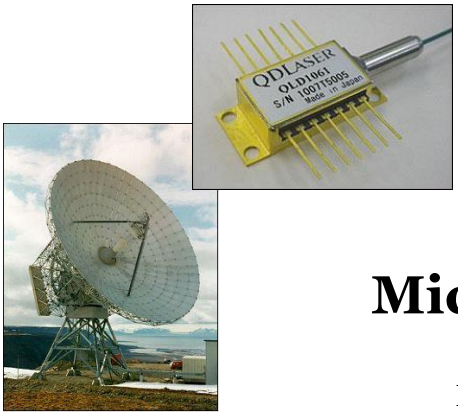
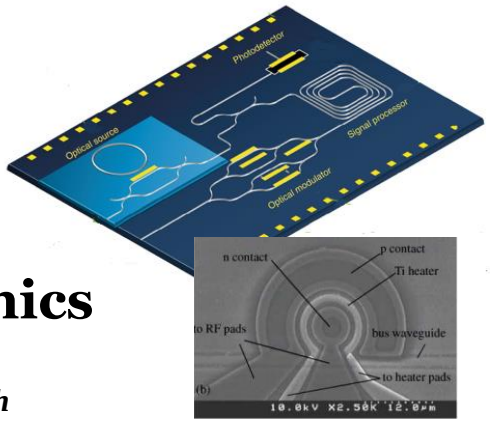


Fall 2019
Course announcement
PHYC- 480/581
ECE- 495/595



Microwave Photonics

Tuesday & Thursday 3:30-4:45
Instructor: ***Mani Hossein-Zadeh***
(mhz@ unm.edu)

Microwave Photonics

Microwave Photonics is an interdisciplinary field that uses a coherent combination of microwave engineering and photonics to tackle problems that are usually difficult or sometimes impossible to solve using only one of these disciplines. Reduced size-weight-cost, low attenuation over a wide modulation bandwidth, high information transfer capacity, improved sensitivity and efficiency, low power consumption, immunity to electromagnetic interference are among the most important benefits of microwave photonic systems compared to conventional microwave systems.

Course Overview

This course is an introduction to *Microwave Photonics (MWP)* with emphasis on practical aspects and technological applications. After a review of the most relevant microwave and photonic components, we study their high frequency performance. The emphasis will be on those aspects of the device design and performance that are relevant for MWP applications and usually are not covered in other courses. Next we will explore different applications of MWP techniques by studying selected systems and configurations. Through these studies we demonstrate the functionalities that can be only realized using interaction between electromagnetic waves at optical and microwave frequencies. Finally we review recent advances in *Integrated Photonics* that are enabling chip-scale complex microwave photonic systems with emphasis on *Silicon Photonics* technology. Starting from basic principles of *Silicon Photonics* design and integration, we study selected on-chip MPW systems through practical examples.

Tentative syllabus:

Review of Microwave & Photonic devices:
Photonics: Semiconductor lasers (Basics, Modulation, Noise), High speed photodetection (Basics, Noise, PIN, Traveling wave and Uni-traveling carrier photodiodes), High speed optical modulators (Mach-Zehnder, Electro-absorption, Microdisk/microring), Optical filters. Microwave: Transmission lines, Resonators and Filters, Amplifiers and Mixers.

Applications of Microwave Photonics:
Photonic microwave links, Photonic generation and processing of microwave signals, Photonic phased array antennas, Optoelectronic microwave oscillator, Photonic analog-to-digital conversion, MWP in satellite communication, Radar and Lidar systems.

Integrated Microwave Photonics:
Materials and Platforms for integrated MWPs, Silicon Photonics (main components, design principles), selected silicon based MWP systems (transceivers, signal processors and *Radar/Lidar* systems).

Recommended background: *Electromagnetic*: Electromagnetic waves and waveguides. *Photonic devices*: Basic familiarity with optoelectronic devices and their functions (diode lasers, photodetectors, filters, resonators). *Signal & systems* (basic concepts). *Semiconductor devices* (basic concepts).