

Plenary Speakers - abstracts

Coherent Ising Machines: a photonic Ising model solver based on degenerate optical parametric oscillator network

Dr. Hiroki Takesue
NTT Corporation, Japan

A coherent Ising machine (CIM) is an artificial spin network for simulating the Ising model using thousands of degenerate optical parametric oscillators coupled with measurement-feedback. In this talk, I report a large-scale CIM experiment, with which we could find solutions to combinatorial optimization problems consisted of 2000 nodes with less than a ten thousandth of a second.

Integrated Photonics for the mid-Infrared wavelength range

Prof. Delphine Marris-Morini
Université Paris-Sud, France

Mid-infrared (mid-IR) spectroscopy is a nearly universal way to identify chemical and biological substances, as most of the molecules have their vibrational and rotational resonances in the mid-IR wavelength range. Commercially available mid-IR systems are based on bulky and expensive equipment, while lots of efforts are now devoted to the reduction of their size down to chip-scale dimensions. The demonstration of mid-IR photonic circuits on silicon chips will benefit from reliable and high-volume fabrication to offer high performance, low cost, compact, low weight and power consumption photonic circuits. This is particularly interesting for mid-IR spectroscopic sensing systems that need to be portable and low cost. Among the different materials available in silicon photonics, Germanium (Ge) and Ge-rich Silicon-Germanium (SiGe) alloys are particularly interesting because of the wide transparency window of Ge up to 15 μm . In this context, recent works towards the development of Ge-rich SiGe photonic integrated circuits will be presented, such as the demonstration of wideband Mach Zehnder interferometers and spectrometers. In addition the possibility to achieve flat anomalous dispersion waveguides will be shown, opening strong perspectives towards the realization of efficient wideband optical sources

Adding versatility to optical fibre lasers and sensors using fs-laser processing

Prof. Kyriacos Kalli
Cyprus University of Technology, Cyprus

Femtosecond lasers (FsL) are well suited to high-resolution inscription in transparent materials of all types, including optical fibres. The short temporal duration of the laser pulses leads to intensity-dependent, non-linear absorption processes for moderate, average laser powers and refractive index changes inside materials are readily possible. This selective material modification allows for the flexible patterning and prototyping of micro- and nano-structures. New opportunities in optical fibre device design using FsL are presented, and include novel fibre Bragg gratings and their use in fibre lasers, the modification of multi-core fibres, integrated circuits in the fibre cladding, and Fourier optic and non-diffracting beam devices on the end face of optical fibres, such as Bessel, Airy and vortex beam generators at sub-micron scales. A consideration of in-fibre photonics will include semiconductor-core fibres, temperature compensated pressure sensors for use in volume restricted areas (such as the brain or blood vessels), and all-in-one smart sensors.

Integrated Quantum Frequency Combs

Prof. Roberto Morandotti

INRS-EMT, Canada

The generation of optical quantum states on an integrated platform will enable low-cost and accessible advances for quantum technologies such as secure communications and quantum computation. We demonstrate that integrated quantum frequency combs (based on high-Q microring resonators made from a CMOS-compatible, high refractive-index glass platform) can enable, among others, the generation of pure heralded single photons, cross-polarized photon pairs, as well as bi- and multi-photon entangled qubit and quDit states over a broad frequency comb covering the S, C, L telecommunications band, constituting an important cornerstone for future practical implementations of photonic quantum information processing.