WHAT IS PHOTONIC COMPUTING?

- Optical Computing
- Photonic computers perform its computations with photons or IR beams as opposed to electron-based computation which are seen in the traditional computers.
- Two types: Pure Optical Computers & Electro-Optical Hybrid
• Use optical fibers and electric parts to read and direct data from the processor. Light pulses send information instead of voltage packets.

• Processors change from binary code to light pulses using lasers.

• Information is then detected and decoded electronically back into binary.
OPTICAL TRANSISTORS

- Transistors based off the Fabry-Perot Interferometer.
- Constructive interference yields a high intensity (a 1 in binary)
- Destructive interference yields an intensity close to zero (a 0 in binary)
HOLOGRAPHIC MEMORY

• A holographic memory can store data in the form of a hologram within a crystal.
• A laser is split into a reference beam and a signal beam.
• Signal beam goes through the logic gate and receives information
• The two beams then meet up again and interference pattern creates a hologram in the crystal.
HOLOGRAPHIC MEMORY
OPTICAL FIBERS

• Small in size
• Low transmission losses
• No interference from radio frequencies, electromagnetic components, or crosstalk
• Safer
• More secure
• Environmental immunity
OPTICAL FIBERS
PROS

- Small size
- Increased speed
- Low heating
- Reconfigurable
- Scalable for larger or small networks
- More complex functions done faster Applications for Artificial Intelligence
- Less power consumption (500 microwatts per interconnect length vs. 10 mW for electrical)
LIMITS OF PHOTONIC COMPUTING

• Optical fibers on a chip are wider than electrical traces.
• Crystals need 1mm of length and are much larger than current transistors
• Software needed to design and run the computers.
MILESTONES

• **1839**: the generation of electric current in a material upon exposure to light by Edmond Becquerel.
• **1905**: Albert Einstein developed a hypothesis that light energy is carried in discrete quantized packets.
• 1966: Charles Kao published a paper on optical fibers and how they transmit signals over long distances.
• **2016**: Intel showed off its silicon photonics modules for lightning-fast connectivity in data centers. This brought both electronic and optical computing together.
• **2017**: Scientists created a photonic computer microchips. The chips’ photonic synapses were thousand times faster the human brain.
RESOURCES


• https://uncw.edu/phy/documents/raphael_06.pdf

• https://www.technologist.eu/a-brief-history-of-photonics/