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(G*) Focal Cone High Harmonic Generation

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The development of coherent XUV radiation sources is leading to significant advancements in imaging and ultrafast studies. High harmonic generation (HHG) is one technique used to generate laser based coherent ultrashort XUV pulses but is relatively inefficient. This process is normally carried out in the beamwaist of a focused laser and, because of the limited intensity range for efficient HHG, can only generate a small amount of energy per pulse. One strategy to increase the XUV pulse energy is to use a high-power laser and have the HHG process occur upstream of focus. This focal cone HHG (FCHHG) process also has the advantage of creating a focusing XUV radiation beam which can be useful in many applications.

We present modeling results and the initial experimental results for the development of such a FCHHG beamline at the University of Alberta. A 15TW Ti:Sapphire laser is used to generate harmonics through a gas target positioned upstream from focus allowing for a high energy XUV beam to be created in the optimum intensity regime. The fundamental laser is focused with a long focal length lens to the gas target placed at varying positions from focus. The resulting XUV spectra and energy yield are examined as well as other diagnostics such as interferometry of the gas target. Based on previous studies into this FCHHG technique the wavefront of the driving laser will significantly impact the quality of the resulting harmonics. Thus, the wavefront quality is examined and the impact on the XUV generation is studied.

Identifying a means of efficiently separating XUV from the pump laser is important for applying such high energy XUV beams. One technique to achieve such separation is by means of non-colinear HHG which we are starting to explore. Results of the modeling and experimental investigations will be presented.

Keyword-1

HHG

Keyword-2

Ultrafast

Keyword-3

XUV

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