Quantum trap optical modulator

Overview

These devices consist of piezo-optomechanical photonic integrated circuits configured as multi-stage Mach-Zehnder modulators that are used to control the intensity of light delivered to a single trapped ion on a separate chip. These elements are expensive, bulky, consume substantial power, and often rely on free-space I/O channels, all of which. This project is funded by the NSF Challenge Institute for Quantum Computation and the National Defense Science and Engineering Graduate Fellowship. Submitted to the Department of Electrical Engineering and Computer Sciences, University of California at Berkeley, in partial satisfaction of the. Researchers have made a major advance in quantum computing with a new device that is nearly 100 times smaller than the diameter of a human hair. This makes the platform well-suited for the engineering of quantum computing devices, but it also presents a set of challenges to the classical electronics that control these. L3Harris is building upon more than 40 years' experience in developing AOM devices and technologies to design illumination modules that control the quantum states of trapped ions with extreme precision. Integrated photonic components are essential for scaling ion trap systems to large numbers of qubits. We will present our work on ion traps with integrated light.

Article Content

Aug 02, 2025

Multi-site integrated optical addressing of trapped ions

In this paper we demonstrate an approach employing waveguides and multi-mode interferometer splitters to optically address multiple 171 Yb + ions in a surface trap by delivering all

May 25, 2026

Design and characterization of individual addressing optics based on ...

Abstract We present the design and characterization of individual addressing optics based on a multi-channel acousto-optic modulator (AOM) for trapped ytterbium-171 ions.

Jul 26, 2025

Laser Intensity Stabilization and Pulse Shaping for Trapped-Ion ...

Abstract This report describes the development of components for a laser intensity stabilization and pulse shaping setup for use in trapped ion quantum information experiments. A radio-frequency

Jul 01, 2025

Chip-Scale Technology Development for Trapped-Ion Quantum

for Industry and Systems Scalable ion trap technology for increased qubit and ion count Scalable generation, modulation, delivery, collection, and detection of visible to NIR light Scalable delivery of

Aug 25, 2025

Integrated photonics in trapped ion quantum computing

Finally, this architecture can be paired with active components such as optical modulators and detectors, representing a breakthrough in integrated technologies for quantum computing. Here

Feb 02, 2026

Integrated Optics for Ion Trap Quantum Information

Integrated Optics for Ion Trap Quantum Information Processing Trapped ions provide an ideal physical system to realize qubits. Well-defined qubits with long

Sep 05, 2025

Trap-modulation spectroscopy of the Mott-insulator transition in ...

We discuss a technique to probe the properties of an interacting cold atomic gas that can be viewed as a dynamical compressibility measurement. We apply this technique to the study of the

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Atomic-Scale Engineering and Strain Modulation of Quantum Defects

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High-fidelity trapped-ion qubit operations with scalable photonic ...

In this work we design, fabricate, and test an optical modulator capable of monolithic integration with a surface-electrode ion trap.

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Accelerated response speed of quantum-dot light

The storage of holes in quantum-dot light-emitting diodes between high-frequency pulsed electrical excitations can create an excitation-history

Nov 12, 2025

Quantum Well Optical Modulator With Circular Patch Antenna for ...

A circular patch antenna-coupled quantum well optical modulator for 1550 nm is proposed for the incident millimeter-wave polarization angle-independent phase modulation. The core layer of the

Oct 13, 2025

Integrated Optical MEMS for Scalable Trapped Ion Quantum Computing

The next section will detail integration of this high extinction optical switch with a surface electrode trap and focusing grating couplers in a fully packaged system.

May 31, 2026

High-fidelity trapped-ion qubit operations with scalable photonic ...

In this work we design and fabricate an optical modulator capable of monolithic integration with a surface-electrode ion trap, demonstrating the first modulator technology capable of

Oct 19, 2025

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sociated with optical coupling between physically separate components. In this work we design and fabricate an optical modulator capable of monolithic integration with a surface-electrode ion trap ...

Feb 22, 2026

Electronics for Trapped Ion Control

Because these couplings are in the optical regime for both microwave and optical qubits, laser control is an essential component of the control system for all

Aug 11, 2025

Electronics for Trapped Ion Control

An indispensable tool for electronic control of laser systems is the Acousto-Optic Modulator (AOM). This device modulates the frequency of an input laser beam at

Aug 21, 2025

Extending Spatial Light Modulation into the Ultraviolet

Researchers routinely marshal hundreds of cold atoms into individual traps using arrays of tightly focused laser beams known as optical tweezers.

Jun 10, 2026

An integrated laser system for manipulating trapped ions qubits

In this work, we demonstrate a laser system that integrates laser cooling, qubit initialization and detection, and Raman operations into a single setup, utilizing fiber laser technology

Mar 01, 2026

Microsoft Word

Abstract Many components that are employed in quantum information and communication systems are well known photonic devices encountered in standard optical fiber communication systems, such as

Mar 24, 2026

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optical signals on and off at a single ion level within an algorithm. One way to achieve greater signal control while pre-serving the benefits of fanout is to fabricate optical mod-ulators...

May 16, 2026

Towards Photonic Integrated Ion Traps for high-performance Quantum ...

In our research projects, we work on the development of photonically integrated ion traps for quantum computing and optical clocks. We design ion traps with passive optical devices such as waveguides,

Jul 25, 2025

Multi-Channel Acousto-Optic Modulator (AOM) Illumination Module

Precision control of optical beams for quantum state manipulation L3Harris is building upon more than 40 years'' experience in developing AOM devices and technologies to design illumination modules

Jul 31, 2025

Tiny optical modulator could enable giant future

Published in the journal Nature Communications, the breakthrough optical phase modulators could help unlock much larger quantum computers by

Jul 17, 2025

Quantum Orchestration for Neutral Atoms

ATOM ARRANGEMENT Neutral atom-based quantum computers use single atoms trapped in an array of optical tweezers as qubits. The atoms are probabilistically loaded into an array of traps (P~50%)

Dec 22, 2025

Multistability and quint points in an intensity-modulated magneto ...

In this Letter, we report on the nonlinear dynamics of the atomic motion in a Rubidium magneto-optical trap (MOT), which is modeled by a five-parameter non-autonomous second-order

Apr 12, 2026

Set up of a double pass AOM system for an ion trap experiment

Acousto-optic modulators are used to control amplitude and frequency of laser pulses. The beam path for a double-pass geometry of an acousto-optic modulator was planned and set up. The efficiency of

Jun 30, 2025

Effective multiple sideband generation using an electro

Herein, we report an effective method for the generation of radio-frequency (RF) sidebands in an electro-optic modulator for the simultaneous

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