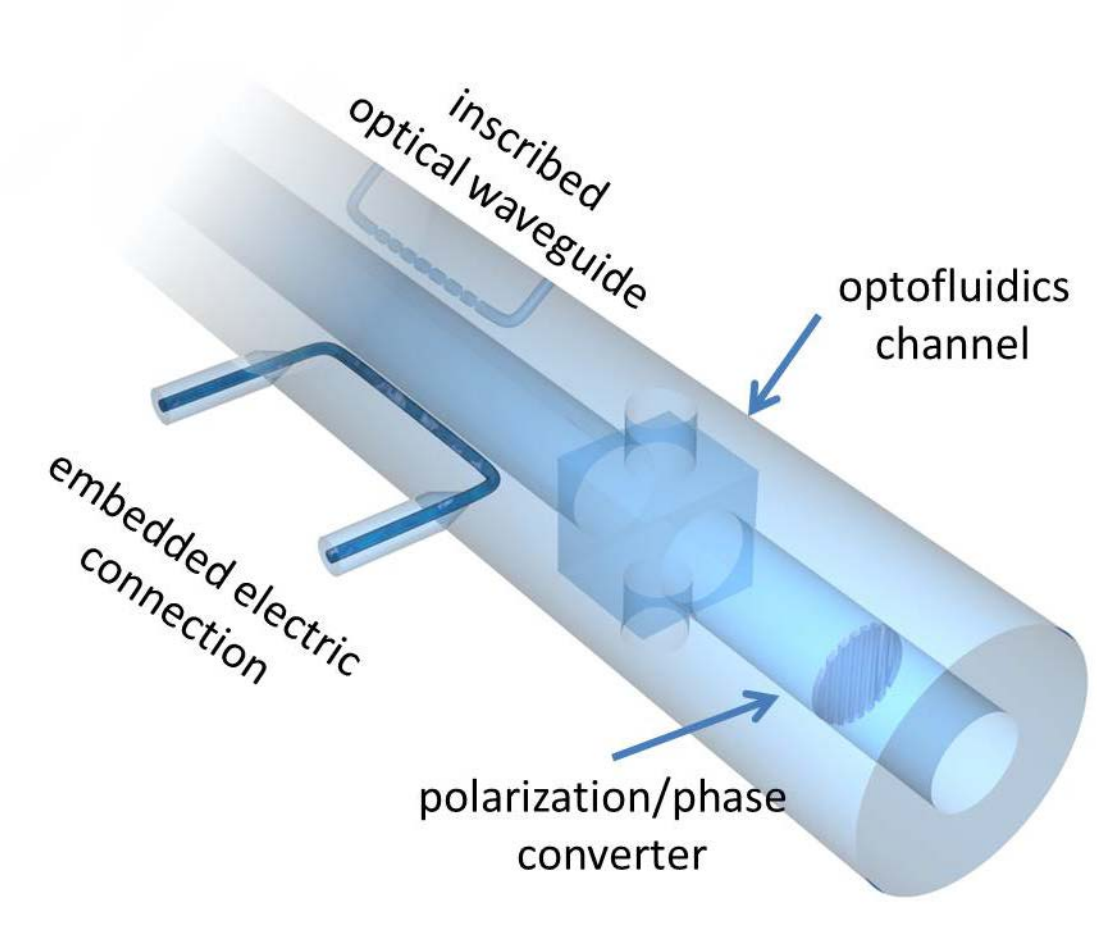
Laser assisted engineering of optical fiber



Short and intense light pulses allows adding new properties to optical fibers.

New ways of controlling light in the fiber.

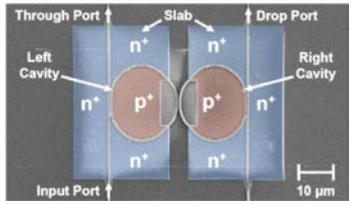
Novel designs for applications in fiber lasers, optofluidics, microscopy, etc.

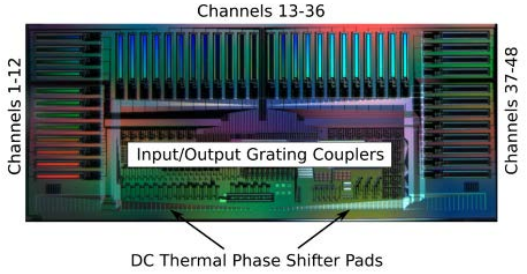
Dr. Martynas Beresna

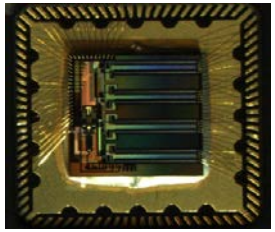
m.beresna@soton.ac.uk

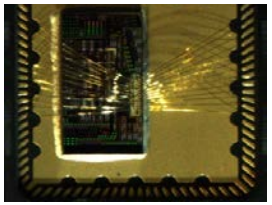
UNIVERSITY OF Southampton

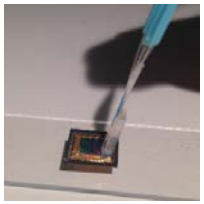
Silicon Photonics for System Level Interconnects:
Hardware-Software Integration

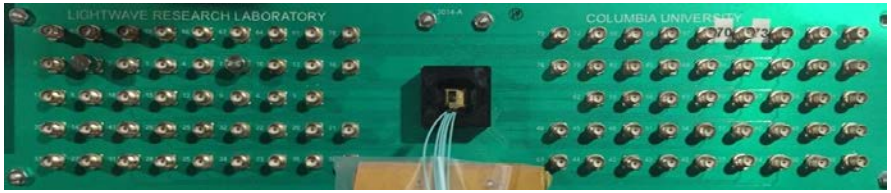






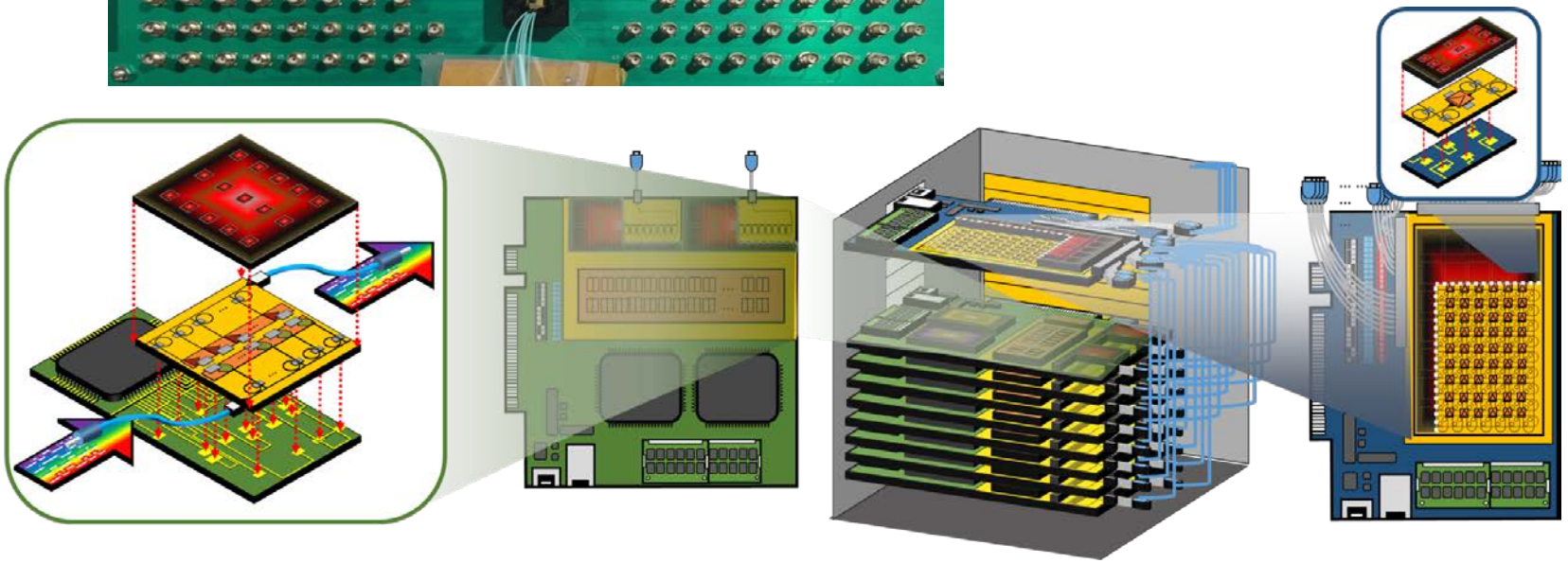






Keren Bergman
Columbia University

- Design and fabrication of nanoscale photonic networks
- Chip-scale packaging
- Integrated software control
- Computing system insertion



APPLIED MATERIALS®
make possible

Waheb Bishara
Physicist, Member of Technical Staff

APPLIED MATERIALS

The world's #1 semiconductor and display equipment company

OUR VISION

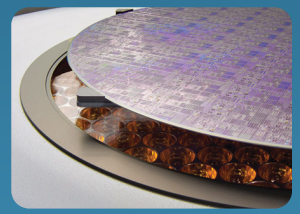
Our innovations **make possible**
the technology shaping the future

OUR MISSION

To lead the world with **materials engineering** solutions that enable customers to transform possibilities into reality

Manipulating materials at an atomic level on an industrial scale


Deposition


Thermal


Metals

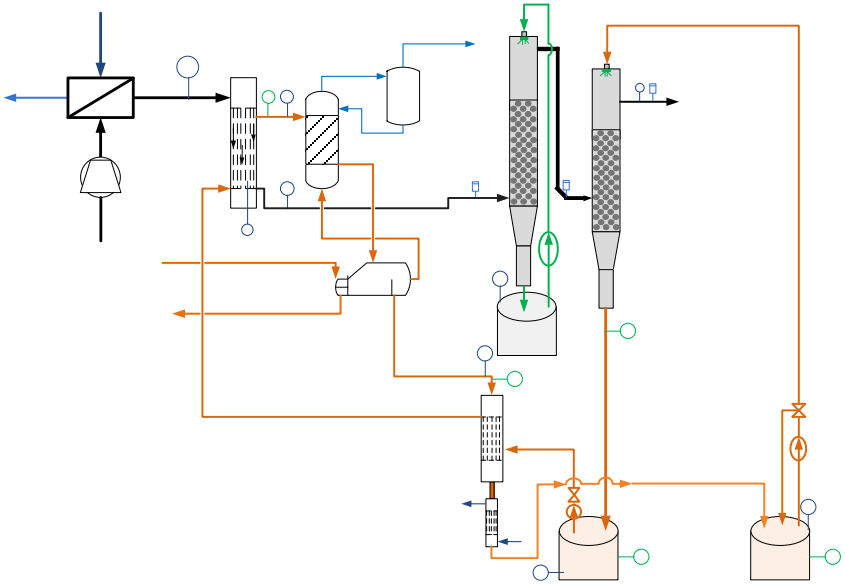

Planarization


Inspection


Etch


Plating


Implant

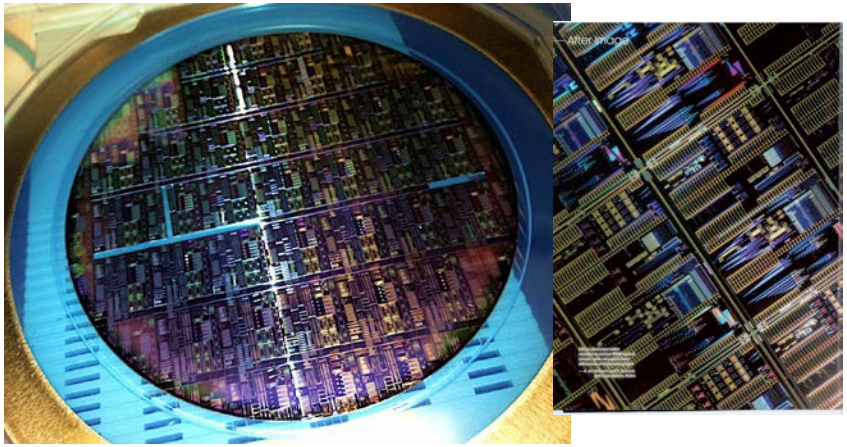


- Cristian DINCA
- **Head of Power Engineering Department**
- **POLITEHNICA Bucharest**

- CO_2 capture for energetic and non-energetic systems
- Modelling and simulation of CO_2 chemical/physical absorption processes
- Optimization of the chemical absorption integration in coal fired power plants
- Economical cost of CCS integration in power plants
- Life cycle assessment of energy systems with CCS

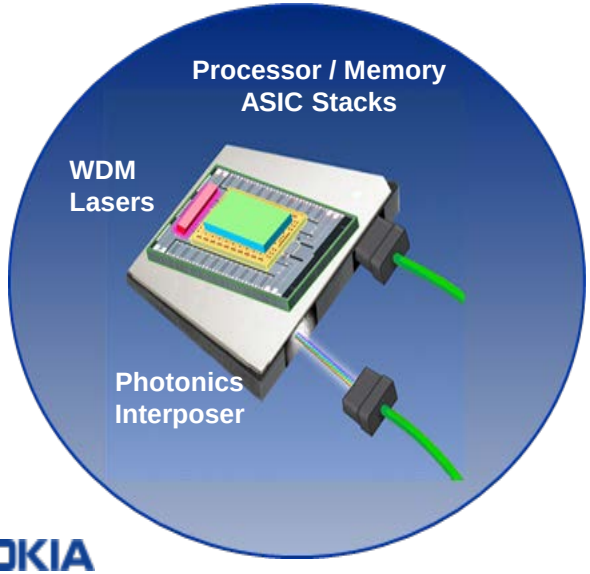
Large-Scale Photonic Integrated Circuits and Systems

Po Dong, Nokia Bell Labs, Holmdel, NJ 07733, USA

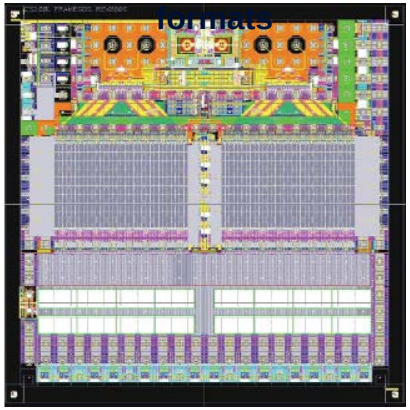


>10, 000 optical elements on silicon photonics wafer

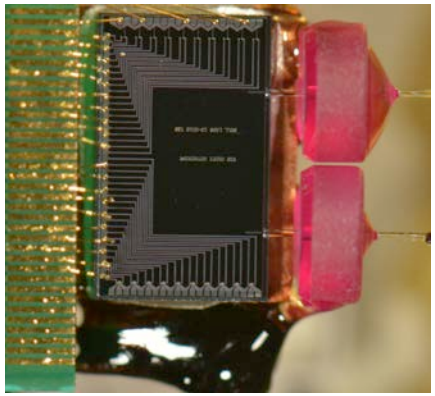
- Provide ultra-high capacity for optical communications and interconnects
- Deliver exponential growth of information communication and computing
- Extend to sensing and imaging applications



CMOS DSP chip to enable advanced modulation



~1Tb/s mm-size optical chip



NOKIA

Bell Labs

Broadband Amplified Spontaneous Emission Optical Fibre Sources

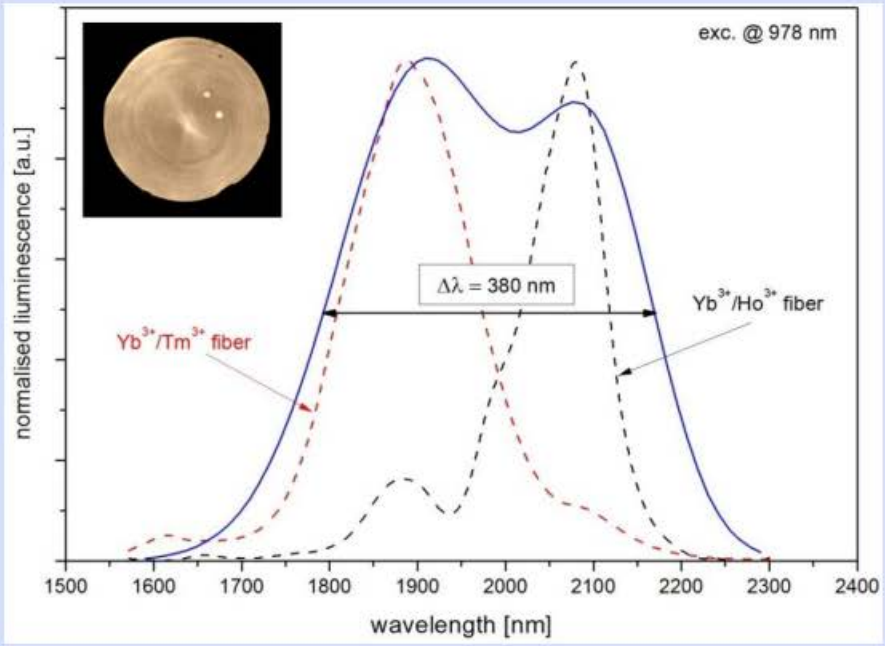


Fig.1. Double core output radiation spectrum at ~2μm and optical fibre construction (inset).

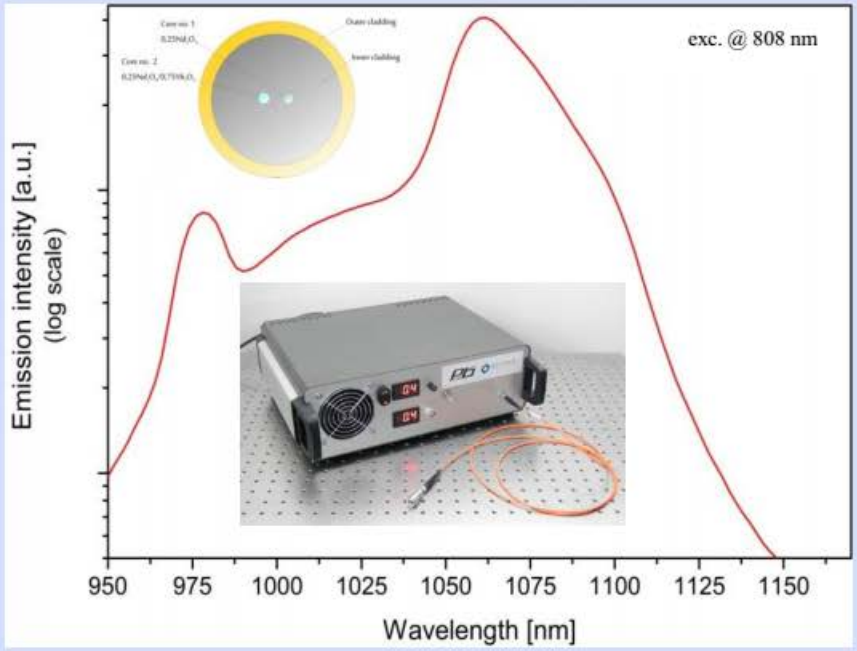


Fig. 2. Double core output radiation spectrum at ~1μm and optical fibre construction (inset).

The broad emission is achieved using lanthanides doped multicore, double clad optical fibre constructions.

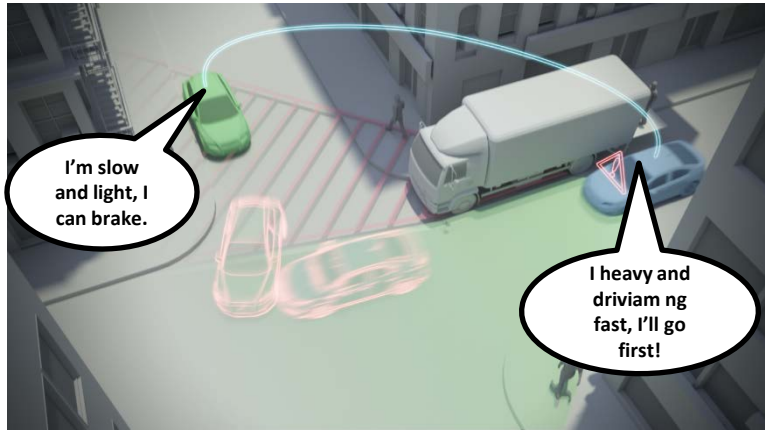
This light source can be used for science and numerous sensing applications.

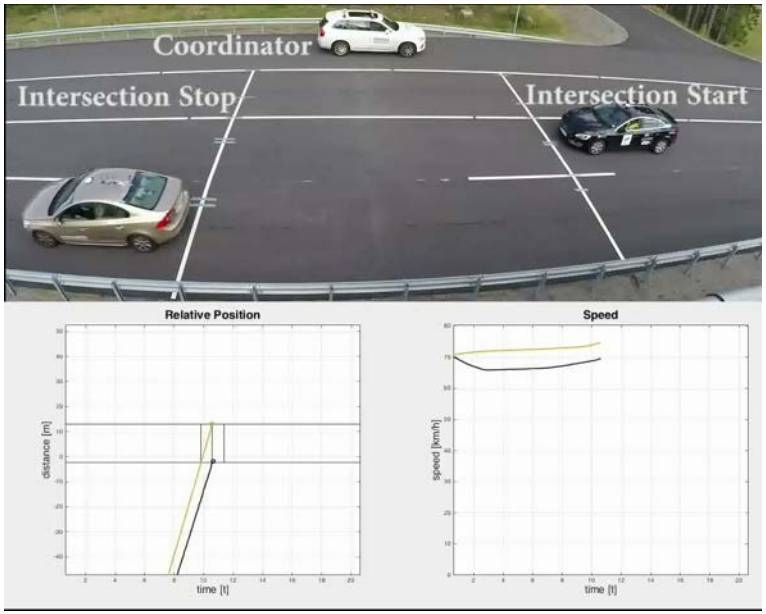
Dominik Dorosz, The Polish Young Academy, Polish Academy of Sciences, Poland, e-mail: dominik.dorosz@gmail.com

AMU
Akademia Młodych Uczonych

Coordination of Autonomous Vehicles at Intersections

Paolo Falcone





- Problem:
  - Traffic safety
  - Traffic efficiency
- Remedy:
  - Vehicle Automation
  - Wireless Communication
- MPC framework:
  - Optimize intersection usage
  - Enforce safety
- Low complexity algorithm:
  - Efficient communication
  - Real-time feasible
  - Tested in experiments
  - Many possible extensions

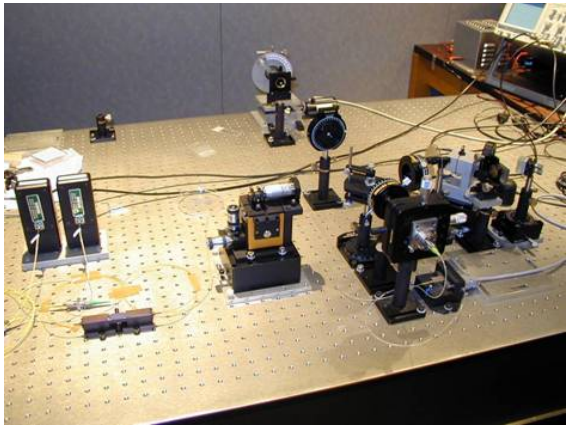
Integrated Photonics

When optics and electronics are merged on the same chip

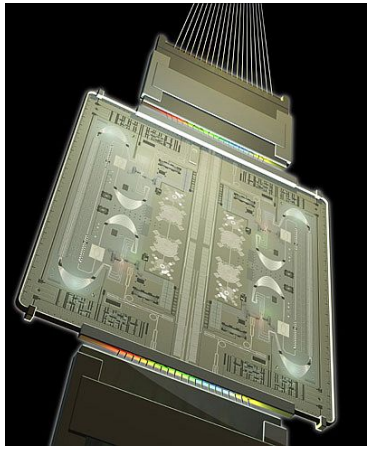
Sasan Fathpour

University of Central Florida

- Heterogeneous Silicon Photonics
- Optoelectronics
- Photonic Integrated Circuits
- Nonlinear Integrated Optics
- Semiconductor Lasers
- Optical Communications



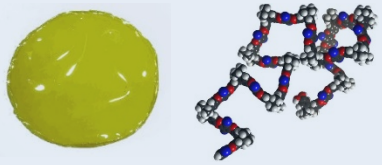
Integration



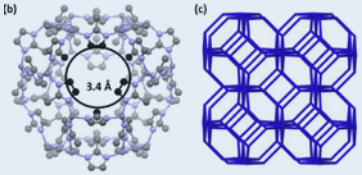
Maria-Chiara Ferrari

Membranes for carbon capture

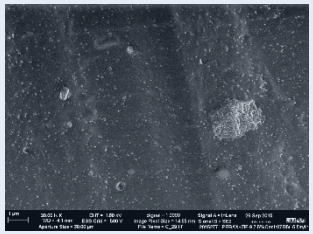
Materials



Polymers

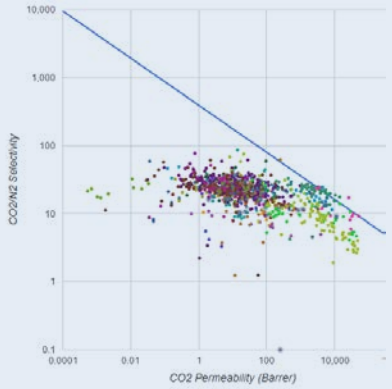


Nanoparticles

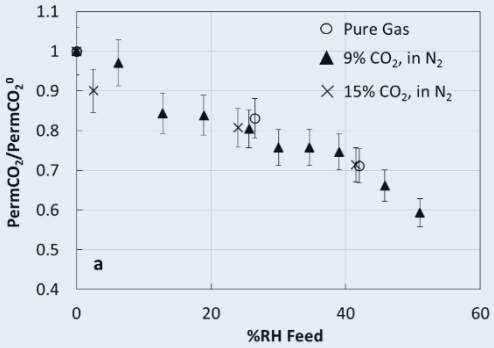


Composites

Experimental characterisation

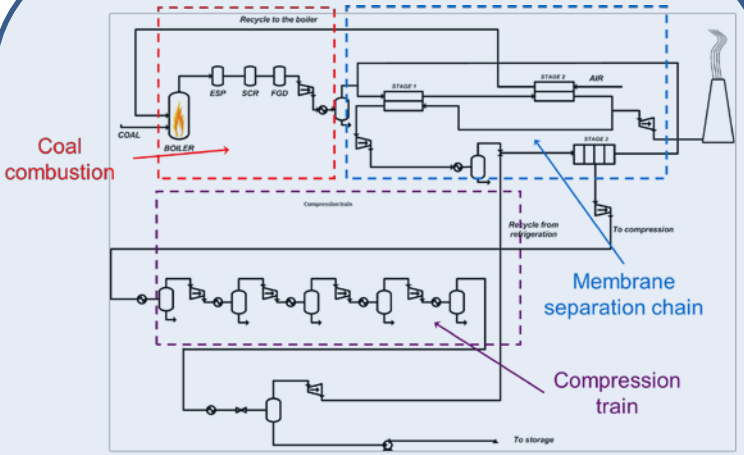


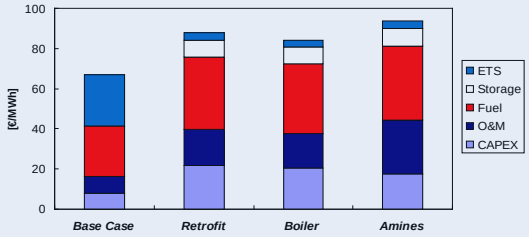
Ideal conditions



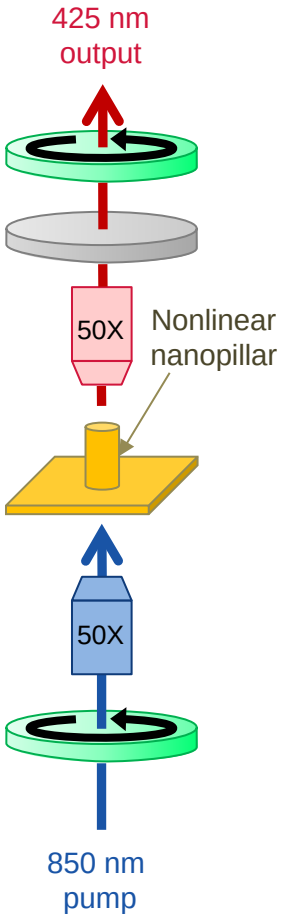
Real streams

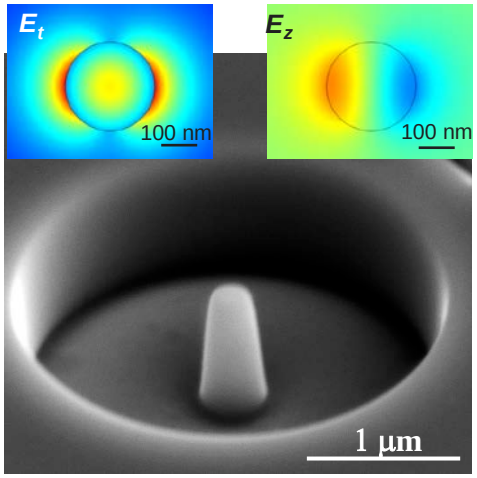
Process design

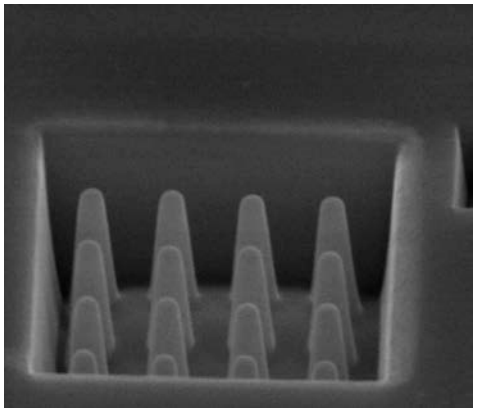




Engineered nonlinear nanoprobes

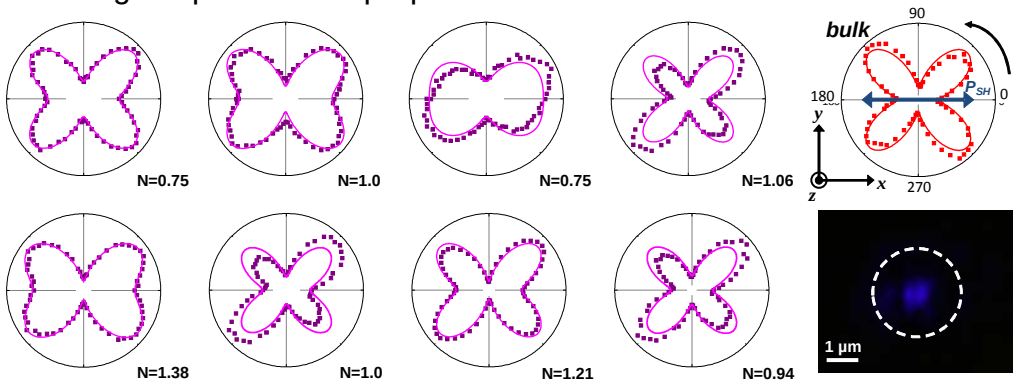




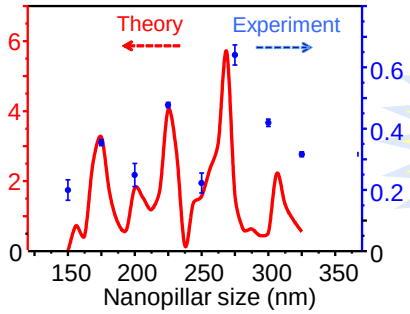


Second harmonic generation (SHG) in $LiNbO_3$ sub-wavelength nanopillar waveguides

- Tailoring the polarization properties of SHG emission



- by means of a sub-micrometric control of the waveguide size



Applications

to bioimaging

& quantum

VETENSKAPSRÅDET
THE SWEDISH RESEARCH COUNCIL

adopt
ADVANCED OPTICS AND PHOTONICS

Katia Gallo

KTH – Royal Institute of Technology

M. A. Baghban and K. Gallo, APL Photonics **1** (6), 061302 (2016)

Mixed (cars & PTWs) Traffic Modeling

S. Gashaw & J. Harri (EURECOM), P. Goatin (Inria)

PTWs in Smart Cities

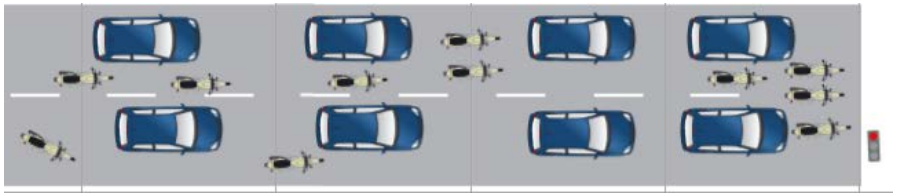
- Alleviate congestion, reduce travel time…
- **Rapidly growing users on roads**
- Most vulnerable road users

Mixed traffic flow involving PTWs

- Limited knowledge on the interaction Cars-PTWs
- Classical homogeneous traffic flow models fail to capture the underlying behaviors

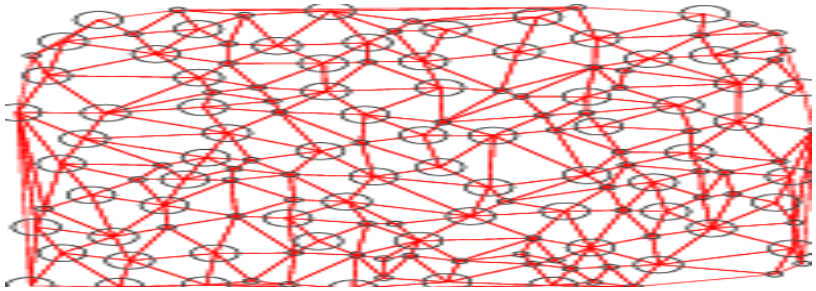
PTWs unique maneuvering behaviors

- Don't follow lane discipline
- Filter between lanes
- Move side by side in the same lane
- Maintain smaller clearance with other vehicles



Approach:

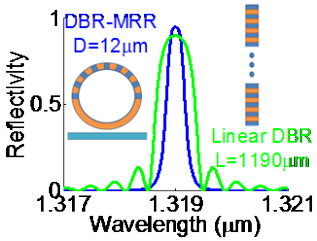
- Traffic flow is modeled analogous to
  fluid flow in porous medium



Harnessing Light

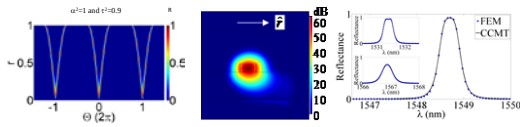
Low Noise Lasers

A replacement for linear DBRs

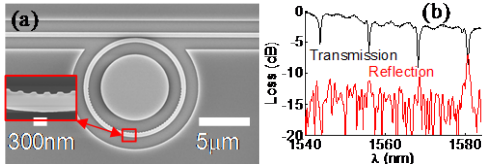


Computational electromagnetics

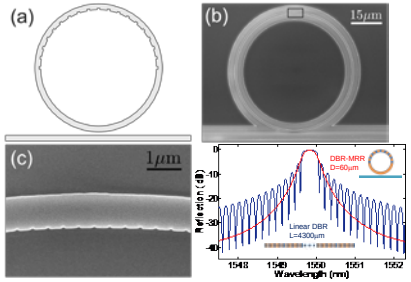
1D graphical TMM | 2D FEM | 3D CCCMT



SOI wafer fabrication and testing results



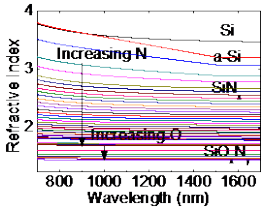
Si_3N_4 core fabrication and testing results



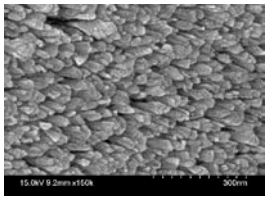
We invented a mirror for low noise lasers. We realized single wavelength reflectors R=92.3%, FWHM=0.4nm, and suppression>7.8dB over a 100nm span.

Novel Processing

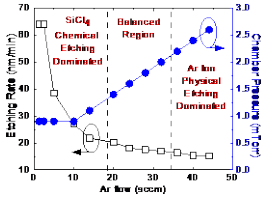
Gradable dielectrics



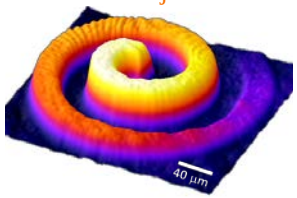
Porous Pd with glancing angle deposition



Slow GaAs etching



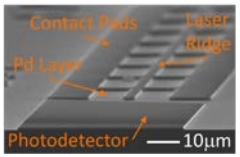
Photochemical Etching with a Projector



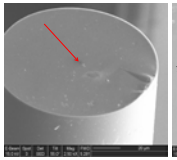
We can define dielectric layers (any n=1.44-3.5) and porous films. We can etch GaAs (1-500nm/s) and make structures with arbitrary topography.

Sensors

Edge emitting



Fiber nano-aperture

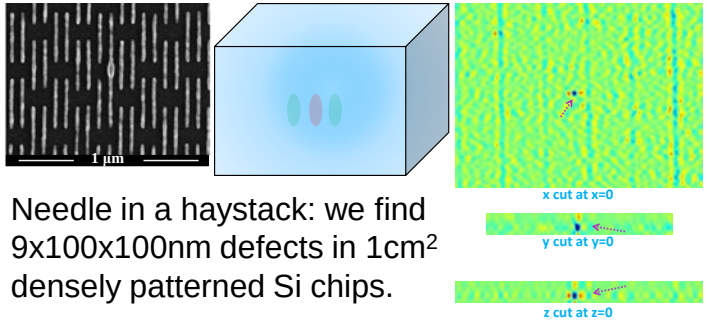


PhC VCSEL

We sense H_2 with Pd coated lasers or fibers.

Wafer defect inspection*

*In collaboration with G. Popescu (ECE)



Needle in a haystack: we find 9x100x100nm defects in $1cm^2$ densely patterned Si chips.

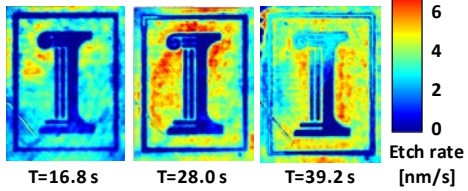
Education/Outreach

Girls' EE camp

Quantitative phase microscopy*

*In collaboration with G. Popescu (ECE)

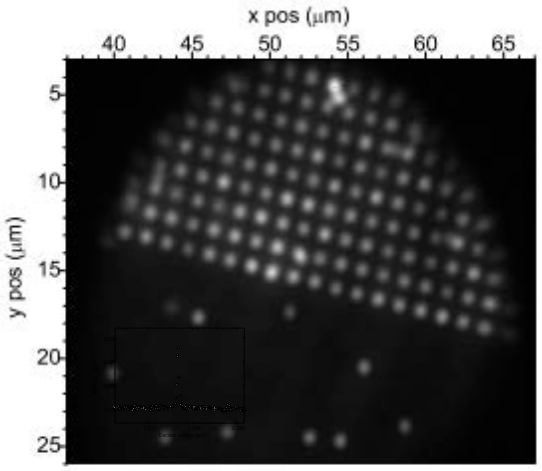
Monitoring etch height while etching



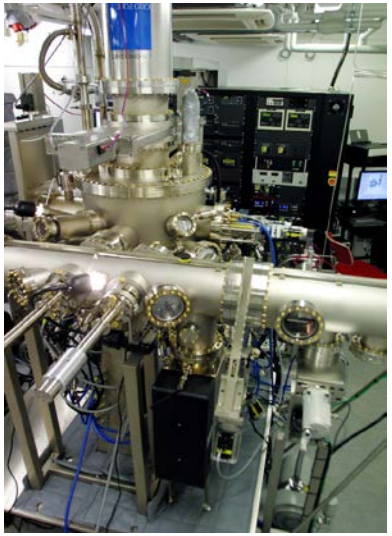
We measure nanoscale dynamics in semiconductors with comparable accuracy to AFM but 1,000x faster.

Lynford Goddard (lgoddard@illinois.edu)

III-V QDs Site-controlled Epitaxy as Tool for Nanophotonic Devices



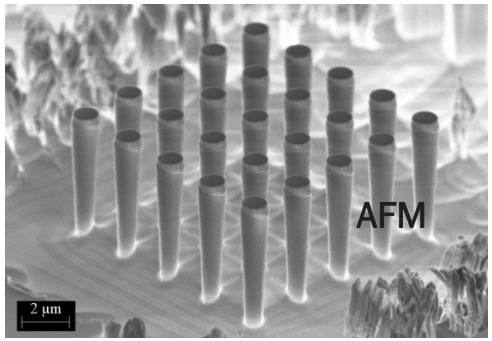
μ-PL image of an ordered QD array



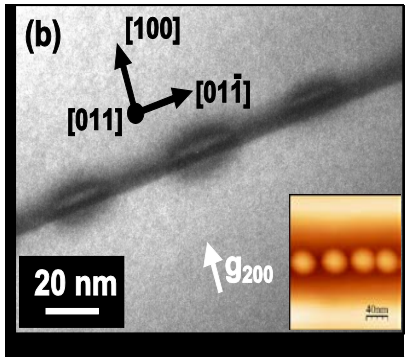
Mircea Guina

Tampere Univ. of Technology

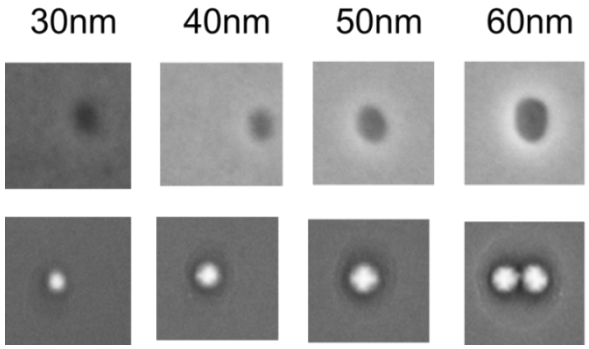
- GaAs substrate patterning
- High quality InAs QDs
- Control of QD density with periodicity down to 60 nm
- Study of optical properties
- Single-photon emitters
- Plasmonic coupling



Array of single-photon emitters



Cross-sectional TEM



QD occupancy vs. pit size