

# Project HOPbit    Hybride Silizium-Organik Photonik für die hochbitratige Datenübertragung

## GOALS

- Development of photonic devices based on photonic integrated circuit technology
- Deposition of electro-optical (EO) materials like polymers in a post-process
- Study of electro-optical characteristics
- Development of a strategy for the hybrid integration of EO materials into a photonic SiGe BiCMOS technology

# MOTIVATION

- Silicon as a material lacks efficient electro-optical (EO) effects
- Organic materials provide strong EO effects
- Two photon and free electron absorption are negligible in organics allowing phase-only modulation

## RESULTS

- The quadratic EO effect and the electric field-induced linear EO effect are observed
- Electro-optical switching is shown using a photonic integrated circuit technology
- A frontside and a local backside etching procedure is developed to integrate organic materials into a photonic SiGe BiCMOS technology by post-processing

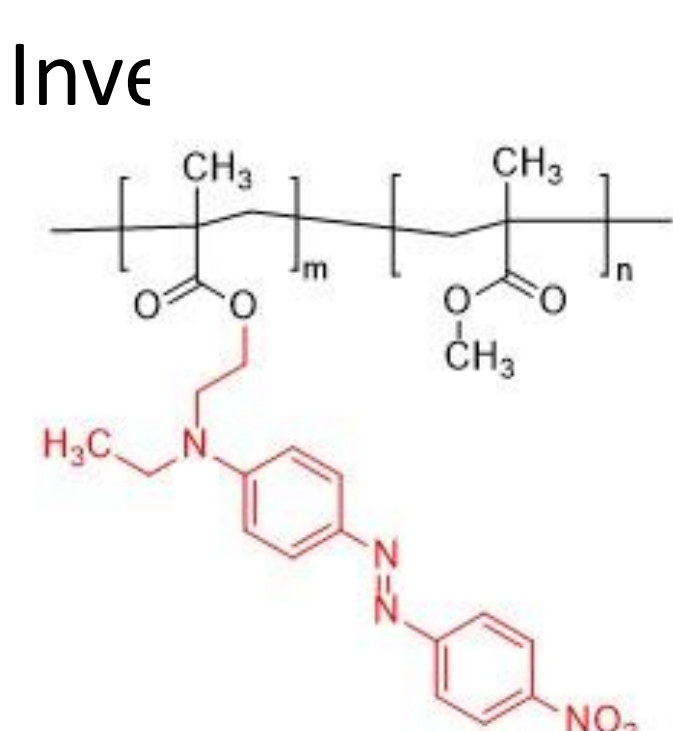
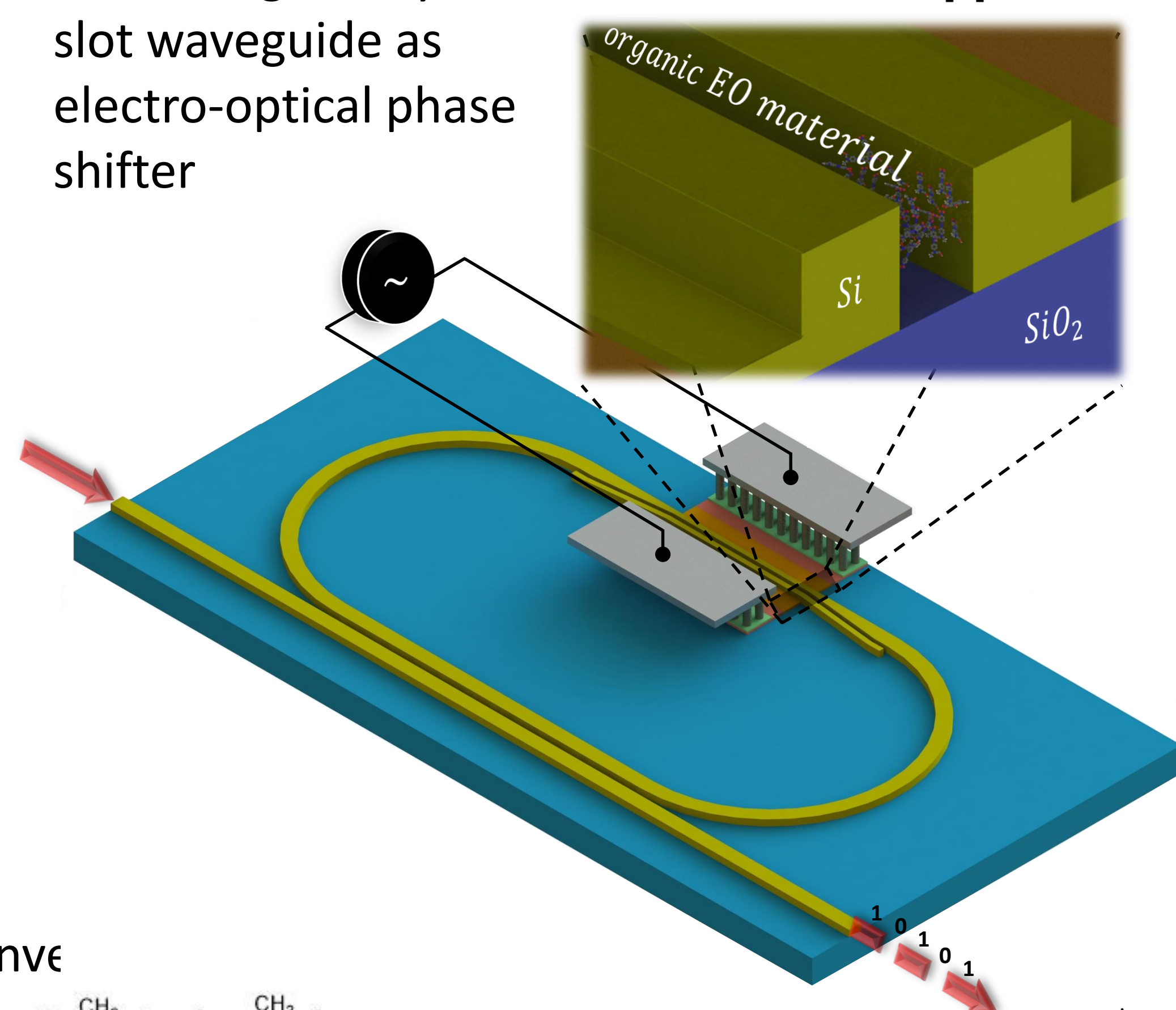
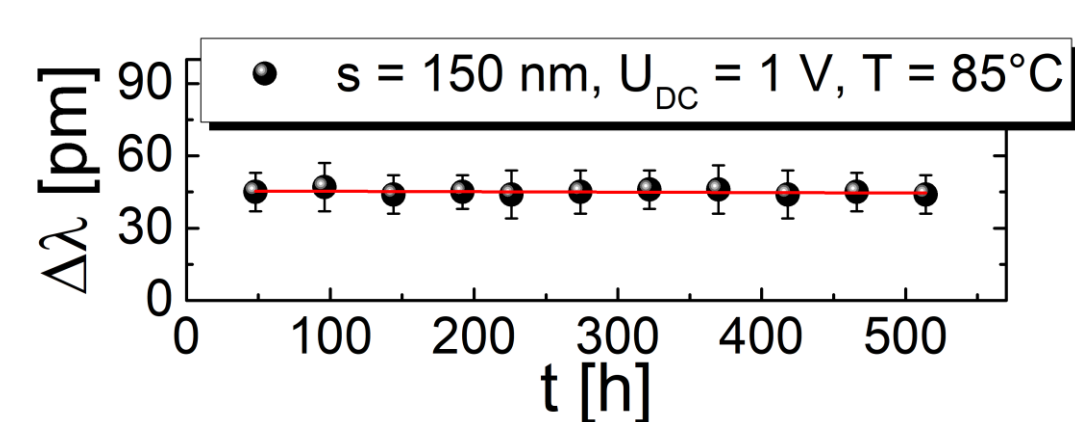
## OUTLOOK

- Novel organic materials with superior EO properties will be employed
- An encapsulation of the organic materials will be developed
- Laser active organic materials and other compounds will be integrated using the same hybrid-integration strategy

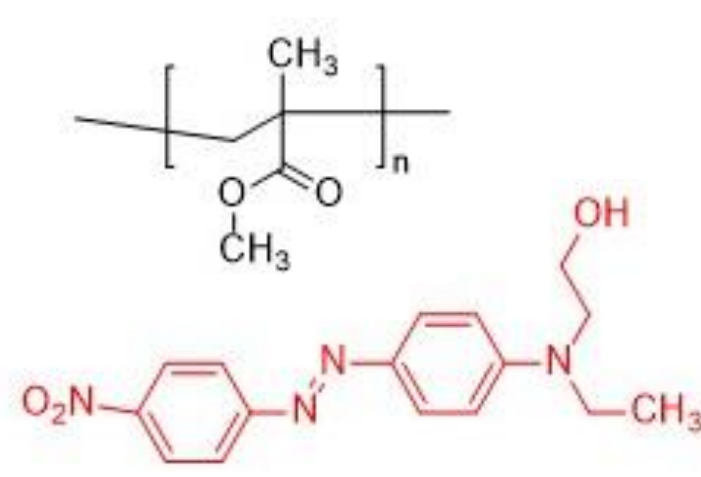
## Quadratic electro-optic effect

## Photonic device

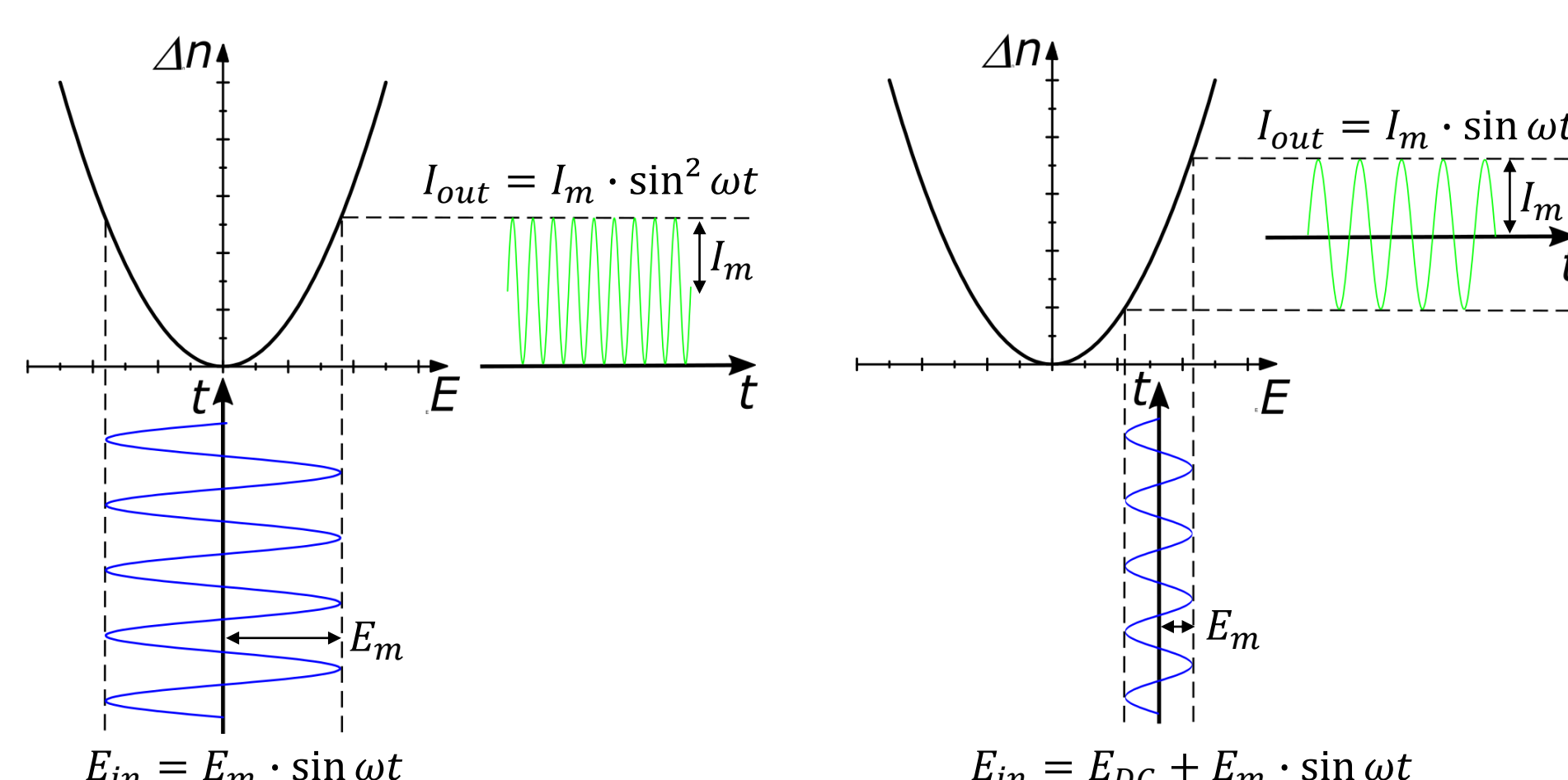
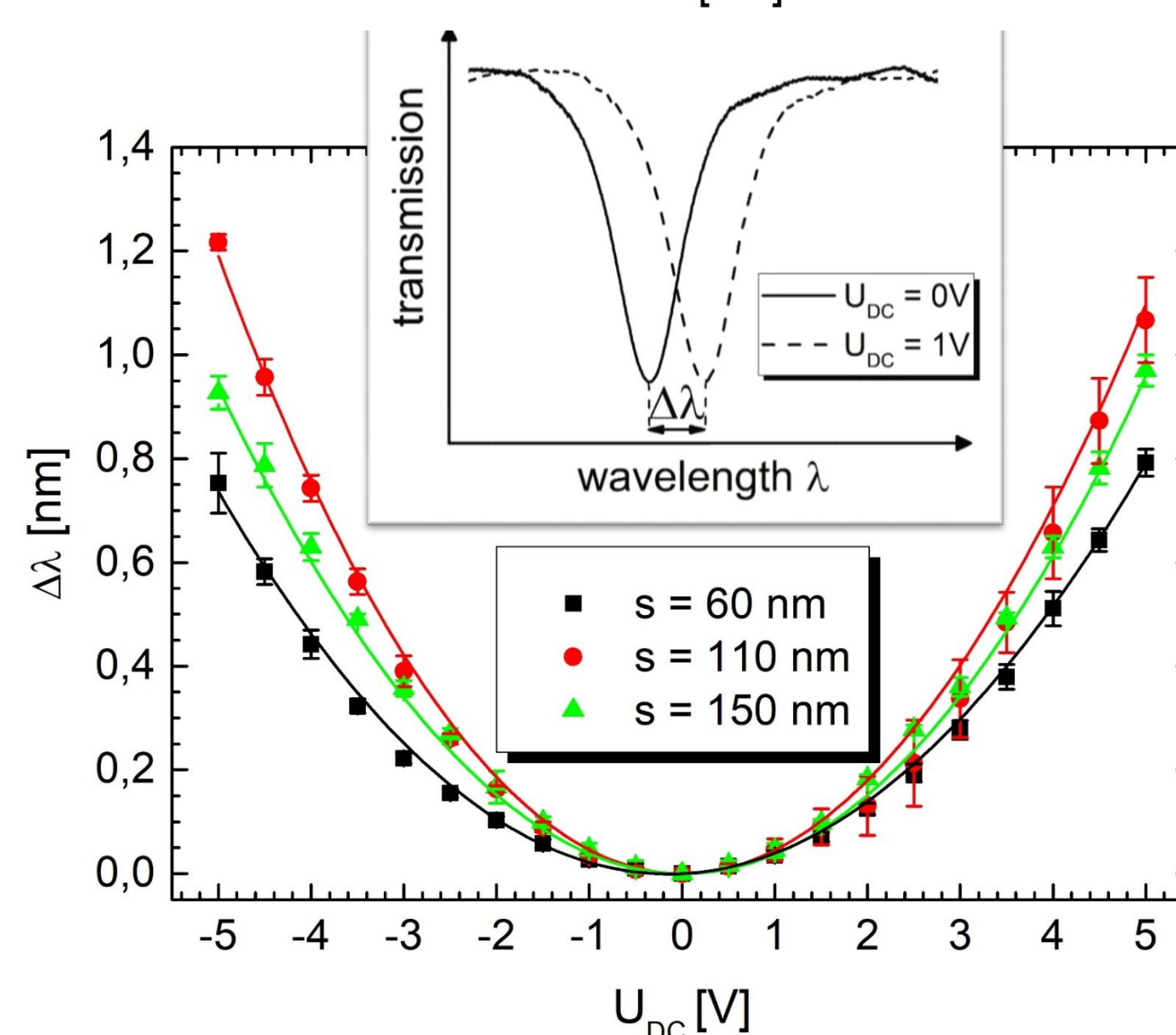
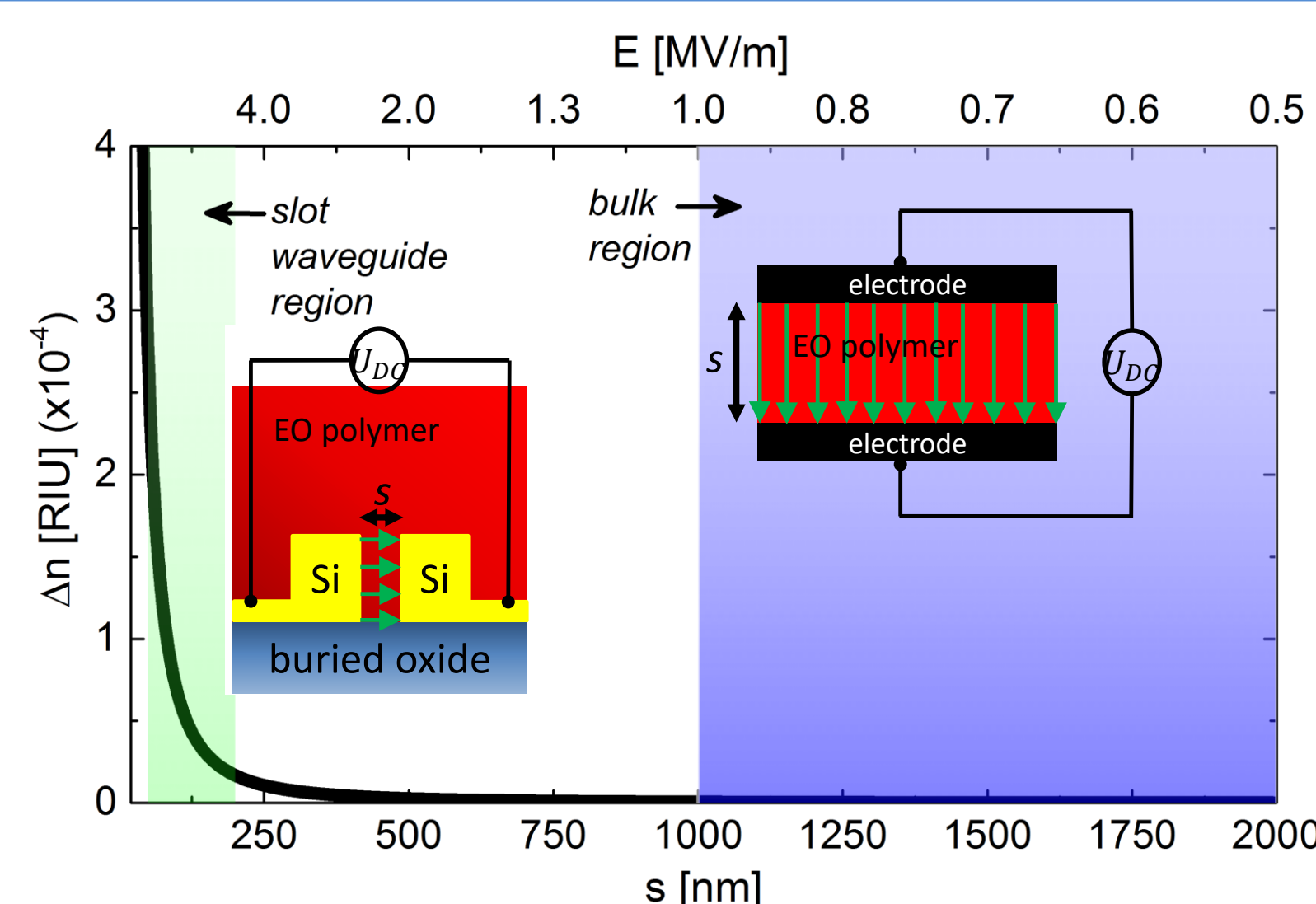
- Silicon ring resonator
- Silicon-organic hybrid slot waveguide as electro-optical phase shifter



PMMA + DR1  
(side-chain system)



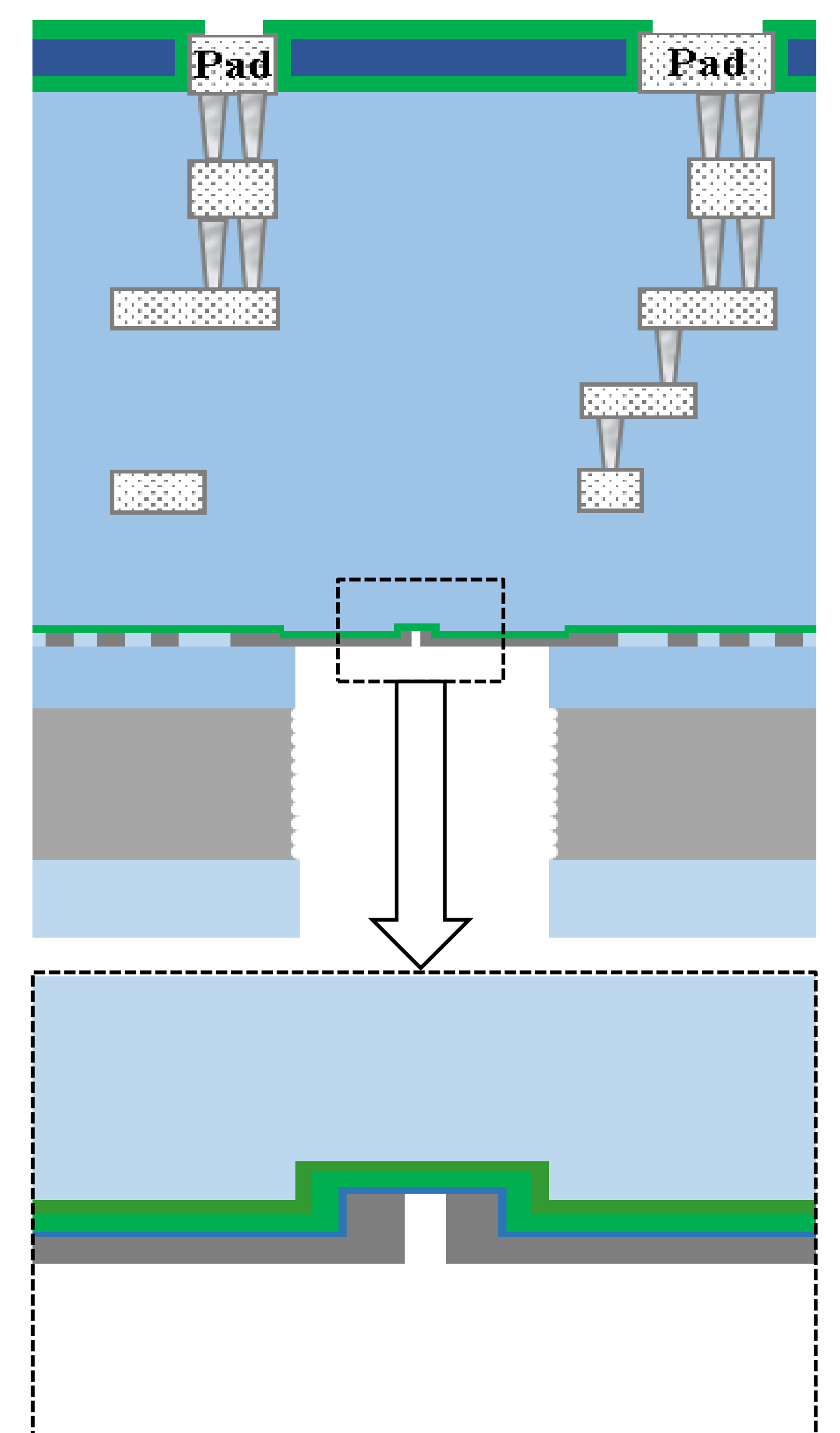
PMMA + DR1  
(guest-host system)



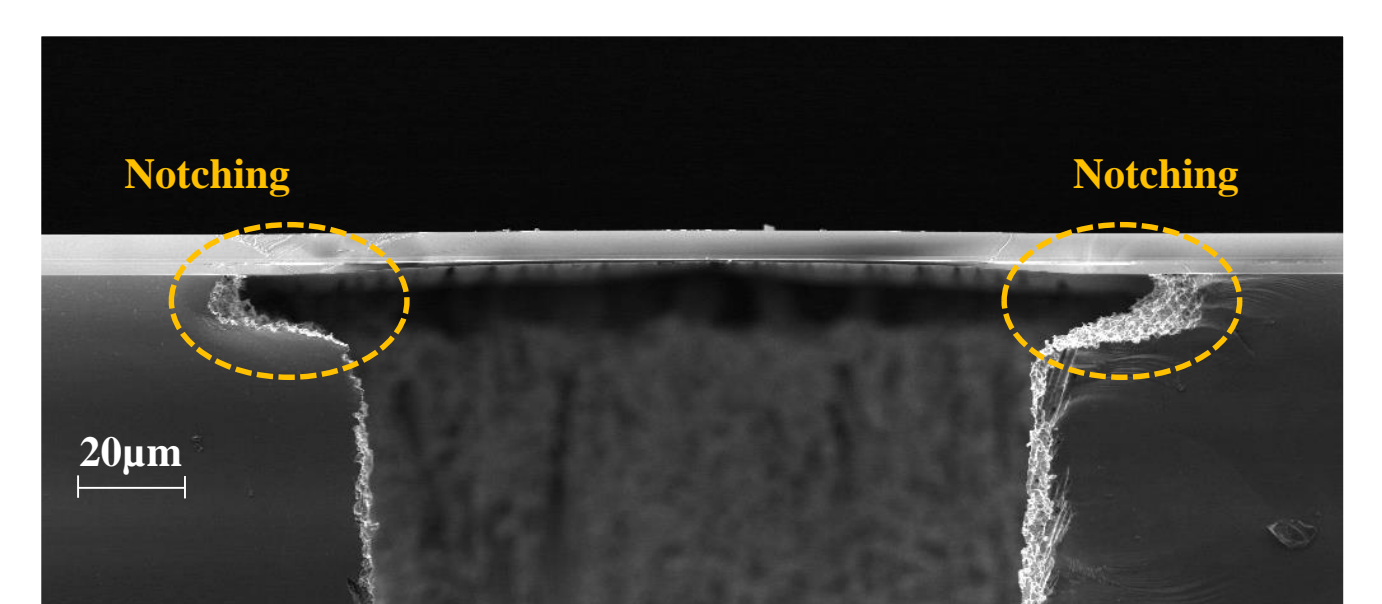
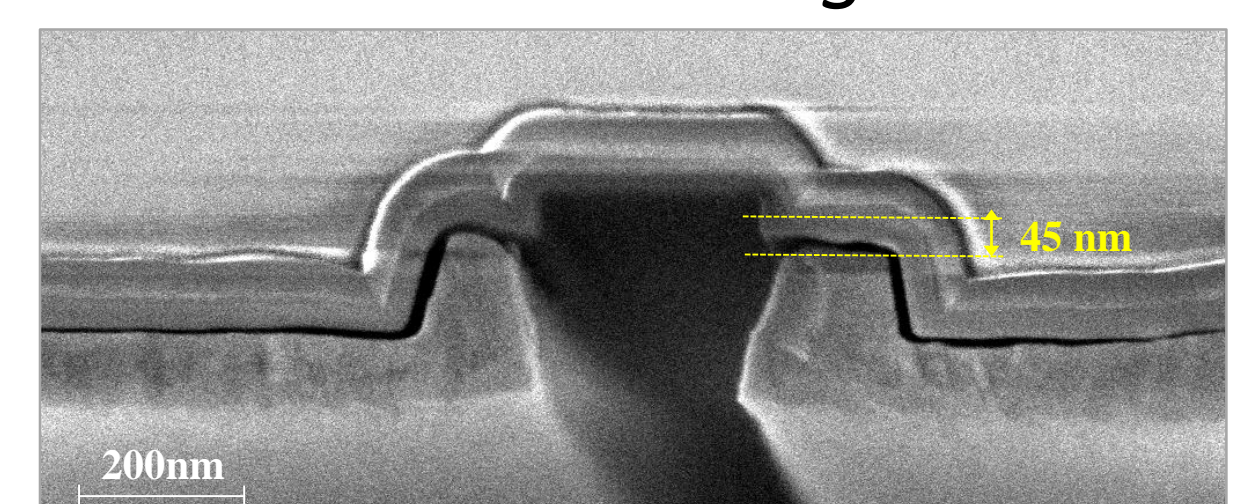
## Backside integration

## General Idea

- SiGe BiCMOS technology with full back-end of line
- Release of silicon-based slot waveguide by local backside etching (LBE)



*Released slot waveguide*



*Cross-section of local backside etched trench*

## Acknowledgement



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