



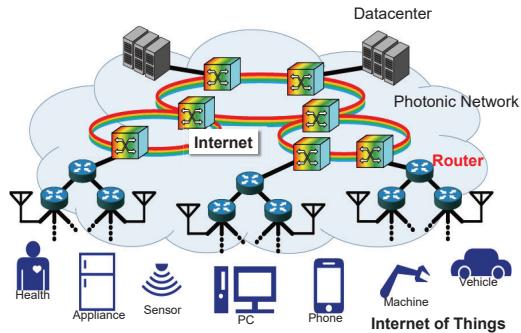
Shoji Lab

Silicon Photonic Devices using Magneto-Optical Materials

FIRST, Quantum Nanoelectronics Research Core

<http://www.ee.e.titech.ac.jp>

Increase of Network Traffic



Increase of power consumption in electric router
(especially for high bit-rate signal processing)

Datacenter

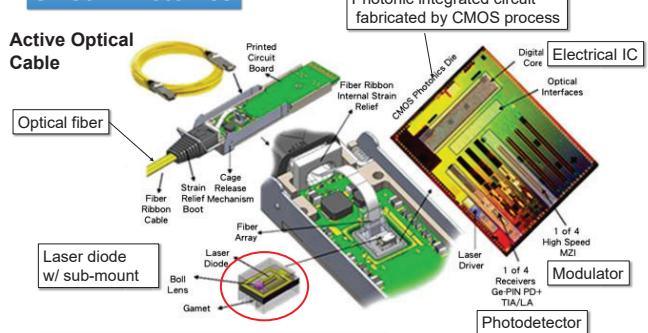


High Performance Computer



Bottleneck of transmission speed between rack-to-rack

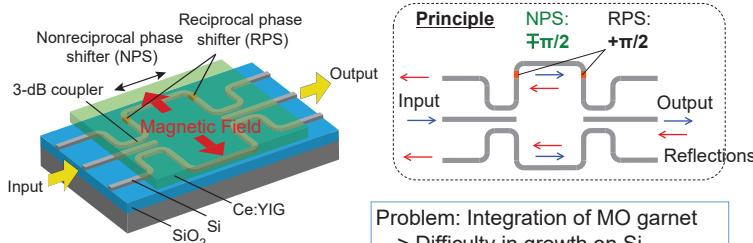
Silicon Photonics



Challenge of optical transceiver:
Monolithic integration of Optical isolator
with LD

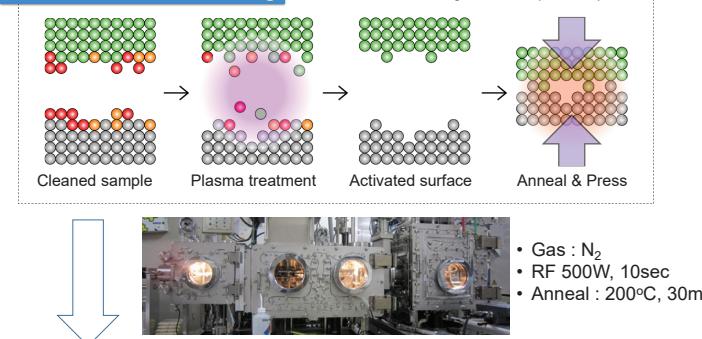
LUXTERA
REINVENTING THE PATH TO TRANSIT CONNECTIVITY

Si optical isolator



Problem: Integration of MO garnet
-> Difficulty in growth on Si

Surface Activated Bonding

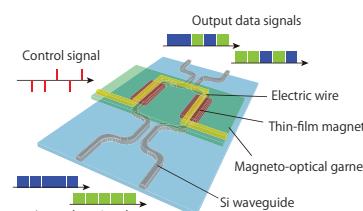


- Gas : N₂
- RF 500W, 10sec
- Anneal : 200°C, 30min

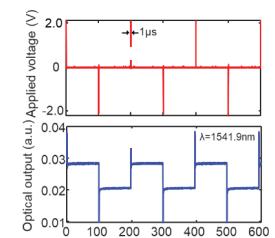
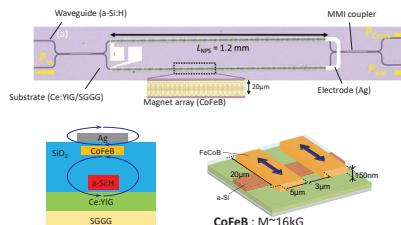
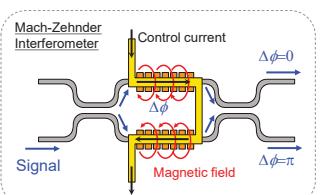
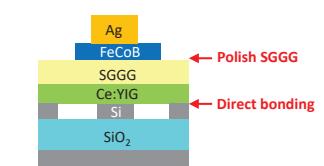
World's first demonstration of waveguide optical isolator on Si

Self-holding optical switch

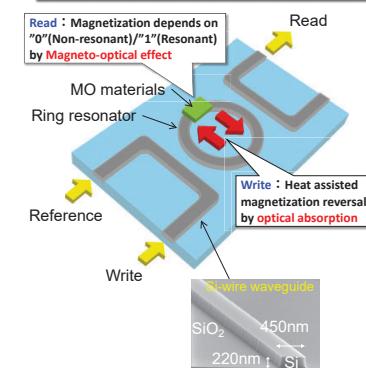
Non-volatility of magnet → Self-holding of switching state



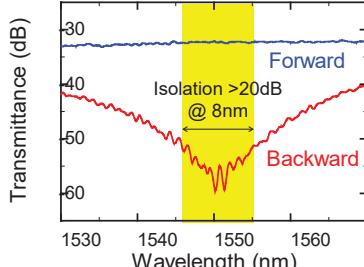
- ✓ Switching state is held w/o power
- ✓ Low power consumption
- ✓ Switching speed : ~10 ns
- ✓ Size (2 × 2) : ~0.5 × 0.1 mm²



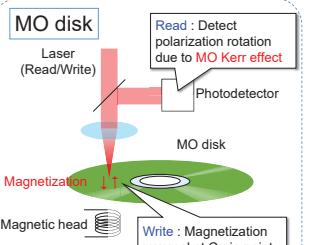
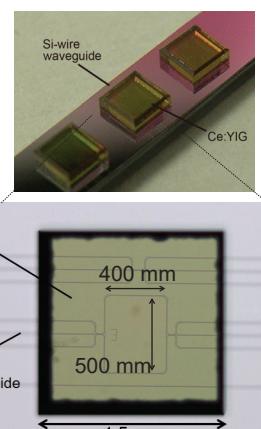
Optical memory switch



T. Murai, et al., Opt. Express, **28**, 31675 (2020).



Y. Shoji, et al., APL, **92**, 071117 (2008).
Y. Shoji, T. Mizumoto, JJAP, **53**, 022202 (2014).



- ✓ Dense integration with Si photonics
- ✓ 1bit : 20 μm sq. → 1.5KB : ~2 mm sq.
- ✓ Read/Write packet data (Sequential access memory)