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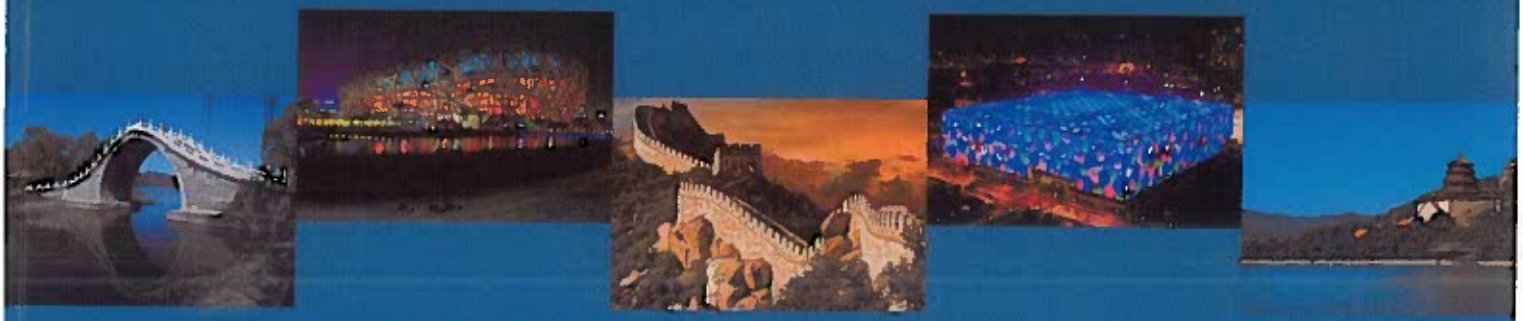
PROGRAM & ABSTRACTS



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Invited

Quantum Cascade devices: from discrete to integrated systems

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Mid-infrared spectroscopy is a reliable tool for the identification of gaseous and liquid mixtures due to their unique and inherent absorption spectra. We used a specially designed intersubband material working as a laser for a given bias voltage and as a detector without any external bias. By the use of such a bi-functional quantum cascade structure material for light sources and detectors, operating at the same frequencies in the same material, the realization of mid infrared on-chip sensors is possible [1, 2]. A bi-functional QC structure will be presented [1,2], that can be operated as coherent light emitter as well as intersubband detector, depending on the bias applied to the structure [3].

This opens the way to on-chip sensing solutions with a high integration density [4]. Liquid sensing at room temperature with a monolithic integrated sensor was achieved by a QCL, a dielectric loaded Surface Plasmon Polariton (SPP) waveguide as interaction section of the infrared light with the liquid, and a QCD.

To demonstrate gas sensing with the same technology a surface emitting and detecting sensor was processed using the very same heterostructure material. A distributed feedback ring quantum cascade laser is integrated on-chip with a detector element. The surface emitted light is collimated, guided through a gas cell, back reflected by a flat mirror, focused, and detected by the sensor element on the very same device. The surface operation mode enables for comparable long interaction lengths as needed for gas absorption measurements [5].

References

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