**INTRODUCTION**

Indium Phosphide (InP)
- III-V material that can provide optical gain
- Used for traditional lasers at 1310 and 1550 nm

Silicon-on-insulator (SOI)
- Mature platform in electronics (CMOS)
- Low optical loss and high-index contrast
- Superior passive functionality – Si photonics
- Does not allow efficient light emission

**InP-on-silicon**
Combines best of both worlds!

**APPLICATION IN TELE- AND DATACOM**
Optical interconnects intra- and inter data centers

---

**DESIGN CONSIDERATIONS**

**DVS-BCB bonding of InP/InGaAsP epi on SOI**
- Robustness in design w.r.t. bonding layer thickness
- DVS-BCB thickness typically between 20 and 100 nm

**Optimization of gain and feedback**
Compromise needed

**InP-to-silicon coupling**
- Through adiabatic tapered couplers
- Narrow taper tips required to minimize back reflections

**Heat sinking**
- Heating = big issue in Si photonics
- Thermal vias required

**WHAT’S NEXT?**
- Fast tunable DFB and DBR lasers for optical packet switching
- High-speed modulation of DFB and DBR lasers
- Narrow-linewidth double-ring lasers for optical transceivers
- Transfer printing to enable integration on an active SOI platform

---

**KEY RESULTS**

- Above 40 Gbit/s direct modulation with a DFB laser
- Above 12 nm continuous wavelength tuning with DBR-like lasers
- Wide wavelength tuning with DFB and DBR-like lasers
- Demonstration of a narrow-linewidth short-pulse mode-locked laser

---

**FABRICATION IN A CLEANROOM ENVIRONMENT**

Google data center in North Carolina, USA

---

**SEM image of an InP-on-silicon laser cross section**

---

**Eye diagram for 43 Gbit/s direct modulation of a standard DFB laser**

**Optical spectra for a thermally tunable UG-DBR laser**

**Wide-span electrical spectrum of a short-pulse mode-locked laser**