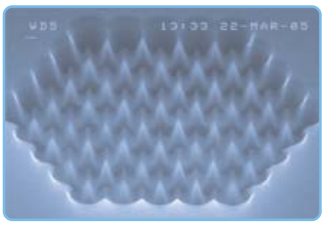
Valencia Nanophotonic Technology Center

Collaboration for new biophotonic & sensor technologies.
The center resources: System Lab: HFC and HFR systems lab & Optical networks lab; **Characterization Lab:** Optical characterization & Physical Characterization; **Nanofabrication Lab:** Complete Si 6 inch fabrication line for nano-photonic components including final test and assembly capabilities, in a 500m^2 class 10-100 clean room. Maximum line size resolution is 20nm, rapid prototype development, small test series, and volume production; **Full Failure Mode Analysis Lab; Simulab:** Hardware/software for photonic component design.

Research lines:

- Photonic technology based on Si: This research line is aimed at developing high speed devices on Si technology, both passive (couplers, multiplexers and demultiplexers) and active/tunable (modulators, switches, photodiodes), and demonstrating their operation as building blocks to implement functionalities such as high-speed optical routing or all-optical logical signal processing in CMOS chips. The NTC has wide and proven expertise in the design and modeling of photonic devices and structures, such as photonic crystals, coupled-ring resonators and interferometers, among others. Furthermore, the NTC has CMOS fabrication equipment allowing processing both electronic and photonic devices and structures on Si-based technology.



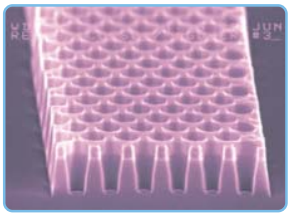
- Photonic technology based on other materials: capability to develop active components, which behavior can be varied dynamically, such as switches or wavelength converters for telecommunications applications or bi-stables and logical gates for digital processing. To this end, the non-linear behavior exhibited by certain materials under high optical power operation can be exploited. At the NTC, several materials are under investigation in order to achieve this functionality, such as non-linear materials (CdTe), Si nano-crystals and the embedding of dye matrices in photonic devices.

- Polymer-based photonic technology: Polymers are, a priori, very attractive materials to act as substrates for the growth of waveguides and other structures. Their advantages are related to their low cost, easy handling, easy shaping and the availability of photo-sensitive polymers, which allow the direct writing employing photolithographic techniques. Their limitations are related to reliability issues, which prevent the immediate application for instance to the telecommunications market.

- Simulation and modeling of structures and devices: This research line can be subdivided in two: devoted to photonic devices as initial fundamental design stage for their fabrication, and devoted to acoustic devices, in which metamaterial properties are affected in very interesting ways.

- Biophotonics: Bio-sensors based in photonic integrated devices are becoming of great importance nowadays due to its high sensitivity, mechanical stability, miniaturization capabilities, readily integration within micro-systems and mass-manufacturing capabilities. These sensors principle of operation is based in the interaction of light with molecular material (analyte receptor) in different structures that allow the detection of the analyte in a selective manner. This way it is possible to detect clinic analytes, environmental contaminants, DNA, explosives or biological weapons, among the most important ones. The NTC aims not only to realize the basic research and proof of concept of different innovative photonic structures but, once the required scientific objective have been reached, to achieve the development of the complete micro-system. To this extent, it is necessary the merging of several scientific disciplines such as nano-fluidics, photonics or bio-chemistry.

- Photonic processing in high-speed optical networks: The work in this research line deals with the study, modeling, simulation, experimental implementation and performance measurement of different techniques and sub-systems for the all-optical signal processing in high-speed digital optical networks. Different functionalities of optical nodes (OADM and OXC) in OTDM/DWDM networks have been researched: optical multiplexing, wavelength conversion, 160 Gb/s filtering and demultiplexing employing dispersive an non-linear optical fibers, semiconductor optical amplifiers and active Mach-Zehnder interferometers (SOA-MZI). The novel highly-efficient orthogonal techniques for the transmission of high-speed signals through optical fibre links have been proposed. The final objective of this research is to develop an photonic packet router, able to perform the label reading, label swapping and packet wavelength conversion and routing functionalities.



- Photonic techniques for broadband access networks: new techniques based in photonic devices are proposed and demonstrated for their application in wired and wireless broadband access networks, in the Hybrid Fiber-Coax (HFC) and Hybrid Fiber-Radio(HFR) framework. Within this research line, many photonic signal processing techniques have been proposed, such as chromatic dispersion effects compensation, optical beamforming for phased array antennas, photonic mixing techniques, photonic filtering of electrical signals, photonic generation of vector modulated signals and performance optimization of HFC and HFR systems and links. Several HFR demonstrators have been deployed at mm-wave band frequencies (>40 GHz).

Experience in European projects 2000-2006: **SABIO,** STREP, IST, Contract 026554 (2006-2008), Contact: **Daniel Hill** (**dhill@ntc.upv.es**); **ePIXnet**, NoE, IST, Contract 004525 (2004-2008), Contact: **Roel Baets** (**Roel.Baets@intec.UGent.be**); **PHODYE**, STREP, IST, Contract 033793 (2006-2009), Contact: **Ángel Barranco** (**phodye@icmse.csic.es**); **PHOLOGIC**, STREP, IST, Contract 017158 (2005-2008), Contact: **Javier Martí** (**jmarti@ntc.upv.es**); **GANDAL**, STREP, IST, Contract 507781 (2004-2006), Contact: **Javier Martí** (**jmarti@ntc.upv.es**); **LASAGNE**, STREP, IST, Contract 507509 (2004-2006), Contact: **Javier Martí** (**jmarti@ntc.upv.es**).

Interest for collaboration: ***Advanced simulation/modelling/CAD and rapid prototype development for:*** Micro and nano photonics devices especially biosensors (photonic cavities, ridge/slot waveguide interferometry and surface plasmon resonance); Optimization of specific technological processes; Biomolecular functionalization of surfaces (in collaboration with the SYM group of the UPV).

- Project coordination: experience in coordinating several of the 10+ projects that we have participated in over the past 7 years.

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