INSTITUT D'ÉLECTRONIQUE FONDAMENTALE
Université Paris-Sud – UMR8622 - Centre Scientifique d'Orsay - Bâtiment 220 - F 91405 ORSAY Cedex

Lundi 21 juin 2016 à 14h00
Bâtiment 209D - Salle 110 (1er étage)

Bruno Paulillo - Photonique

Circuit-tunable subwavelength terahertz devices

Membres du jury :

Directeur de thèse:	M. Colombelli, Raffaele	IEF – Univ. Paris Saclay
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Résumé :

The increasing need for small, fast, low-power optoelectronic components is driving the research towards radiation sources and detectors having a dimension that is smaller than the emitted/detected wavelength. This is hampered by the optical diffraction limit which constrains the minimum dimension of optical devices at half the operating wavelength. Conversely, electronic devices, such as antennas and oscillating circuits, are not diffraction-limited in size and can be frequency tuned with lumped components. Hence, blending the worlds of photonics and electronics has the potential to enable novel optoelectronic devices with no lower size limit imposed by the wavelength and with novel functionalities borrowed from electronic circuits. The ideal spectral region to develop this paradigm is the terahertz (THz) range, halfway between the electronics and optics realms. In the first part of this work, we present novel subwavelength 3D micro-resonators that behave as microscopic LC circuits, where the resonant frequency can be tuned acting separately on the capacitive and/or inductive regions. In the second part we illustrate the power of this concept by implementing novel lumped-elements-based passive THz meta-devices (polaritonic, optically switchable). The last part is devoted to active meta-devices. Single-pixel and arrays of THz quantum well photodetectors featuring a $\sim\lambda_{eff}/10$ dimension are demonstrated, thanks also to an effective and original contact scheme to extract (inject) current from (into) the semiconductor core embedded by each resonator.

Mots clés : metamaterials, terahertz, RF antennas, sub-wavelength confinement, intersubband quantum devices

Vous êtes cordialement invités au pot qui suivra cette soutenance