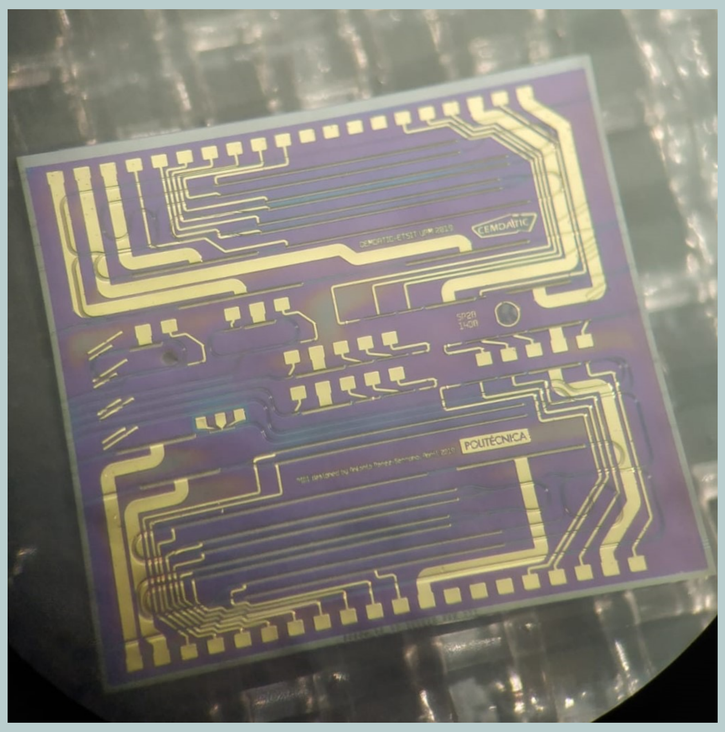
WHAT DO WE RESEARCH? Photonic Integrated Circuits

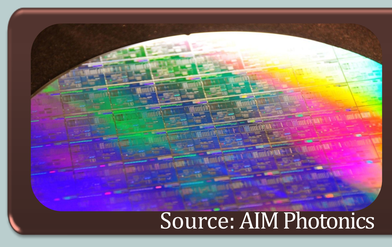
A photonic integrated circuit is a device that integrates multiple photonic functions, similar to an electronic integrated circuit. Some of the elements that may include are:

- Passives: Waveguides, couplers, filters, multiplexers and demultiplexers ...
- Active: Lasers, modulators, photodiodes ...



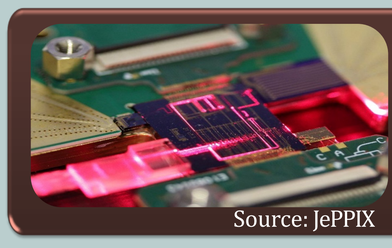
4x4.6 mm Indium Phosphide (InP) PIC

Indium Phosphide (InP): This semiconductor material allows the integration of both passive and active elements. They emit in the C band of optical communications (around 1550 nm).



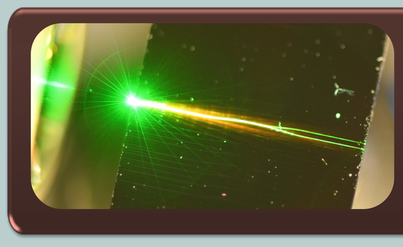
Source: AIM Photonics

Silicon Photonics (Si): Although they do not allow the direct integration of active elements such as lasers or amplifiers, their high refractive index contrast allows making very small circuits.



Source: JePPIX

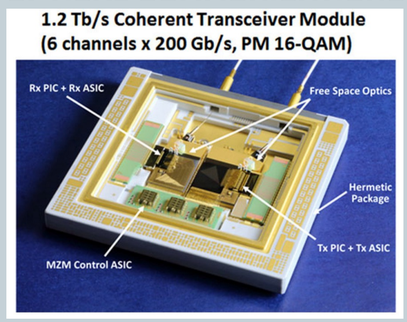
Silicon Nitride (SiN): This technology allows the integration of passive elements and offers the widest wavelength range, from visible to mid-infrared.



Polymers: Allows the integration of passive and active elements, offering a range of wavelengths from visible to mid-infrared. In addition, it allows the 3D fabrication of structures.

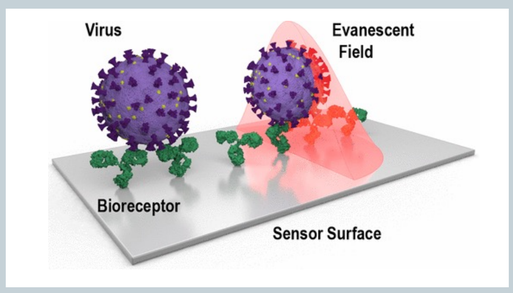
APPLICATIONS

OPTICAL COMMUNICATIONS



Source: Infinera, IEEE JSTQE

SENSORS



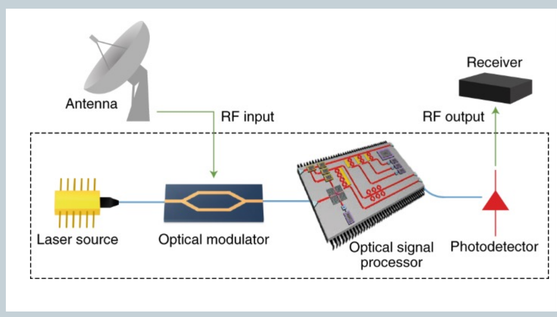
Test for rapid detection of COVID-19

Source: ACS Sensors

LiDAR SYSTEMS

Source: POB

RADIOFREQUENCY

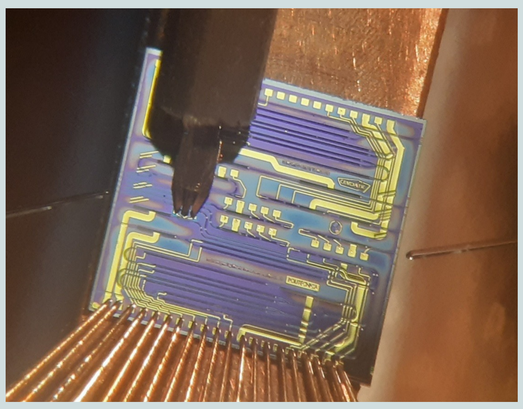


Source: Nature photonics

RESEARCH LINES

GAS SENSORS BASED ON InP PICs

Integration of LiDAR systems for differential absorption and dual comb spectroscopy.



InP PIC developed at UPM

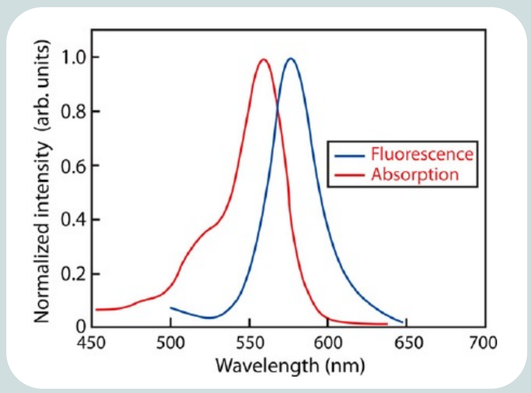
ORGANIC PHOTONICS

Manufacture of PIC in polymer by UV lithography, laser writing or Nanoimprint.

UV lithography mask aligner

FLUORESCENT MATERIALS

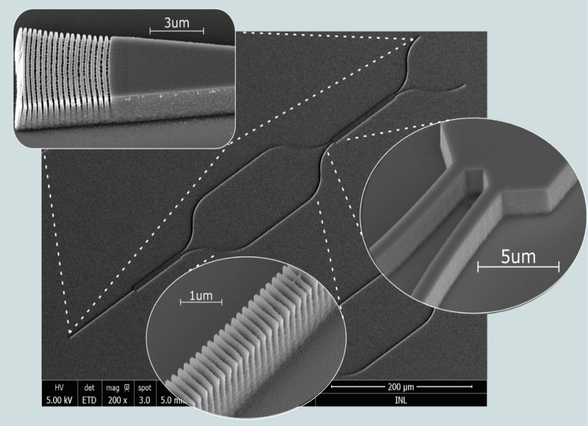
Fluorescent organic materials are used to generate light within waveguides.



They have the ability to absorb light and emit it at lower energy.

APPLICATIONS OF A PHOTONIC BIOSENSOR

The use of the evanescent wave in Mach-Zehnder interferometers is used as a sensing medium in different applications.



Mach-Zhender interferometer for detection