

# **Photonics based Silicon waveguides** **fabrication for integrated quantum processor**

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## **Abstract**

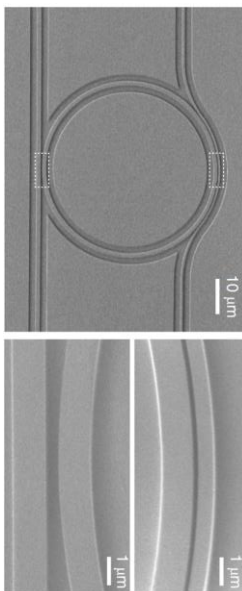
Advancements in fabrication of Silicon photonics in recent years have led to enabling utilization in generation and detection of optical signals integrated on-chip.

For achieving integrated Silicon photonics circuits, Silicon Nitride has promising characteristics with operation in sub-milliwatt optical pump power, high spectral brightness, and high photon purity. Fabrication of Silicon Nitride waveguides is performed in way like CMOS fabrication technology involving DUV stepper lithography, dry etching, and low-pressure chemical vapor deposition.

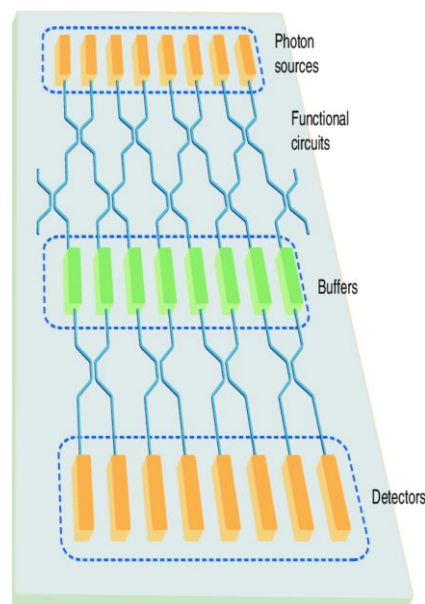
Integrated Silicon Nitride micro-ring resonator is fabricated with cladding of silicon dioxide on lower side with top air cladding. In fabrication of resonators, core of the device is a high-Q Si<sub>3</sub>N<sub>4</sub> micro-ring that needs critical parameters monitoring for Silicon Nitride film thickness, ring width and ring radius.

For silicon nitride (Si<sub>3</sub>N<sub>4</sub>) supporting a much wider bandgap, enabling operation across wavelengths from the near-ultraviolet to the mid-infrared, it leads to achieve high yield photonic micro-resonators for quantum processors, it is required to high quality silicon nitride waveguides for loss less circuit, along with generation of single photon delay lines and entanglement generation with CNOT gates.

Integrated Silicon nitride photonics-based quantum gates fabrication will help to release bulk photonics integrated circuits in uniform and scalable form with different components like memories and detectors fabricated on to get a full integrated processor.



Silicon waveguide – Fabrication



Integrated Photonic based quantum components on chip

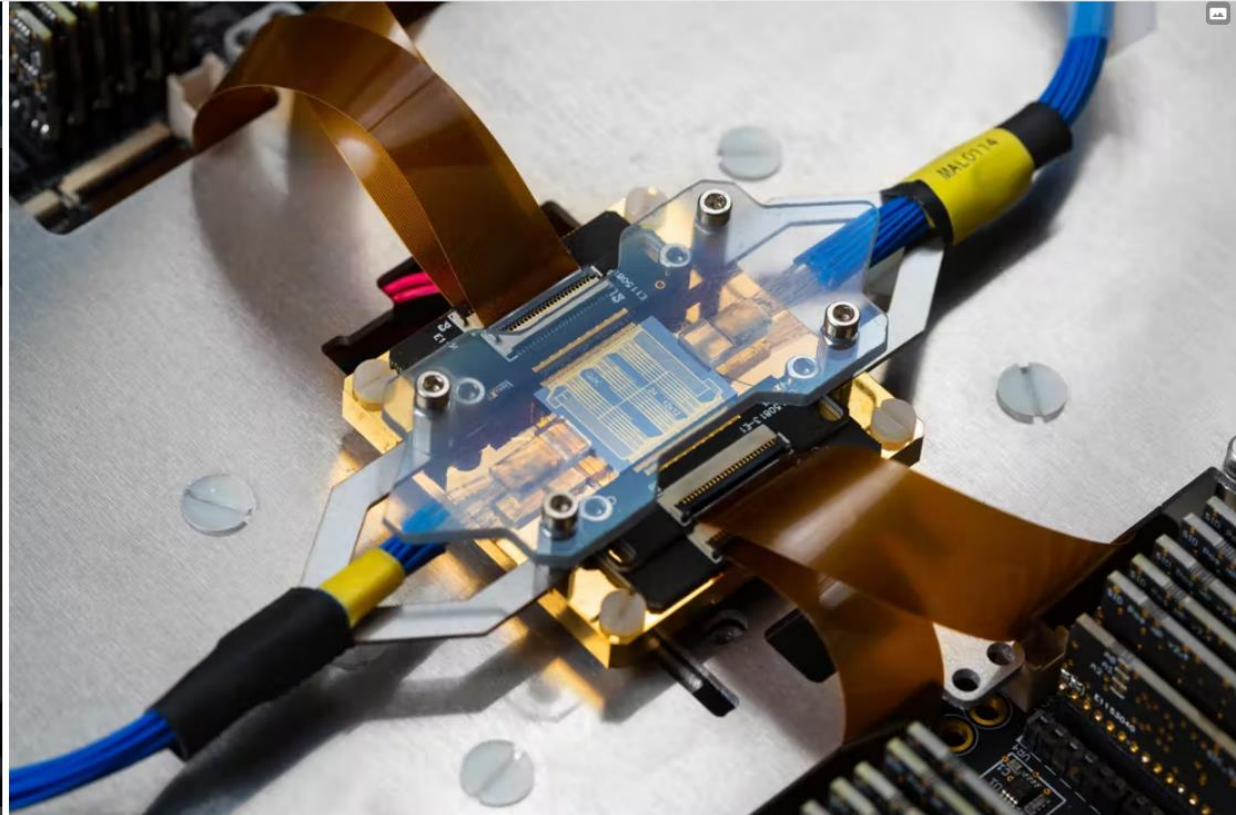


FIGURE 1. Photonic assembly of the 12-mode universal quantum photonic processor. The photonic integrated circuit (PIC) is optically and electrically interfaced—featuring more than 150 tuning elements for full programmability.

## References :

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