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Ultra-supercontinuum broadening from self-phase modulation for isotropic condensed media with extremely intense femtosecond pulses

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Ultra-supercontinuum (USC) broadening has been theoretically stimulated from the envelope response to the fifth- and third-order susceptibilities under the influence of an extremely high-intensity bright femtosecond laser pulse to produce extremme spectra broadening changes extending from extreme X rays , XUV , UV , visble , NIR ,MIR , IR and THz to even DC to fill most of the Maxwell Rainbow .

The theoretical results show that an extremely high-intensity pulse as high as on the order of 1014~1016 W/m2 can influence the refractive index arising from both fifth-order susceptibility large enough that the nonlinear n4I02 term to overtakes the n2I0 term to produce the ultra-supercontinuum broadening in the liquids such as CS2 and rare gas liquids and solids such as Argon and Krypton. There has been experimental verification at lower intensities that the SC extends from, UV visible, NIR, to MIR by many researchers using various states of matter. This provides opportunity to extend SPM model from X rays to DC to form USC using extreme intensity pulses in four states of matter and generate attosecond pulses from other states of matter using the SPM model.

Using the electronic response of n2 and n4 for extreme intensinies of laser pulses Carrier Evelope Phase , HHG generation can be explained in gases, and condensed matter.

This research is performed with Shah Fasisal Mazhar and Lingyan Shi

Biography

In 2019, Robert Alfano received SPIE (Society of Photo-Optical Instrumentation Engineers) Gold Medal Award, the highest honor bestowed by the society. Robert Alfano is an Italian-American experimental physicist. He is a Distinguished Professor of Science and Engineering at the City College and Graduate School of New York of the City University of New York, where he is also the founding Director of the Institute for Ultrafast Spectroscopy and Lasers (1982). He is a pioneer in the fields of Biomedical Imaging and Spectroscopy, Ultrafast lasers and optics, tunable lasers, semiconductor materials and devices, optical materials, biophysics, nonlinear optics and photonics; he has also worked extensively in nanotechnology and coherent backscattering. His discovery of the white-light supercontinuum laser is at the root of optical coherence tomography, which is breaking barriers in ophthalmology, cardiology, and oral cancer detection (see "Better resolution with multibeam OCT," page 28) among other applications. He initiated the field known now as Optical Biopsy

He recently calculated he has brought in $62 million worth of funding to CUNY during his career, averaging $1.7 million per year. He states that he has accomplished this feat by "hitting the pavement"; he developed a habit of aggressively reaching out to funding partners and getting them interested in his work. Alfano has made discoveries that have furthered biomedical optics, in addition to fields such as optical communications, solid-state physics, and metrology. Alfano has an outstanding track record for achievements regarding the development of biomedical instruments. His contributions to photonics are documented in more than 700 research articles, 102 patents, several edited volumes and conference proceedings, and well over 10,000 citations. He holds 45 patents and published over 230 articles in the biomedical optics area alone. His discovery of the white-light supercontinuum laser is at the root of optical coherence tomography, which is breaking barriers in ophthalmology, cardiology, and oral cancer detection (see "Better resolution with multibeam OCT," page 28) among other applications. Alfano has trained and mentored over 52 PhD candidates and 50 post-doctoral students. For the past ten years, he has trained innumerable high school students in hands on photonics.

Areas of Expertise/Research

Bonding of Tissues with Light Biomedical Optics and Detection of Cancer with Light Spectroscopy Expertise in Properties of Light and Photonics Ultrafast Spectroscopy and Lasers Physics and Electrical Engineering Science and Engineering

KEYNOTE SPEAKER