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Research portfolio





The Opto Group's activity concerns all stages of the development of optoelectronic components.

The group's expertise extends from the design to the manufacture and characterization of components and systems, in the field of optoelectronics.

Its activity is focused on innovative themes: optomicrowave sampling, photovoltaics, acousto-optics, plasmonic biosensors and, transversally, modelling.

Photovoltaics

Full PVD deposition of thin film solar cells





Acoustooptic

AcoustoOptic Tunable Filters for Hyperspectral Imaging

In-house developed AOTF with 5



Designed to simultaneously

diffract ordinary and

extraordinary rays.



- CIGS cells: Room temperature deposition + post-anneal
- \succ Si based tandem cells (Zn-IV-N₂)
- III-V quaternaries

electrodes for transfer function apodization. In collaboration with:



Filtered output of a sample
 illuminated with white light:



Modelling

Beam propagation method BPM, integrated optics



Details on the design of a 1 mm long Linearly absorbing Si3N4/SiO2 nanoguide: 3D BPM + **Genetic algorithm** optimisation. ANR PHENIX, collaboration with THz group. 1x2 MMI simulated with **3D BPM** (visualization with gtk-fortran and ForColormap)



Al, ray-tracing: photovoltaics



1. 0.51 2.3 1.3 0.36 0.06601 400 500 600 700 Temperature (K)

Solar cell reflectivity cepending on surface texturisation (pyramids), determined from **ray-tracing**.

Comparison of results obtained with Silvaco TCAD and a **neural network**, for different learning algorithms: prediction error is well below 2%.

Collaboration with ENIM, Monastir, Tunisia



Acousto-Optic Tunable Filters

Computational analytics: Acousto-optics

for hyper-spectral imaging: Diffraction efficiency as a function of angular aperture, in the case of parallel tangents.





· [110]

13 14 15 16 17 18 19 20 21 22 θ_{f} [°]

Off-synchronism efficiency optimization for wideband operation, for dual diffraction AOTF.

Efficiency difference(%) for 200 nm

Plasmonic biosensing

Surface plasmon resonance sensing

Sensitivity improvement



 Input beam

 Imput beam

Sensor including coupling optics

Fluidics integration and spectral interrogation

Université Polytechnique HAUTS-DE-FRANCE JUNIA Grande école d'ingénieurs

Centralemile



Université de Lille

(CNrs)



Application to real time:
detection of pathogens in phytosanitory domain
biopesticide spreading optimization

Net

SMARTBIOCONTROL BioSens



Microwave-photonics

Microwave subsampling ADCs

Electro-optic sampling High speed photoswitch using GaAs LT All optical sampling Integrated optics light deflector

Top-illuminated device





Packaged device (**iXblue**)

Superstrate Optical coupling

Integrated optical waveguide device



Collaboration with THALES



Frequency (GHz)



https://www.iemn.fr