Laser Light Conversion and Manipulation with Nonlinear Optics

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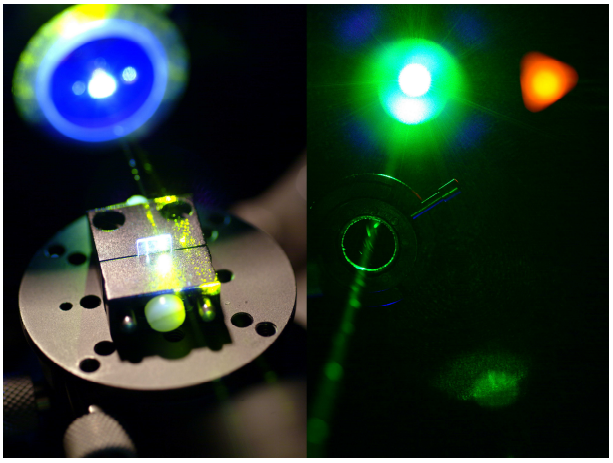

Since its first demonstration in 1960, the *Laser* has become an indispensable tool capable of transforming light from its naturally incoherent state to a highly coherent state in space and time. The impact of this "optical coherence transformer" on the field of *Optics* can be likened to that of the "transistor" on the field of *E*lectronics. However, after nearly 50 years, operation of lasers remains confined to restricted spectral and temporal regions, due to fundamental limitations, rendering them less-than-ideal light sources for many applications. *Nonlinear Optics* can overcome the limitations of lasers by permitting access to new spectral and temporal regions through the exploitation of suitable dielectric materials in combination with the laser. In particular, *optical parametric generation, amplification,* and *oscillation* are enabling technologies that can provide coherent light with unique spectral and temporal flexibility, from the ultraviolet to the THz spectrum, and from continuous-wave to the ultrafast femtosecond time domain.

The advent of novel nonlinear materials, new solid-state, semiconductor, and fiber laser sources, and innovative design concepts, during the last decade, have led to the realization of a new generation of optical parametric sources with unprecedented capabilities, and their utility has been demonstrated in many new applications.

This talk will provide an overview of the recent advances in optical parametric devices, with particular emphasis on *optical parametric oscillators* (OPOs) from the cw to femtosecond time-scales. The talk will include a description of nonlinear materials, device architectures, and applications of OPO devices in spectroscopy, environmental sensing, life sciences, and biomedicine.