even harmonics are generated off axis with the frequencies $\omega_m(\theta) = m\,2\gamma_0^2\omega_u/(1+K^2/2+\gamma_0^2\theta^2), m = 1,2,3,\ldots$ (c) The dependence of the intensity of the first harmonic on the normalized azimuthal angle. The angular width of the first harmonic is $\sigma_\theta \approx 1/(\gamma_0\sqrt{N_u})$, with N_u the period number of the undulator.