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# Ultrahigh-Bandwidth Low-Latency Reconfigurable Memory Interconnects by Wavelength Routing

Tech ID: 33805 / UC Case 2021-901-0

## ABSTRACT

Researchers at the University of California, Davis, have developed a memory system that uses optical interconnects.

## FULL DESCRIPTION

The technology encompasses low latency memory systems and a novel silicon photonics (SiPh) architecture using Wavelength Division Multiplexing based optical interconnects. The silicon photonic interconnects enable optical parallelism and wavelength routing to reduce contention in the entire path from a processor to a memory subarray. The low latency architecture can include three pieces: a contention-less optical data plane, a low-bandwidth electrical control plane, and fine-grained memory banks with integrated photonics. In the data plane, the arrayed wavelength grating router (AWGR)-based optical interconnect can provide a dedicated data path from every requester to every memory bank, with no intermediate buffering, to reduce the queuing and interconnect latency. In the control plane, a low-bandwidth electrical or optical interconnect can communicate the addresses and commands between processors and memory and coordinate the time that a processor sends or receives data. The fine-grained memory banks (also referred to as microbanks) can be directly accessed by the memory controller to allow for massive amounts of parallelism.

## APPLICATIONS

- ▶ Low Latency Memory System Architecture
- ▶ Silicon Photonics (SiPh) with space saving scalability
- ▶ Processor and Memory Interconnect Solution
- ▶ Suitable for processor, memory, and system designers and manufacturers

## FEATURES/BENEFITS

- ▶ High parallelism data communication in memory systems
- ▶ Fast throughput and low energy data communication
- ▶ Replaces conventional electrical interconnects

## PATENT STATUS

| Country                   | Type                  | Number                         | Dated      | Case     |
|---------------------------|-----------------------|--------------------------------|------------|----------|
| Patent Cooperation Treaty | Published Application | <a href="#">WO 2022/265796</a> | 12/22/2022 | 2021-901 |

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## OTHER INFORMATION

### KEYWORDS

low-latency memory,  
 memory, optical  
 interconnects, Silicon  
 Photonics (SiPh)

### CATEGORIZED AS

- ▶ **Optics and Photonics**
  - ▶ All Optics and Photonics
- ▶ **Computer**
  - ▶ Hardware
  - ▶ Other
- ▶ **Nanotechnology**
  - ▶ Electronics
  - ▶ Other
- ▶ **Semiconductors**
  - ▶ Design and Fabrication
  - ▶ Other

### RELATED CASES

2021-901-0

## ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Higher-Speed and More Energy-Efficient Signal Processing Platform for Neural Networks](#)

- ▶ Crystal Orientation Optimized Optical Frequency Shifter
- ▶ Hyperspectral Compressive Imaging
- ▶ Multi-Wavelength, Nanophotonic, Neural Computing System
- ▶ Athermal Nanophotonic Lasers
- ▶ Ultra-High Resolution Multi-Platform Heterodyne Optical Imaging
- ▶ Multi-Wavelength, Laser Array
- ▶ Optical Interposers for Embedded Photonics Integration
- ▶ Development of a CMOS-Compatible, Nano-photonic, Laser
- ▶ Energy Efficient and Scalable Reconfigurable All-to-All Switching Architecture
- ▶ Compressive High-Speed Optical Transceiver
- ▶ All-Optical Regenerators
- ▶ Tensorized Optical Neural Network Architecture
- ▶ Silicon Based Chirped Grating Emitter for Uniform Power Emission
- ▶ Energy-Efficient All-Optical Nanophotonic Computing
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