Basics of nonlinear optics I: parametric nonlinear optics

Summary: Parametric nonlinear optics is one of the most fascinating fields of nonlinear optics involving both corpuscular and wave aspects of light in strong interaction with the electrons of matter, and leading to optical frequency synthesis and mixing at the origin of numerous applications. The lecture will focus on several fundamental aspects among which : constitutive relations and Maxwell equations in the nonlinear regime ; classification of the nonlinear interactions through the corpuscular approach ; intrinsic and extrinsic symmetries of the electric susceptibility ; nonlinear polarizations ; basics of crystal optics ; coupled amplitudes equations ; effective coefficient and the field tensor formalism ; phase-matching and quasi-phase-matching ; angular, spectral and thermal acceptances ; spatial and temporal walk-off effects.

Lecturer:

Benoit Boulanger (*Univ. Grenoble Alpes, CNRS, Grenoble INP, Institut Néel,)* (born 1961) received the Ph.D. degree in Material Sciences from the University of Nancy in 1989. He was researcher at the National Center for Scientific Research (CNRS) from 1989 to 2000 at the University of Nancy, Stanford University, and the University of Bourgogne. In 2000, he joined Grenoble-Alpes University as Professor. He does his research at Institut Néel CNRS where he leads the works in parametric nonlinear optics. He has authored over 250 papers in refereed journals and conference proceedings. His work is at the frontiers between nonlinear crystal optics, material engineering and quantum optics. His main achievements concern the crystal growth of KTP compounds, the development of the field factor formalism, the invention of the sphere method, the understanding of gray-tracking in KTP, the development of angular-quasi-phase-matching, and the first demonstration of triple photons generation. Benoit Boulanger received several awards and distinctions: Bronze Medal of CNRS in 1993, iXcore Foundation for Research Prize in 2009, Fellow of the Optical Society of America (OSA now OPTICA) and of the European Optical Society since 2012, and a position of Distinguished Professor of Tianjin University of Technology (2018 – 2021). He was program co-chair in 2011 and general co-chair in 2013 of Non Linear Optics / OSA (Hawaii), program co-chair in 2015 (Berlin) - 2016 (Boston) and general co-chair in 2017 (Nagoya) – 2018 (Boston) of Advanced Solid State Lasers / OSA. He was Topical Editor for Optics Letters from 2014 to 2020.