Efficient high-order harmonic generation via surface plasma compression with lasers

B.Y. Li[1,2], F. Liu[1], M. Chen[1], F.Y. Wu[1], J.W. Wang[3], L. Lu[1], J.L. Li[1], X.L. Ge[1], X.H. Yuan[1], W.C. Yan[1], L.M. Chen[1], Z.M. Sheng[1,2], J. Zhang[1,2]

[1] *Key Laboratory for Laser Plasmas (MOE), School of Physics and Astronomy, Shanghai Jiao Tong University, Shanghai 200240, China*

[2] *Tsung-Dao Lee Institute, Shanghai Jiao Tong University, Shanghai 200240, China*

[3] *State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China*

The efficiency of high-order harmonic generation from a relativistic laser interacting with solid targets depends greatly on surface plasma distribution. The usual method of enhancing efficiency involves tuning the plasma scale length carefully by improving the laser contrast [1,2]. Here, we experimentally demonstrate that efficient harmonics can be achieved directly by compressing large-scale surface plasma via the radiation pressure of a circularly polarized normally incident prepulse. The harmonic generation efficiency obtained by this method is comparable to that obtained with optimized plasma scale length by high-contrast lasers, and the harmonic spectrum plateaus at high orders. Our scheme does not rely on high-contrast lasers and is robust and easy to implement. Thus, it may pave a way for the development of intense extreme ultraviolet sources and future applications with high repetition rates. Moreover, our studies also reveal that the preplasma can be actively tailored into a curved surface using the radiation pressure of a normally incident prepulse. This may also be an efficient way to focus relativistic harmonics [3] or to produce high-order vortex harmonics [4].

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