



## Enhanced Conversion Efficiency of Optical Harmonics with Structured Plasmas

High-energy, ultra-broad bandwidth laser pulses are of benefit to many of the spectroscopic and imaging techniques that are integral to the study of ultrafast dynamics in molecular systems. These techniques are frequently utilized in fields such as photophysics, photochemistry, photobiology, and excited-state dynamics—including dynamics at conical intersections. However, the generation of these laser pulses leaves much to be desired, and improving the efficiency of coherent non-linear frequency conversion is an important aspect of non-linear optics.

Researchers in the Department of Electrical and Computer Engineering at Colorado State University experimentally observe a greater than 300-fold enhancement in the conversion efficiency of third-harmonic generation (THG) by a femtosecond laser pulse focused in an argon gas cell. Similarly large enhancements in THG conversion efficiency are also observed for pump-probe geometries with several other atomic and molecular gases. Furthermore, a clear improvement in the third harmonic beam quality of the probe pulse is observed in the presence of the pump-induced plasma.

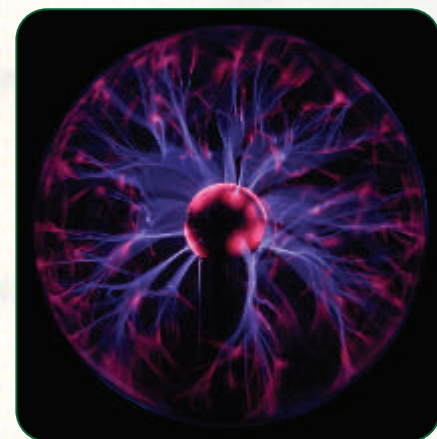
This technology is valuable as a source of high-energy, ultrafast laser pulses with photon energies  $>4.5$  eV for the center wavelength. Applications include ultrafast spectroscopy and characterization of deep UV lithography optics.

Contact us for more information regarding commercialization and licensing opportunities.

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**Patent Information**  
Patent pending

**Inventor Information**  
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### Features and Benefits

- High-energy, ultra-broad bandwidth laser pulses for spectroscopic and imaging applications.
- Greater than 300-fold enhancement in third-harmonic generation efficiency.
- Improved efficiency of conversion leading to brighter sources.
- Simple design—easy to build.
- Applications include ultrafast spectroscopy and characterization of deep UV lithography optics.

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