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(G*) Focal Cone High Harmonic Generation in a Gas Sheet

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A new geometry of Focal Cone High Harmonic Generation (FCHHG) for generation of High Harmonic radiation is presented by focusing the incoming cone of light through a gas sheet leading to a focusing beam of harmonic radiation. Using 100 TW to 1 PW laser pulses, high energy, microjoule to millijoule, high harmonic pulses should be achievable. Such a focusing geometry generates a converging cone of high harmonic radiation producing a high intensity high harmonic hot spot (HHHS) at focus. An experimental investigation of this scheme was carried out at the Centro de Láseres Pulsados (CLPU) in Salamanca Spain. We will present the initial findings of this study using a rectangular gas sheet target of argon gas generated by a puffed gas jet. The rectangular gas sheet is chosen to provide a region of uniform areal density over which the laser can interact. The interaction area is scaled to maintain the interaction intensity in the optimum range of 1-2 x 1014 W cm-2 for efficient harmonic generation, so as not to exceed the saturation intensity for argon. A number of diagnostics were employed to characterize the emission including spatial imaging with an XUV CCD camera, quantitative XUV diode measurements, x-ray transmission grating measurements of the spectra, divergence measurements using patterned aperture plates and spatial coherence measurements using knife edge diffraction. The effect of a non-uniform gas region was also explored by scanning the laser beam away from the gas jet exit to regions where the gas jet expands and becomes more non-uniform. In all cases, the primary laser light was blocked using multiple layers of 800nm thick aluminum foil, which led to significant attenuation of the high harmonic signal in the current experiments. The initial results will be presented and scaling to efficient high energy, high harmonic pulse sources will be discussed.

Author: Mr GJEVRE, John Matthew (University of Alberta)

Co-authors: Dr PEREZ-HERNANDEZ, Jose Antonio (CLPU); Dr LERA, Roberto (CLPU); Dr LOPEZ, Carlos Salgado (CLPU); Dr EHRET, Michael (CLPU); Dr ZERAOULI, Ghassan (Colorado State University); Prof. ROSO, Luis (CLPU); Prof. FEDOSEJEVS, Robert (University of Alberta)

Presenter: Mr GJEVRE, John Matthew (University of Alberta)

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