

# SILICON IN PHOTONICS

**Under the Guidance of  
Dr. Partha S. Mallick**

*Presented by*  
**Manoranjan Beura**  
**Roll no: EI200147294**

# Introduction

- The field called silicon photonics arose from the research performed in this area. Its overarching goal is to develop high volume, bolt-and-go optical components using silicon. While silicon is opaque in the visible spectrum, it is transparent at the infrared wavelengths used in optical transmission, hence it can guide light.

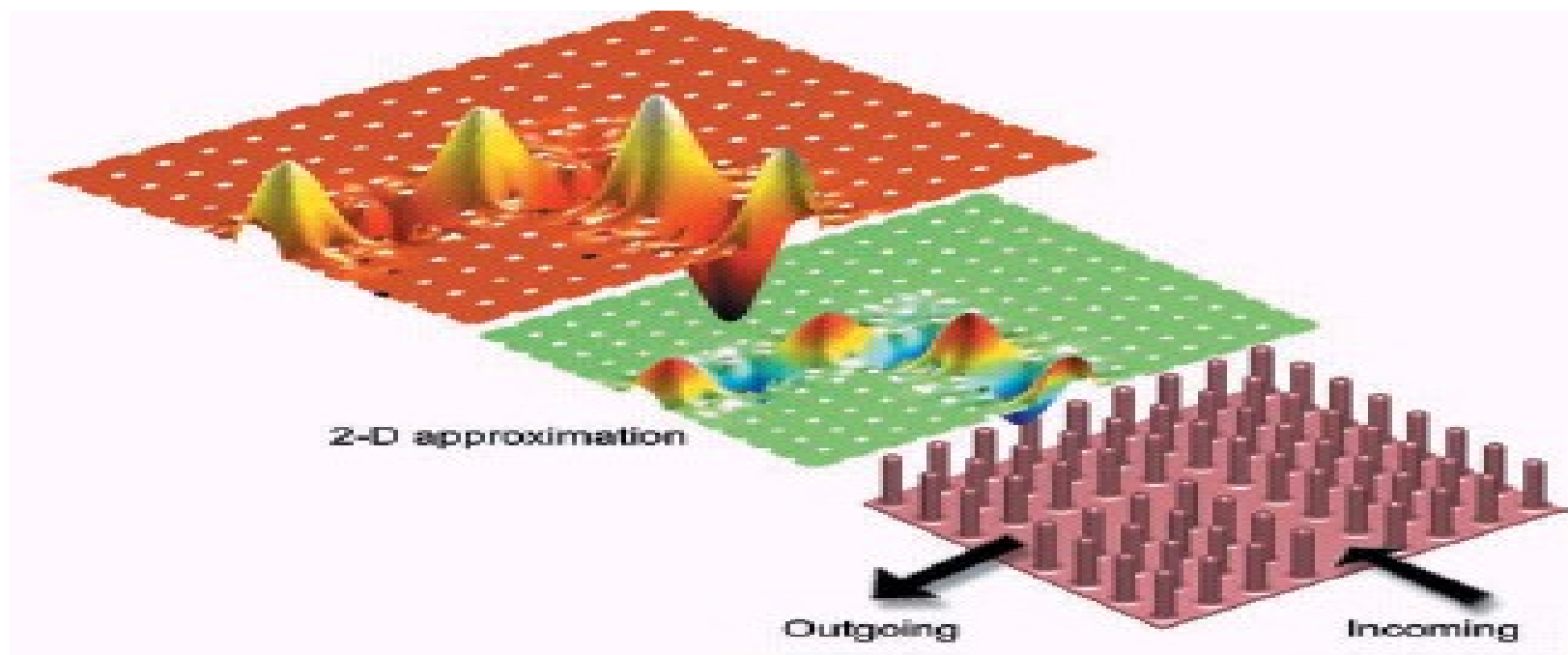
# Features of - Photonics

- phase insensitive
- frequency conversion → WDM meets perfectly the requirements of ultra fast all-optical data optical data
- processing and regeneration processing and regeneration
- alternative or supplement to semiconductor semiconductor-based photonics.

# Silicon Material

- Amorphous silicon
- Porous silicon
- Black silicon

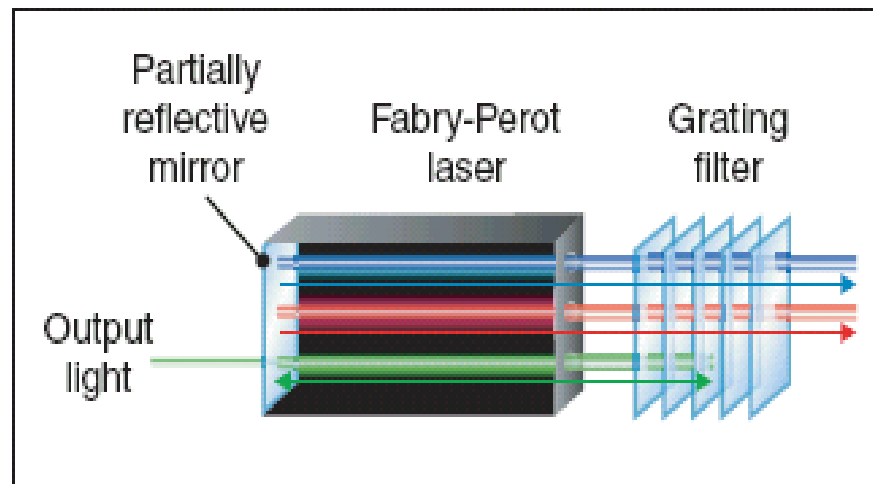
# Light propagation through silicon crystal



## **Silicon Light Source**

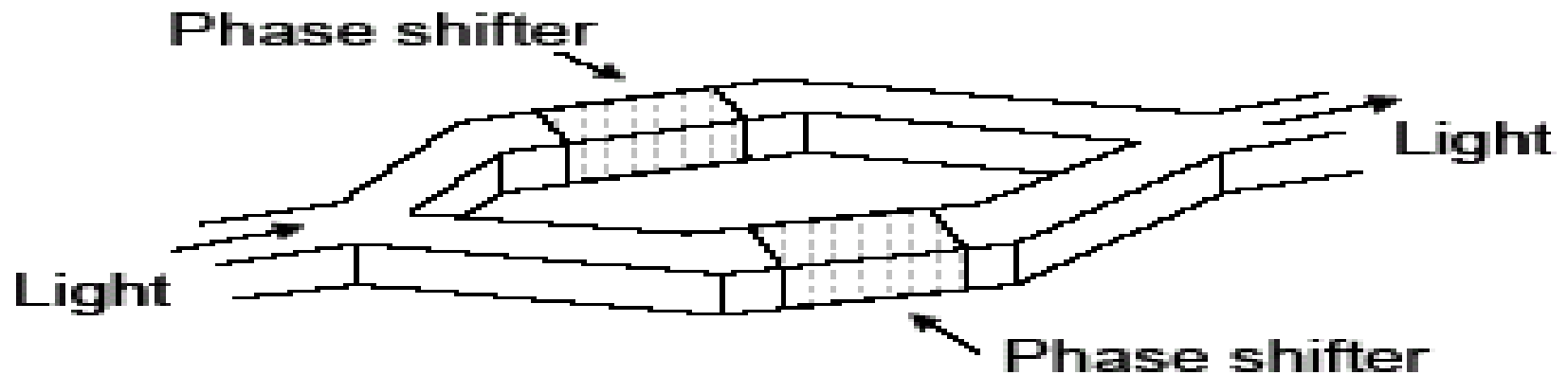
The work towards a silicon-based emitter is ongoing but still far from mature. Until an efficient, reliable silicon based light source is available, a photonic integrated system will need to use a conventional III-V material light emitter.

# Filtering Light



To cause the laser to generate only one specific wavelength, the light can be filtered by a grating, which reflects a specific set of wavelengths in a different direction. The specific wavelengths needed for communication can be individually selected and directed toward other photonic components.

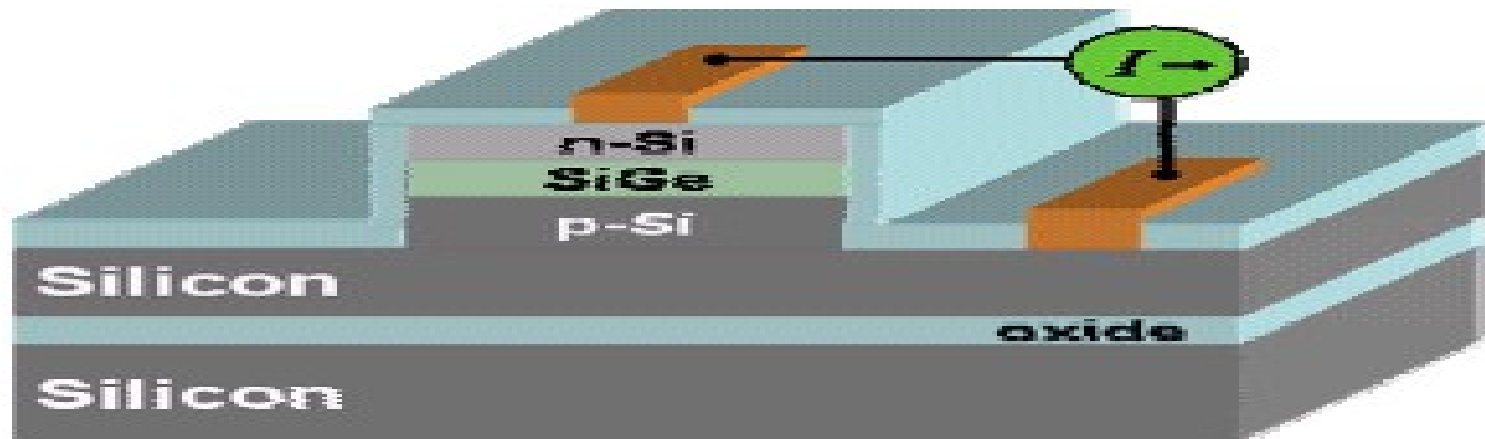
# Silicon Modulator



Schematic of a Mach-Zehnder interferometer modulator with two phase shifter sections



# Silicon Based Photo Detector



$\text{Si}_{1-x}\text{Ge}_x$  waveguide-based photodetector on a SOI wafer. The waveguide is formed by the ridge of p-Si material and is running perpendicular to the cross-section. The SiGe MQW are inside the region labeled SiGe

## Conclusion

Silicon modulators operating at 2.5 GHz have demonstrated two orders of magnitude improvement over other known si-based modulators, with theoretical modeling indicating performance capabilities beyond 10 GHz. And initial results from SiGe photo detectors have shown the feasibility of monolithically integrated waveguide detectors. Through further research and demonstration of novel silicon photonics devices.

*Thank You !!!*