Centre de Nanosciences et de Nanotechnologies

Soutenance de thèse

Vendredi 3 décembre
14h00
Centre de Nanosciences et de Nanotechnologies
10 boulevard Thomas Gobert
91120 Palaiseau
Amphithéâtre

Link : https://univ-cotedazur.zoom.us/j/89349956213?pwd=U1plWlpvMnFPNlBzVTVYT2J2ZTdtUT09

Francesco Manegatti

Jury members :

Frederic Gardes	Professeur	Université de Southampton	Rapporteur
Olivier Gauthier-Lafaye	DR	LAAS-CNRS	Rapporteur
Sara Ducci	PU	Université de Paris	Examinatrice
Ségolène Olivier	Docteur	CEA-LETI	Examinatrice
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Abstract :

Exploiting light as a vehicle of the information instead of electrons is thought to be one of the best solutions to go beyond the electrical interconnects limitations. While photonic solutions have already replaced electrical lines for long-distance applications, an optical alternative to the lossy metallic interconnects inside integrated circuits is still missing: particularly, even though silicon waveguides represent a great opportunity to transfer the optical signal throughout the whole chip, active nanophotonic components for low-power applications presenting small footprint, ultra-high driving speed and compatibility with the CMOS-technology, suitable for the on-chip cointegration of photonic and electronic integrated circuits, have not been commercialized yet.
This PhD aimed at developing two fundamental devices we can find inside an integrated photonic circuit: an optical nanoamplifier and a nanolaser source, both relying on an electrically injected hybrid InP on SOI bidimensional Photonic Crystal (2D-PhC). Firstly, we modeled the two devices, demonstrating their efficient electrical injection scheme as well as optical interfacing with a silicon-based passive circuitry, rendering them good candidates for low-power applications. Then, we developed a full technological process flow, fabricating these structures while respecting the limitations imposed by the microelectronic industry. This meticulous task allowed us to validate the designed electrical injection scheme and to demonstrate electrically driven nanolaser, working at room temperature and presenting ultra-low laser threshold power (around 75 µA at 1 V) under an AC electrical bias. Eventually, the limiting technological step was identified and discussed. Its resolution will lead to the demonstration of these nanolasers under a DC electrical signal.