Supercontinuum sources in integrated optics

Summary: Supercontinuum generation in waveguides, defined as the extreme spectral broadening of an input pulsed laser light, is a powerful technique to bridge distant spectral regions based on single-pass geometry, without requiring additional seed lasers or temporal synchronization. Owing to the influence of dispersion and its interplay with nonlinearities, which define the spectral broadening mechanisms, advanced control of light confinement can greatly improve our understanding and shaping of supercontinuum generation. Supercontinuum generation in optical fibers is an established, yet still evolving, and commercially available technology. Recently, maturing in fabrication of photonic integrated waveguides has resulted in access to supercontinuum generation platforms benefiting from precise lithographic control of dispersion, high yield, compact footprint, and improved power consumption. This lecture aims to present a comprehensive overview of supercontinuum generation in chip-based platforms: it will briefly cover the underlying physics mechanisms behind supercontinuum generation, present various material platforms and their properties, cover design rules specific to integrated waveguides, and describe a selection of recent demonstrations. The lecture will also include applications of these integrated sources and perspective for the field.

Bio: Camille-Sophie Brès is an associate professor at EPFL in the institute of Electrical Engineering. She received her bachelor degree with honors in electrical engineering from McGill University, Canada, in 2002. She obtained her PhD in electrical engineering from Princeton University in 2006. After a post-doctoral position at the University of California San Diego, she joined EPFL in 2011 as a tenure track professor and director of the Photonic Systems Laboratory. She and her team specialize on the design, simulation and demonstration of optical waveguides and devices for enhancing and controlling nonlinear processes aimed at light generation, signal processing, or sensing. The group's work exploits dispersion engineering offered by integrated photonics, material properties of various optical platforms, and architectural features of systems to enable improved functionalities of nonlinear devices. She was awarded the early career Women in Photonics Award from the European Optical Society in 2016, as well as ERC starting (2012), Consolidator (2017) and Proof of Concept (2019) grants. She has regularly served on the technical program committees for various international conferences (CLEO US, CLEO Eu, OFC, ECOC, Advanced Photonic Congress) since 2011 and is an OPTICA fellow.