Silicon Photonics: Optical modulation and detection

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Silicon is the mainstream material in the electronic industry and it is rapidly expanding its dominance into the field of photonics. Indeed, silicon photonics has been the subject of intense research activities in both industry and academia as a compelling technology paving the way for next generation of energy-efficient high-speed computing, information processing and communications systems. The trend is to use optics in intimate proximity to the electronic circuit, which implies a high level of optoelectronic integration. Over the last decade, the field of silicon photonics has advanced at a remarkable pace. Most applicative sectors have now included silicon photonics in their roadmaps as a key technology to be deployed over short, medium or long term horizons. This evolution towards silicon-based technologies is largely based on the vision that silicon provides a mature integration platform supported by the enormous existing CMOS manufacturing infrastructure which can be used to cost-effectively produce integrated optoelectronic circuits for a wide range of applications, including telecommunications, optical interconnects, medical screening, spectroscopy, and biological and chemical sensing…

This lecture will introduce silicon photonics and the basics and recent results of silicon optical modulators and germanium photodetectors and their integrations in a common photonic/electronic platform. The outline of the talk will be:

I. Silicon photonics: Motivation
II. Optical modulator
    a. Physical effects
    b. Figures of merit
    c. Experimental results
III. Light detection
    a. Material choice
    b. Properties
    c. Experimental results
IV. Conclusion and perspectives