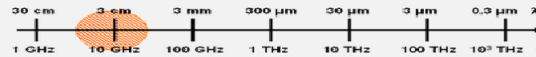


# DOME GROUP

## Dispositifs Opto et Microélectronique

L. BURGNIER, E. LHEURETTE, D. LIPPENS, X. MÉLIQUE, V. SADAUNE and O. VANBÉSIEN

### ELECTROMAGNETIC META-MATERIAL TECHNOLOGIES: FROM MICROWAVES TO OPTICS



#### Meta-Materials (MMs) @ Microwave/THz and infrared

**Artificial Materials:** Negative- and zero- postive index media by means of composite Right Left Handed (CRLH) metamaterial

**Linear and non linear Devices:** Negative Index Material (NIM) and Gradient Index (GRIN) lens, Phase shifter, tunable MMs, perfect metamaterial Absorbers (PMA)

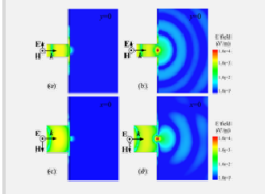
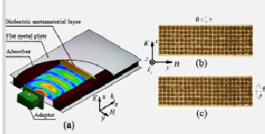
**Systems:** communications, spectroscopic and High Resolution (HR) imaging systems

**Technologies:** 2D and 2D1/2 surface and bulk technologies Transmission lines

**Constitutive materials:** Metallodielectric and Full dielectric structures based on conduction and displacement current loops

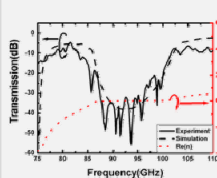
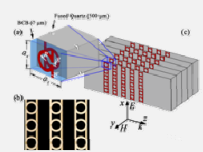
### FULL DIELECTRIC AND METAL TECHNOLOGIES

#### Ferroelectric BST array



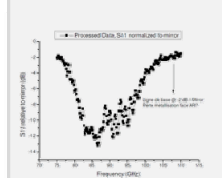
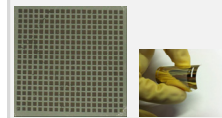
Extraordinary transmission

#### Split Ring resonator(SRR)



Negative index in V-band(50-75 GHz)

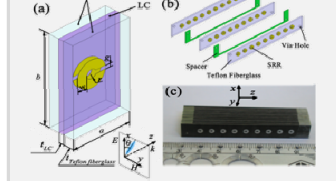
#### Perfect Metamaterial Absorbers flexible substrate



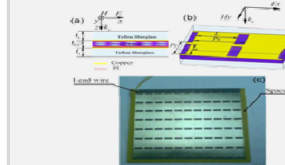
flexible substrate PMA

### TUNABLE MMs BY LIQUID CRYSAL (LC) AND FERROELECTRICS

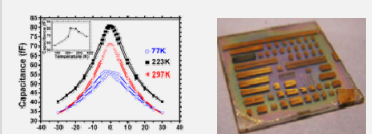
#### Broad side coupled SRR tuned with LC's



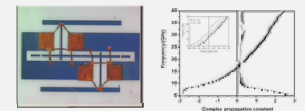
#### Fishnet-like tunable MMs



#### Ferroelectric BaSrTiO<sub>3</sub> CRLH transmission lines



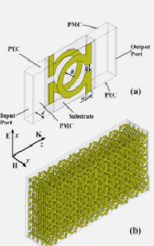
BST characterization at low temperatures



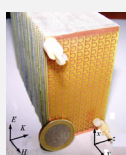
Monolithic fabrication and dispersion characteristics

### BEAM STEERING VIA CRLH OMEGA-TYPE MMs

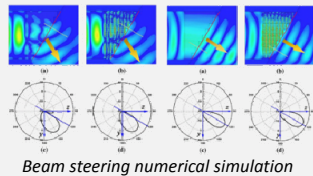
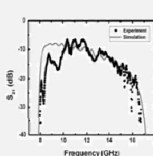
#### Omega type arrays



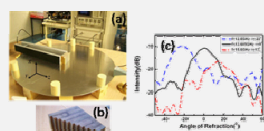
Basic cell and array schematic



Transmission



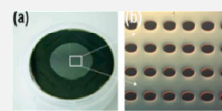
Beam steering numerical simulation



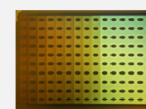
Negative-zero-positive regime (far field condition)

### FISNET LIKE NIM AND CHIRAL MMs

#### Sub-wavelength hole arrays

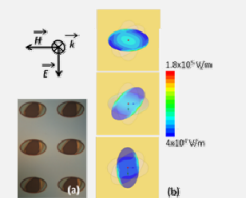


Membrane-like sample



Wedge (type device) and refraction at 0.5 THz

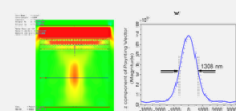
#### Twisted hole structures



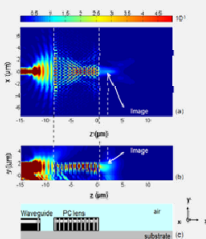
Rotary power as high as 100°/λ

### FOCUSING VIA NIM AND GRIN FLAT LENS

#### GRADIENT INDEX (GRIN) flat lens



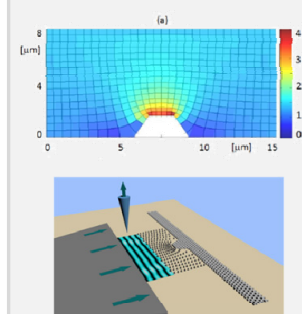
#### Negative Index flat lens



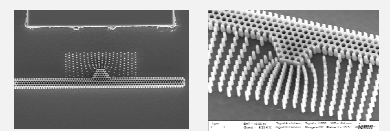
Metal technology

Semiconductor PC technology

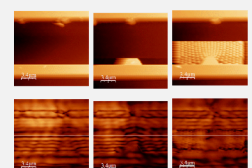
### IMAGING AND STEATH SYSTEMS



Simulation by transformation optics



Photonic crystal ( pillar-hole) technology



Scanning Near field Optical Microscopy