Ming Wu Research Lab

Integrated Photonics Laboratory | mingwulab.berkeley.edu

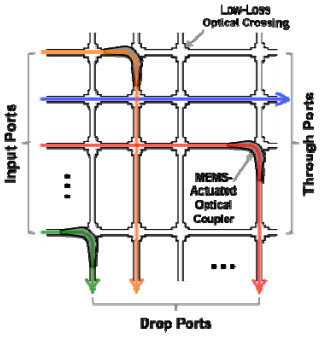
Berkeley Sensor & Actuator Center | bsac.berkeley.edu

Si Photonics/Switch

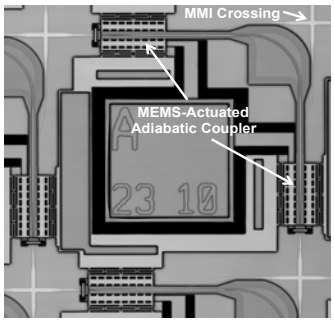
Data centers use highly aggregated traffic: Need optical circuit switches

- Highly scalable matrix architecture
  - 64x64 switch: 3.7 dB on-chip loss 7.6x7.6 mm^2 footprint
  - Broadband operation
- MEMS-actuated adiabatic couplers move up and down
- MEMS-actuators designed for digital switching
  - >60 dB ON/OFF ratio
  - <1 μs switching time
- Packaged switch
  - Collaboration with Tyndall Inst., Ireland

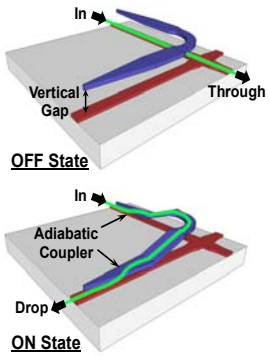
Switch Matrix Architecture



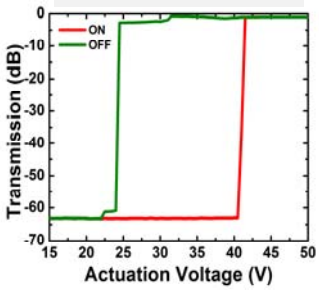
Unit Cell Of Fabricated Switch



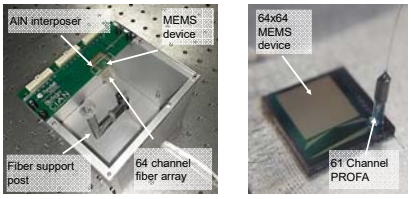
Switching Mechanism: Coupler Moves Up And Down



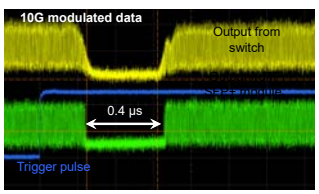
Bias Voltage Characteristics



Packaged Switches



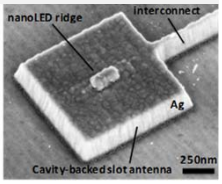
System-level Experiment

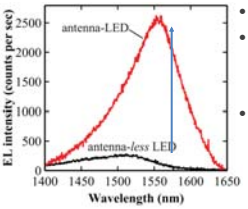


Antenna-LED

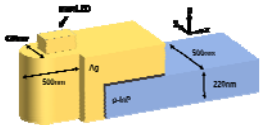
Fast, efficient, nanoscale light source for on-chip optical communication

III-V antenna-LED

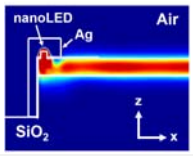




- Electrically-injected
- Measured 200X increase in spontaneous emission rate
- > 100 GHz modulation rate is possible



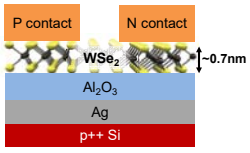
Perspective view of the parabolic reflector



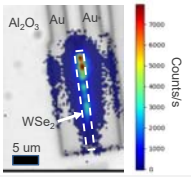
Cross-section of power flow

- 90% on-chip waveguide coupling efficiency.
- >380nm 1dB bandwidth

- Monolayer transition metal dichalcogenide
- Easy integration with arbitrary substrate
- Efficient light emission



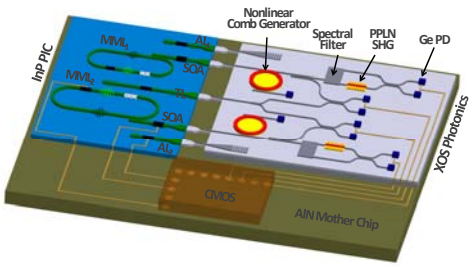
Monolayer WSe_2 Light emitting diode

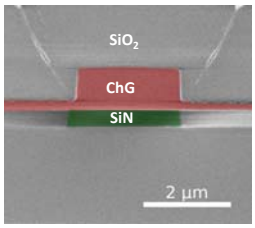


Spatial map of light emission

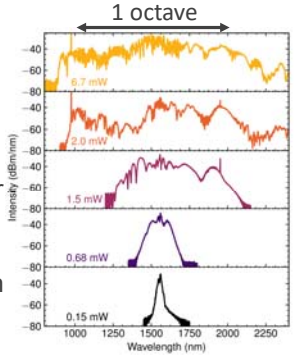
On-chip Optical Synthesis

- Optical frequency synthesizers revolutionized the accuracy of metrology, sensing, timekeeping and optical communication
- Miniaturization and power reduction promises to bring the ubiquity of microwave control to the optical domain





- Use of chalcogenide glass as efficient, 3rd order nonlinear material
- Octave-wide supercontinuun achieved from mW average power input
- Passive components and second harmonic generation integrated on same chip



Research lab contact: wu@eecs.berkeley.edu

BSAC website: bsac.berkeley.edu

To join BSAC, contact Dr. Michael Cable: mdcable@berkeley.edu

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