TROY TECHNICAL

OPTICAL COMMUNICATIONS & PHOTONICS

WEEKLY REPORT

November 8 - November 14, 2026 | Issue 2026-W45

Link budget, packaging, thermal reliability and deployable supply

11	10
ANALYZED ARTICLES	PRIORITY THEMES

Issued 2026-11-14 | English edition | fixed approved cover artwork



Optical Communications & Photonics: the boundary moved from isolated claims to qualification evidence

11 English articles were reviewed independently from the Japanese edition. Ten themes are retained for management decisions.

SIGNAL 01 | LIGHT SOURCE

Thin-Film Lithium Niobate Memristors: All-Optical Specs and Fabrication

Researchers have developed all-optical photonic memristors fabricated directly on thin-film lithium niobate, achieving three-bit multilevel non-volatile memory.

SIGNAL 02 | PHOTONIC DEVICE

Hollow-Core Fiber: China's 1,000-km Transmission Specs and AI Impact

China has completed a 1,007.48-kilometer hollow-core fiber transmission verification achieving bidirectional speeds of 64 Tb per second.

SIGNAL 03 | PACKAGING

KNN Optical Modulators: 180 Gbaud Performance and Specs

Kyushu University and Sumitomo Chemical have demonstrated a potassium sodium niobate (KNN) thin-film optical modulator capable of ultrafast operation at 180 Gbaud.

SIGNAL 04 | NETWORK SYSTEM

Optical Transmitter: 180 Gbps Link Without Optical Isolators

Researchers led by Waseda University have demonstrated an optical transmitter capable of 180 gigabits per second data transmission without the use of a conventional optical isolator.

DECISION

Focus this week's management attention on link budget, packaging, thermal reliability and deployable supply. Move only when the linked evidence can be reproduced under your own operating conditions.

THREE MANAGEMENT MOVES

1. Buyers: evaluate optical architectures by reach, power, latency, interoperability and field service.
2. Suppliers: pair optical performance with packaging yield, test, thermal drift and qualified capacity.
3. Executives: track yield, coupling loss, temperature drift, interoperability, volume and cost.

EVIDENCE DISCIPLINE

FACT states what the collected English source reports. BUSINESS READ and ACTION are editorial interpretations. UNKNOWN lists information that the source file does not establish. A linked article is not treated as independent confirmation of every claim.

Numbers and evidence anchors that require conditions

180 G
A07

SOURCE-BOUND CONDITION
Kyushu University and Sumitomo Chemical have demonstrated a potassium sodium niobate (KNN) thin-film optical modulator capable of ultrafast operation at 180 Gbaud.

1.31%
A10

SOURCE-BOUND CONDITION
The system achieved a quantum bit error rate (QBER) of 1.31% and a secret key rate exceeding 11 kbit/s without using adaptive optics.

HOW TO USE THESE NUMBERS
Each value is shown with the condition stated in the collected English article. Do not compare values across different test methods, device sizes, operating temperatures or commercial stages without normalizing those conditions.

Where the value chain moved

Each stage combines one leading theme and one supporting theme. The report treats handoffs as evidence transfers, not decorative arrows.

1

Light source

P01/P06

Researchers have developed all-optical photonic memristors fabricated directly on thin-film lithium niobate, achieving.

2

Photonic device

P02/P07

China has completed a 1,007.48-kilometer hollow-core fiber transmission verificati on achieving bidirectio nal speeds of 64 Tb.

3

Packaging

P03/P08

Kyushu University and Sumitomo Chemical have demonstrated a potassium sodium niobate (KNN) thin-film optical modulator.

4

Network system

P04/P09

Researchers led by Waseda University have demonstrated an optical transmitter capable of 180 gigabits per second data.

5

Operations

P05/P10

Researchers at ICFO have demonstrated a free-space quantum key distribution (QKD) link spanning 18.9 kilometers across.

EVIDENCE REQUIRED AT EACH HANDOFF

Light source to Photonic device	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck yield, coupling loss, temperature drift, interoperability, volume and cost.
Photonic device to Packaging	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck yield, coupling loss, temperature drift, interoperability, volume and cost.
Packaging to Network system	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck yield, coupling loss, temperature drift, interoperability, volume and cost.
Network system to Operations	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck yield, coupling loss, temperature drift, interoperability, volume and cost.

COMMON CONTROL POINT

No theme moves to a commercial commitment until a named owner has reproduced the relevant evidence and documented yield, coupling loss, temperature drift, interoperability, volume and cost.

Priority map: maturity and next decision locus



P01	Thin-Film Lithium Niobate Memristors: All-Optical Specs and Fabrication Tech / process | cue: no system/business cue
P02	Hollow-Core Fiber: China's 1,000-km Transmission Specs and AI Impact Business / rules | cue: capacity
P03	KNN Optical Modulators: 180 Gbaud Performance and Specs Tech / process | cue: no system/business cue
P04	Optical Transmitter: 180 Gbps Link Without Optical Isolators System / adoption | cue: system
P05	Free-Space QKD: ICFO's 18.9km Urban Quantum Key Exchange Specs System / adoption | cue: system
P06	OCI-MSA: AI Optical Interconnect Specs, Roadmap and Adopters System / adoption | cue: Adopters
P07	Staera: Integrated Silicon Optical Links and 2030 Roadmap System / adoption | cue: Integrated
P08	Optical Computing Framework: University of Tokyo's AI Efficiency System / adoption | cue: system
P09	Optical Waveguides: Keio University and Otsuka Electronics' Non-Destructive Refractive Index Measurement Tech / process | cue: no system/business cue
P10	Photonic Router Architecture: O(N) Scaling via Lithium Niobate Tech / process | cue: no system/business cue

REPRODUCIBLE POSITIONING RULE

Horizontal position uses five discrete stages: Research, Prototype, Joint evaluation, Product adoption and Scale. The vertical bands classify the next decision locus: Tech / process, System / adoption, or Business / rules (including supply systems). Article-title cues take precedence; the overview is used only when the title is silent. These are categories, not impact ranks. Bubble diameter reflects the editorial score.

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P01 Thin-Film Lithium Niobate Memristors: All-Optical Specs and Fabrication

A08 | Light source | Pilot

Prior release 2026-11-07

FACT

Researchers have developed all-optical photonic memristors fabricated directly on thin-film lithium niobate, achieving three-bit multilevel non-volatile memory. The devices feature submicrosecond response times and switching energies at the femtojoule scale, providing a scalable foundation for large-scale photonic neural networks.

WHY IT MATTERS

The decision relevance is link budget, packaging, thermal reliability and deployable supply. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, pair optical performance with packaging yield, test, thermal drift and qualified capacity.

ACTION

Within 30 days, evaluate optical architectures by reach, power, latency, interoperability and field service; record the evidence and owner against P01.

UNKNOWN

Still unproven or incompletely stated: yield, coupling loss, temperature drift, interoperability, volume and cost.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

P02 Hollow-Core Fiber: China's 1,000-km Transmission Specs and AI Impact

A05 | Photonic device | Product adoption

2026-11-11

FACT

China has completed a 1,007.48-kilometer hollow-core fiber transmission verification achieving bidirectional speeds of 64 Tb per second. This breakthrough reduces latency and increases capacity compared to solid-core fibers, providing a critical infrastructure layer for AI data centers and computing power networks.

WHY IT MATTERS

The decision relevance is link budget, packaging, thermal reliability and deployable supply. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, pair optical performance with packaging yield, test, thermal drift and qualified capacity.

ACTION

Within 30 days, evaluate optical architectures by reach, power, latency, interoperability and field service; record the evidence and owner against P02.

UNKNOWN

Still unproven or incompletely stated: yield, coupling loss, temperature drift, interoperability, volume and cost.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: BUSINESS / RULES

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P03 KNN Optical Modulators: 180 Gbaud Performance and Specs

A07 | Packaging | Research

2026-11-14

FACT

Kyushu University and Sumitomo Chemical have demonstrated a potassium sodium niobate (KNN) thin-film optical modulator capable of ultrafast operation at 180 Gbaud. The device achieves a modulation efficiency nearly three times that of thin-film lithium niobate (TFLN), offering a low-cost, high-speed alternative for photonics-electronics convergence.

WHY IT MATTERS

The decision relevance is link budget, packaging, thermal reliability and deployable supply. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, pair optical performance with packaging yield, test, thermal drift and qualified capacity.

ACTION

Within 30 days, evaluate optical architectures by reach, power, latency, interoperability and field service; record the evidence and owner against P03.

UNKNOWN

Still unproven or incompletely stated: yield, coupling loss, temperature drift, interoperability, volume and cost.

EDITORIAL SCORE 20/25 | MATURITY 1/5 | DECISION LOCUS: TECH / PROCESS

P04 Optical Transmitter: 180 Gbps Link Without Optical Isolators

A06 | Network system | Pilot

Prior release 2026-11-07

FACT

Researchers led by Waseda University have demonstrated an optical transmitter capable of 180 gigabits per second data transmission without the use of a conventional optical isolator. By coordinating the wavelength-dependent responses of photonic components, the system mitigates the disruptive effects of reflected light. This architecture offers a path toward more compact and easily integrated high-speed communication hardware for AI and cloud data centers.

WHY IT MATTERS

The decision relevance is link budget, packaging, thermal reliability and deployable supply. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, pair optical performance with packaging yield, test, thermal drift and qualified capacity.

ACTION

Within 30 days, evaluate optical architectures by reach, power, latency, interoperability and field service; record the evidence and owner against P04.

UNKNOWN

Still unproven or incompletely stated: yield, coupling loss, temperature drift, interoperability, volume and cost.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: SYSTEM / ADOPTION

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P05 Free-Space QKD: ICFO's 18.9km Urban Quantum Key Exchange Specs

A10 | Operations | Pilot

2026-11-13

FACT

Researchers at ICFO have demonstrated a free-space quantum key distribution (QKD) link spanning 18.9 kilometers across Barcelona. The system achieved a quantum bit error rate (QBER) of 1.31% and a secret key rate exceeding 11 kbit/s without using adaptive optics. This proves the feasibility of integrating hybrid fiber-free-space quantum networks within densely populated urban environments.

WHY IT MATTERS

The decision relevance is link budget, packaging, thermal reliability and deployable supply. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, pair optical performance with packaging yield, test, thermal drift and qualified capacity.

ACTION

Within 30 days, evaluate optical architectures by reach, power, latency, interoperability and field service; record the evidence and owner against P05.

UNKNOWN

Still unproven or incompletely stated: yield, coupling loss, temperature drift, interoperability, volume and cost.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: SYSTEM / ADOPTION

P06 OCI-MSA: AI Optical Interconnect Specs, Roadmap and Adopters

A04 | Light source | Research

2026-11-09

FACT

The OCI-MSA consortium, including Nvidia, AMD, and Microsoft, is establishing an open optical interconnect standard to replace copper in AI scale-up architectures. By utilizing multi-wavelength fibers and CPO, the standard aims to reduce power consumption to one-third of pluggable transceivers while providing a scalable bandwidth runway for decades.

WHY IT MATTERS

The decision relevance is link budget, packaging, thermal reliability and deployable supply. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, pair optical performance with packaging yield, test, thermal drift and qualified capacity.

ACTION

Within 30 days, evaluate optical architectures by reach, power, latency, interoperability and field service; record the evidence and owner against P06.

UNKNOWN

Still unproven or incompletely stated: yield, coupling loss, temperature drift, interoperability, volume and cost.

EDITORIAL SCORE 20/25 | MATURITY 1/5 | DECISION LOCUS: SYSTEM / ADOPTION

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P07 Staera: Integrated Silicon Optical Links and 2030 Roadmap

A03 | Photonic device | Research

2026-11-10

FACT

Staera has emerged from stealth with $4.6m in pre-seed funding to commercialize "Lightwire," a technology that integrates optical data links directly into silicon chips. By replacing copper wiring with on-chip light sources, the company aims to reduce energy consumption to under 0.2pJ/bit and enable HBM speeds exceeding 24TB/s.

WHY IT MATTERS

The decision relevance is link budget, packaging, thermal reliability and deployable supply. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, pair optical performance with packaging yield, test, thermal drift and qualified capacity.

ACTION

Within 30 days, evaluate optical architectures by reach, power, latency, interoperability and field service; record the evidence and owner against P07.

UNKNOWN

Still unproven or incompletely stated: yield, coupling loss, temperature drift, interoperability, volume and cost.

EDITORIAL SCORE 20/25 | MATURITY 1/5 | DECISION LOCUS: SYSTEM / ADOPTION

P08 Optical Computing Framework: University of Tokyo's AI Efficiency

A09 | Packaging | Pilot

2026-11-09

FACT

Researchers from the University of Tokyo and NTT have developed a physics-based AI framework using optical computing to significantly reduce computational demands. By redesigning learning protocols and simplifying network structures, the system leverages light-based processing to lower energy consumption compared to traditional digital architectures.

WHY IT MATTERS

The decision relevance is link budget, packaging, thermal reliability and deployable supply. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, pair optical performance with packaging yield, test, thermal drift and qualified capacity.

ACTION

Within 30 days, evaluate optical architectures by reach, power, latency, interoperability and field service; record the evidence and owner against P08.

UNKNOWN

Still unproven or incompletely stated: yield, coupling loss, temperature drift, interoperability, volume and cost.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: SYSTEM / ADOPTION

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P09 Optical Waveguides: Keio University and Otsuka Electronics' Non-Destructive Refractive Index Measurement

A01 | Network system | Pilot

2026-11-09

FACT

Keio University and Otsuka Electronics have developed a non-destructive method to measure the refractive index and temperature dependence of optical waveguides in their actual shapes. The team successfully demonstrated an athermal optical waveguide that maintains a constant light spot diameter between 25 and 75°C. This technology is expected to support high-density Co-Packaged Optics (CPO) and next-generation optical communication devices.

WHY IT MATTERS

The decision relevance is link budget, packaging, thermal reliability and deployable supply. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, pair optical performance with packaging yield, test, thermal drift and qualified capacity.

ACTION

Within 30 days, evaluate optical architectures by reach, power, latency, interoperability and field service; record the evidence and owner against P09.

UNKNOWN

Still unproven or incompletely stated: yield, coupling loss, temperature drift, interoperability, volume and cost.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

P10 Photonic Router Architecture: O(N) Scaling via Lithium Niobate

A11 | Operations | Pilot

2026-11-13

FACT

Researchers from MIT and the Technical University of Denmark have developed a photonic router that reduces programmable phase shifter requirements from O(N squared) to O(N). This linear scalability enables more compact, energy-efficient interconnects for AI clusters and modular quantum processors.

WHY IT MATTERS

The decision relevance is link budget, packaging, thermal reliability and deployable supply. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, pair optical performance with packaging yield, test, thermal drift and qualified capacity.

ACTION

Within 30 days, evaluate optical architectures by reach, power, latency, interoperability and field service; record the evidence and owner against P10.

UNKNOWN

Still unproven or incompletely stated: yield, coupling loss, temperature drift, interoperability, volume and cost.

EDITORIAL SCORE 19/25 | MATURITY 2/5 | DECISION LOCUS: TECH / PROCESS

Playbook and 0-5 year roadmap

STAKEHOLDER	NOW | 0-30 DAYS	NEXT | 1-12 MONTHS	LATER | 1-5 YEARS
Operating companies	evaluate optical architectures by reach, power, latency, interoperability and field service	Run production-like qualification with explicit acceptance and stop criteria.	Build a portfolio and architecture that can absorb technology and supplier changes.
Materials, equipment and technology suppliers	pair optical performance with packaging yield, test, thermal drift and qualified capacity	Create shared reliability, process-window and failure-analysis data with customers.	Standardize interfaces, traceability, lifecycle support and recovery services.
Trading, investment and legal teams	Map yield, coupling loss, temperature drift, interoperability, volume and cost.	Contract for capacity, quality, change notice, liability, alternatives and exit.	Diversify regional, technical and customer concentration risk.

ROADMAP

NOW | 0-30 DAYS
Evidence ledger
Owner: Strategy + quality
Deliverable: claim, source, condition, owner

NOW | 0-30 DAYS
Risk screen
Owner: Procurement + legal
Deliverable: unknowns, alternatives, stop

NEXT | 1-12 MONTHS
Joint qualification
Owner: R&D + supplier
Deliverable: process window and failure data

NEXT | 1-12 MONTHS
Commercial gate
Owner: Business + finance
Deliverable: unit economics and capacity

LATER | 1-5 YEARS
Platform strategy
Owner: Executive team
Deliverable: portfolio and interface roadmap

LATER | 1-5 YEARS
Service layer
Owner: Operations + channel
Deliverable: monitoring, maintenance and recovery

GO / NO-GO GATES

GATE	OWNER	REQUIRED EVIDENCE	NO-GO CONDITION
G1 Evidence	**Quality**	Source, test conditions and reproducibility	No traceable evidence
G2 Integration	**R&D**	Interface, process window and failure analysis	Cannot meet system conditions
G3 Commercial	**Business**	Capacity, total cost, contract and alternatives	Economics or supply cannot be supported
G4 Lifecycle	**Operations**	Monitoring, maintenance, change notice and exit	No accountable operating plan

ANALYZED ARTICLES | ITEMS 01-11

Every title and URL is displayed in full. URLs wrap without shortening and remain clickable. A verified-reference label means the translated HTML did not retain its original source URL.

ID	FULL ARTICLE TITLE	FULL SOURCE / VERIFIED REFERENCE URL - CLICKABLE
A01	Optical Waveguides: Keio University and Otsuka Electronics' Non-Destructive Refractive Index Measurement	https://optronics-media.com/news/20261109/113771/
A02	NTT Programmable Optical Circuits: 60% Signal Spread Reduction	https://optronics-media.com/news/20261113/114030/
A03	Staera: Integrated Silicon Optical Links and 2030 Roadmap	https://www.semiconductor-today.com/news_items/2026/nov/staera-101126.shtml
A04	OCI-MSA: AI Optical Interconnect Specs, Roadmap and Adopters	https://semiengineering.com/the-optical-super-highway-for-ai/
A05	Hollow-Core Fiber: China's 1,000-km Transmission Specs and AI Impact	https://www.chinadaily.com.cn/a/202611/11/WS6af3c64be4b03ebf8519bb85.html
A06	Optical Transmitter: 180 Gbps Link Without Optical Isolators	https://knowridge.com/2026/11/new-laser-transmitter-could-simplify-high-speed-links-between-data-centers/
A07	KNN Optical Modulators: 180 Gbaud Performance and Specs	https://bioengineer.org/knn-thin-film-optical-modulators-demonstrate-ultrafast-operation-at-180-gbaud/
A08	Thin-Film Lithium Niobate Memristors: All-Optical Specs and Fabrication	https://bioengineer.org/all-optical-photonic-memristors-fabricated-directly-on-thin-film-lithium-niobate/
A09	Optical Computing Framework: University of Tokyo's AI Efficiency	https://bioengineer.org/optical-computing-framework-slashes-ai-processing-demands-using-light-based-learning/
A10	Free-Space QKD: ICFO's 18.9km Urban Quantum Key Exchange Specs	https://quantumzeitgeist.com/icfo-ciencies-barcelona-quantum-key-exchange/
A11	Photonic Router Architecture: O(N) Scaling via Lithium Niobate	https://quantumzeitgeist.com/photonic-router-fewer-phase-shifters-implementation/

Photonics — Selected Articles

Date: 2026-11-15

Articles: 11

Table of Contents

#01 Optical Waveguides: Keio University and Otsuka Electronics' Non-Destructive Refractive Index Measurement

#02 NTT Programmable Optical Circuits: 60% Signal Spread Reduction

#03 Staera: Integrated Silicon Optical Links and 2030 Roadmap

#04 OCI-MSA: AI Optical Interconnect Specs, Roadmap and Adopters

#05 Hollow-Core Fiber: China's 1,000-km Transmission Specs and AI Impact

#06 Optical Transmitter: 180 Gbps Link Without Optical Isolators

#07 KNN Optical Modulators: 180 Gbaud Performance and Specs

#08 Thin-Film Lithium Niobate Memristors: All-Optical Specs and Fabrication

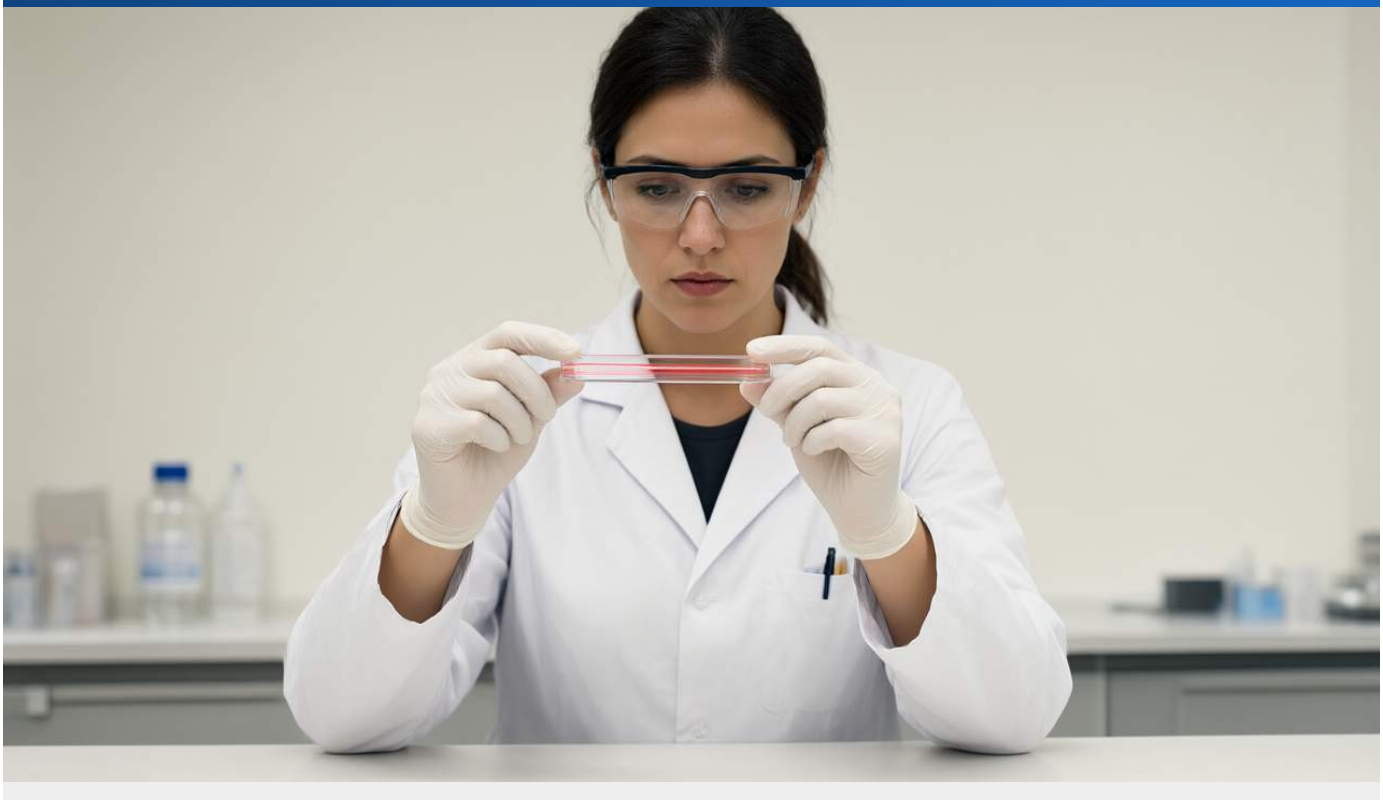
#09 Optical Computing Framework: University of Tokyo's AI Efficiency

#10 Free-Space QKD: ICFO's 18.9km Urban Quantum Key Exchange Specs

#11 Photonic Router Architecture: O(N) Scaling via Lithium Niobate

#01 Optical Waveguides: Keio University and Otsuka Electronics' Non-Destructive Refractive Index Measurement

Published November 09, 2026 OPTRONICS ONLINE Japan



OVERVIEW

Keio University and Otsuka Electronics have developed a non-destructive method to measure the refractive index and temperature dependence of optical waveguides in their actual shapes. The team successfully demonstrated an athermal optical waveguide that maintains a constant light spot diameter between 25 and 75°C. This technology is expected to support high-density Co-Packaged Optics (CPO) and next-generation optical communication devices.

IN DEPTH

Key Findings

Researchers from Keio University and Otsuka Electronics have achieved the non-destructive measurement of the three-dimensional refractive index distribution within optical waveguides made of resin and optical glass. By applying this technique, the team developed an athermal optical waveguide that maintains a mode field diameter of 4.2μm across a temperature range of 25 to 75°C. This represents a reduction in the temperature dependence of the refractive index difference by approximately one order of magnitude compared to two conventional material combinations.

Technical Details

The measurement system utilizes Otsuka Electronics' 3D Optical Wave Field Microscope (3D-OWFM, product name: MINUK). The research group applied this to resin optical waveguides with circular cores produced via the "mosquito method" developed by Keio University. This approach allows for the direct measurement of the refractive index difference between the core and cladding without requiring the materials to be processed into films or prisms. By heating the samples during measurement, the team was able to evaluate the temperature dependence of the refractive index difference.

Background and Context

The rise of generative AI has increased the demand for high-speed, large-capacity communication and reduced power consumption in data centers. CPO technology, which integrates electronic and optical integrated circuits within the same package, is being developed to meet these needs. In CPO, micro-optical waveguides are critical for connecting optical integrated circuits to optical fibers. Because the refractive index of waveguide materials changes with temperature, transmission characteristics can fluctuate in high-temperature environments, potentially increasing connection losses.

Significance and Outlook

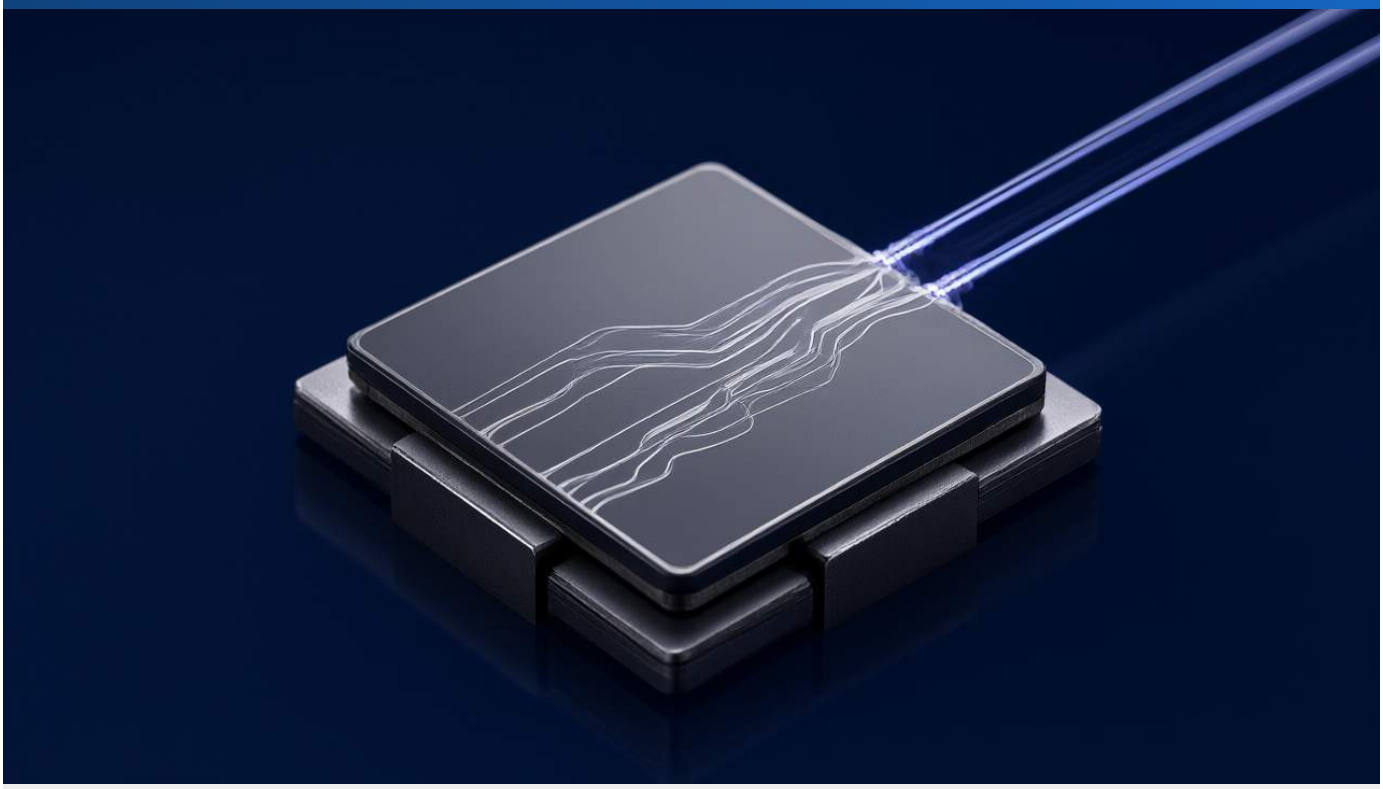
The ability to measure refractive indices in actual waveguide shapes enables the optimization of material combinations to suppress thermal fluctuations. Future goals include improving measurement accuracy, automating the process, and expanding application to semiconductor materials such as silicon. The researchers also intend to apply this to the simultaneous measurement of thermal expansion coefficients and thermo-optic constants, as well as the evaluation of adhesive curing processes for next-generation optoelectronic fusion modules. These results are scheduled for presentation at the IEEE CPMT Symposium (ICSJ2026) from November 10 to 12 at Ritsumeikan University's Shugakuin Campus.

Source: https://optronics-media.com/news/20261109/113771/

Collected: November 15, 2026 | Automated Research System (AI)

#02 NTT Programmable Optical Circuits: 60% Signal Spread Reduction

Published November 13, 2026 OPTRONICS ONLINE Japan



OVERVIEW

NTT has demonstrated a programmable optical circuit that reduces signal temporal spread by approximately 60% over a 1300km transmission distance. This technology lowers the computational load on receiver-side digital signal processing (DSP), contributing to higher capacity and lower power consumption in long-haul optical networks.

IN DEPTH

Key Findings

NTT has successfully demonstrated a programmable optical circuit capable of reducing signal temporal spread from approximately 27ns to approximately 10ns over a transmission distance of 1331.2km. This represents a reduction of about 60%, which corresponds to a potential reduction in the processing load of the receiver-side digital signal processing (DSP) by 60% or more.

Technical Details

The developed circuit utilizes Planar Lightwave Circuit (PLC) technology based on silica waveguides. It features an array of Mach-Zehnder interferometers, where the phase of each interferometer is adjusted to control the mixing of multiple optical signals. The prototype achieved the following specifications:

- Insertion loss: 2.1dB
- Operating bandwidth: 40nm
- Control fidelity: Over 96%
- Input/output ports: 8
- Polarization independence

To optimize the circuit, NTT treated the entire transmission path as a deep neural network (DNN). Using the backpropagation method typically used in DNN training, the system adjusts the phase of each interferometer to minimize signal spread.

Background and Context

The demand for increased transmission capacity is rising due to the proliferation of cloud services and generative AI. Specifically, Space Division Multiplexing (SDM) technology, which uses multiple spatial modes in a single fiber, suffers from signal spreading caused by propagation speed differences and mode mixing. Traditionally, this required massive DSP at the receiver end, leading to increased power consumption and processing delays.

Significance and Outlook

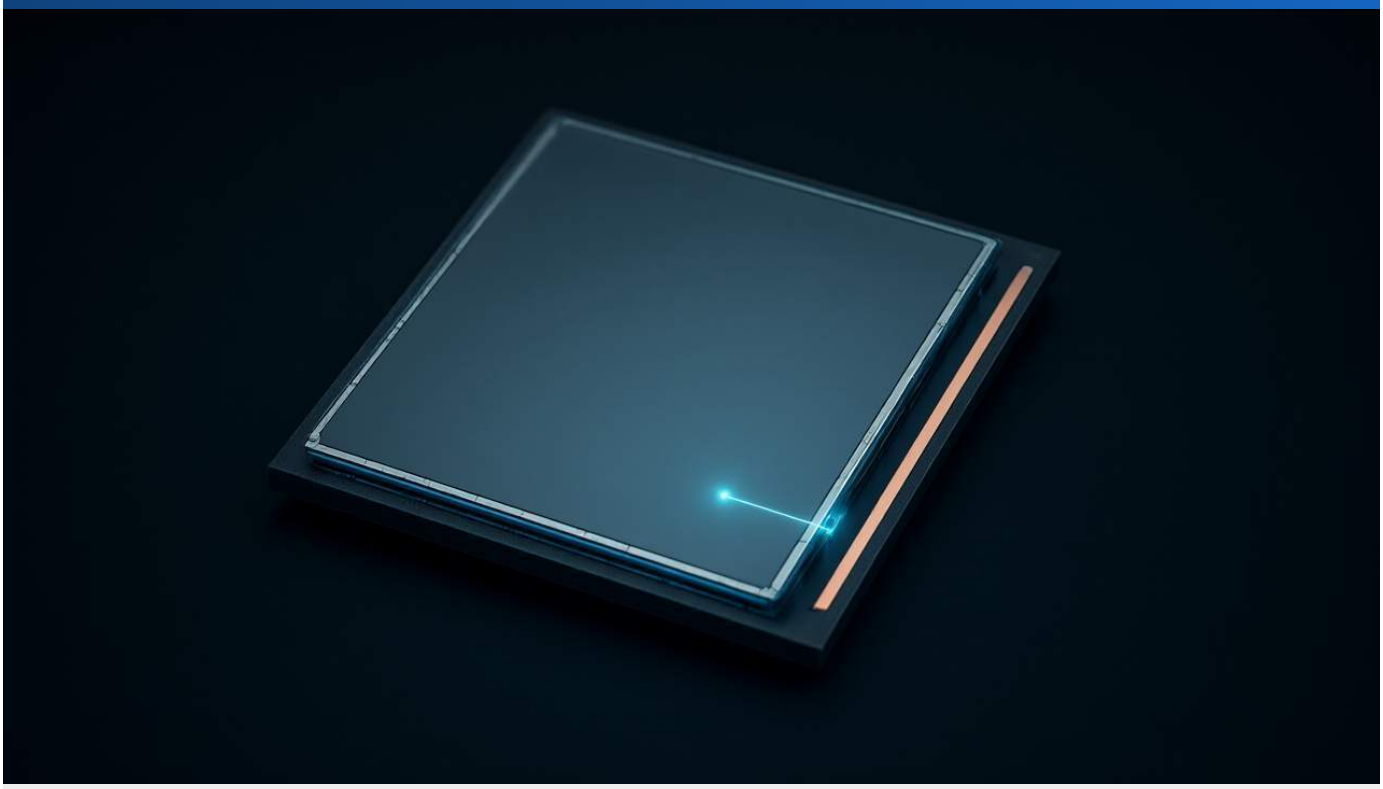
While the experiment did not directly measure a 60% reduction in DSP power consumption, it demonstrated a reduction in the required calculation and memory volume by shortening the time range of the signal that needs compensation. NTT intends to expand this technology to handle more spatial modes, integrate it with optical switching functions, and implement real-time control. The goal is to deploy these circuits in networks ranging from data center interconnects to transcontinental submarine cables.

Source: https://optronics-media.com/news/20261113/114030/

Collected: November 15, 2026 | Automated Research System (AI)

#03 Staera: Integrated Silicon Optical Links and 2030 Roadmap

Published November 10, 2026 Semiconductor Today USA



OVERVIEW

Staera has emerged from stealth with $4.6m in pre-seed funding to commercialize "Lightwire," a technology that integrates optical data links directly into silicon chips. By replacing copper wiring with on-chip light sources, the company aims to reduce energy consumption to under 0.2pJ/bit and enable HBM speeds exceeding 24TB/s.

IN DEPTH

Key Findings

Staera Semiconductor has raised $4.6m in pre-seed funding, led by Openspace Capital with participation from SGInnovate, Black Kite Capital, 28 Holdings, In Group, and Decimus Technologies. The funding supports the transition of its "Lightwire" technology from the laboratory to commercial customers, with a target release date of 2030. Formerly known as New Silicon Corp (NSC), the San Francisco-based company focuses on solving the data movement bottleneck in AI systems by integrating optical links directly into silicon wafers.

Technical Details

Unlike traditional optical links that use external lasers or LEDs, Lightwire fabricates the light source and the complete optical link inside commercial silicon wafers using existing fab processes. The technology utilizes gallium nitride (GaN) LEDs built into silicon chips, a process Staera has operated since 2016 with 98-99% yield. Lightwire is integrated into the bridge or interposer chip, ensuring compatibility with existing packaging.

- **Performance:** 4-8Gbps per link, with over 600 links per millimeter of chip edge.
- **Energy Efficiency:** Designed for under 0.2pJ/bit, compared to approximately 5pJ/bit for co-packaged optics.
- **Data Throughput:** HBM based on Lightwire is designed to exceed 24TB/s, significantly higher than the 2.8TB/s of current HBM4 stacks.
- **Power Consumption:** Moving 24 terabytes per second would consume less than 50W, whereas co-packaged optics require nearly a kilowatt.
- **Reach:** Extends beyond 50mm, compared to 2mm for UCIe-A die-to-die links.

Background and Context

The shift toward optics is driven by the limitations of copper wiring, which sees electrical performance drop a thousandfold between 1mm and 1m. With the International Energy Agency projecting data-center electricity use to rise from 415 terawatt-hours in 2024 to 945 terawatt-hours by 2030, the industry is seeking lower-power alternatives. This trend is reflected by Nvidia, which plans to utilize a mix of copper and optics in its AI systems.

Significance and Outlook

Staera's approach aims to eliminate the power and complexity associated with "bolt-on" optics. The company recently received recognition at the IEEE Electronic Components and Technology Conference (ECTC) 3rd Start-up Competition and was a runner-up at the 2026 Lam Capital Venture Competition.

Source: https://www.semiconductor-today.com/news_items/2026/nov/staera-101126.shtml

Collected: November 15, 2026 | Automated Research System (AI)

#04 OCI-MSA: AI Optical Interconnect Specs, Roadmap and Adopters

Published November 09, 2026 Semiconductor Engineering USA



OVERVIEW

The OCI-MSA consortium, including Nvidia, AMD, and Microsoft, is establishing an open optical interconnect standard to replace copper in AI scale-up architectures. By utilizing multi-wavelength fibers and CPO, the standard aims to reduce power consumption to one-third of pluggable transceivers while providing a scalable bandwidth runway for decades.

IN DEPTH

Key Findings

The Optical Compute Interconnect Multi-Source Agreement (OCI-MSA) has emerged as the primary industry consensus for AI scale-up interconnects. Founding members include AMD, Broadcom, Meta, Microsoft, Nvidia, and OpenAI. The consortium aims to break proprietary constraints to ensure cross-vendor compatibility, allowing components like AMD GPUs to communicate with Broadcom switches without vendor lock-in.

Technical Details

OCI-MSA Gen 1 specifies 8 wavelengths per fiber (4 in each direction), with each wavelength operating at 53.125Gbps NRZ, resulting in an effective data rate of 50Gbps per wavelength after error correction. Wavelengths are spaced slightly more than 2nm apart. The reference model uses 500m SMF-28 fiber with a total insertion loss of 2.5 dB.

The roadmap for bandwidth scaling includes:

- **Generational increases:** Gen 2 and Gen 3 will each double the bandwidth of the previous generation.
- **Scaling vectors:** Bandwidth can be increased by expanding wavelengths (from 4 to 8, 16, 32...), increasing speeds (50Gbps to 100, 200, 400Gbps), utilizing two polarizations instead of one, and moving from NRZ to PAM/QAM-n signaling.
- **Viability:** 200G x 16 wavelengths has already been demonstrated as viable, representing 16 times the bandwidth of Gen 1.

Background & Context

The industry is transitioning from copper to all-optical interconnects over the next five years. While optical already dominates scale-out, it is moving into scale-up to connect racks in large pods of hundreds to thousands of XPUs. To avoid the high power and cost of high-speed PHYs and increased fiber counts associated with pluggable transceivers, the industry is shifting toward multi-wavelength bidirectionality via Near-Packaged Optics (NPO) and Co-Packaged Optics (CPO).

Significance & Outlook

OCI in CPO format offers the best combination of long reach and low link power per bit; for 200G aggregate bandwidth, it consumes one-third the power of a pluggable transceiver. Microsoft plans a phased adoption, starting with CPO on switches and NPO on accelerators, eventually moving to CPO at both ends. Fully functional OCI Gen 1 implementations and interoperability demos are expected in 2027.

Source: https://semiengineering.com/the-optical-super-highway-for-ai/

Collected: November 15, 2026 | Automated Research System (AI)

#05 Hollow-Core Fiber: China's 1,000-km Transmission Specs and AI Impact

Published November 11, 2026 China Daily（新華社） China



OVERVIEW

China has completed a 1,007.48-kilometer hollow-core fiber transmission verification achieving bidirectional speeds of 64 Tb per second. This breakthrough reduces latency and increases capacity compared to solid-core fibers, providing a critical infrastructure layer for AI data centers and computing power networks.

IN DEPTH

Key Findings

China Telecom, Yangtze Optical Fibre and Cable, and ZTE have successfully verified a hollow-core fiber transmission link spanning 1,007.48 kilometers. The test achieved simultaneous bidirectional signal transmission at 64 Tb per second in each direction. According to China Telecom, this throughput is equivalent to uploading and downloading 160 4K resolution films per second.

Technical Details

The verification highlights significant performance gains over traditional solid-core fibers:

- **Latency:** Signals travel through air channels at nearly 300,000 kilometers per second, compared to 200,000 kilometers per second in quartz glass cores. A one-way trip across the 1,000-kilometer link takes 3.43 milliseconds.
- **Capacity and Reach:** The technology doubles transmission capacity and extends transmission distance by 60 percent relative to the best-performing solid-core fibers currently available.
- **Compatibility:** The experiment confirmed that these results are achievable using existing transmission equipment.

Background and Context

While most widespread optical fibers utilize solid cores, hollow-core technology shifts the signal path to air channels to minimize transmission time. This technology has already moved beyond the laboratory; it is currently applied in a commercial line connecting Shenzhen and Hong Kong. Additionally, more than ten commercial and pilot projects have been implemented across Asia, Europe, and other regions.

Significance and Outlook

Huo Xiaoli, chief expert for next-generation information and communications at China Telecom, stated that this verification provides a key technological reserve for computing power networks. The reduction in latency and increase in bandwidth are particularly critical for AI training and inference.

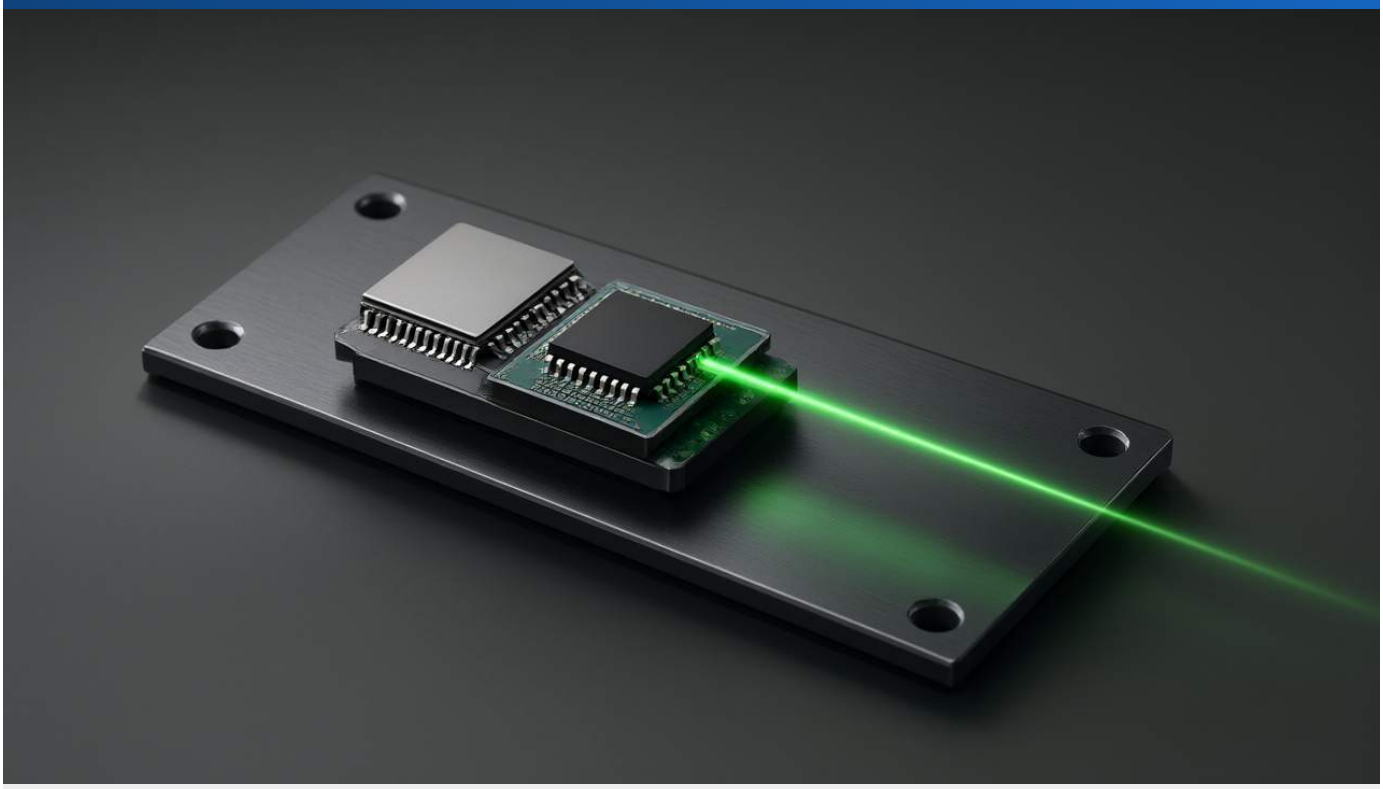
From an infrastructure perspective, the adoption of hollow-core fibers can improve computing efficiency and lower investment costs for memory chips and GPUs in AI data centers, as these components rely heavily on high-speed, low-latency optical connections.

Source: https://www.chinadaily.com.cn/a/202611/11/WS6af3c64be4b03ebf8519bb85.html

Collected: November 15, 2026 | Automated Research System (AI)

#06 Optical Transmitter: 180 Gbps Link Without Optical Isolators

Published November 07, 2026 Knowridge Science Report Japan



OVERVIEW

Researchers led by Waseda University have demonstrated an optical transmitter capable of 180 gigabits per second data transmission without the use of a conventional optical isolator. By coordinating the wavelength-dependent responses of photonic components, the system mitigates the disruptive effects of reflected light. This architecture offers a path toward more compact and easily integrated high-speed communication hardware for AI and cloud data centers.

IN DEPTH

Key Findings

A research team led by Tomohiro Kita at Waseda University has developed an optical transmitter that achieves data transmission rates of 180 gigabits per second. The primary breakthrough is the elimination of the optical isolator, a component typically required to shield the laser from reflected light that can degrade communication stability. The system maintained stable operation in a single mode across a tunable wavelength range of approximately 67 nanometers, even without active temperature control.

Technical Details

The transmitter utilizes a coordinated design across different photonic platforms to manage optical feedback. The architecture integrates three primary elements:

- A tunable laser for light generation.
- Silicon nitride ring resonators to select the laser wavelength.
- A thin-film lithium niobate modulator to encode data through rapid changes.

Rather than using a physical barrier to block reflections, the researchers designed the wavelength-dependent responses of these components to work in tandem. This joint design shapes the feedback returning to the laser, limiting its destabilizing effects and allowing the system to function without an isolator.

Background & Context

High-speed links between data centers are facing increased demand due to AI workloads and cloud services. Standard optical transmitters often combine components from different technology platforms, creating interfaces where light can travel backward. Conventionally, an optical isolator is added to block these signals, but this increases the device footprint and adds complexity to the integrated assembly.

Significance & Outlook

The ability to tune wavelengths over a broad range suggests potential utility for wavelength-division multiplexing, allowing multiple data channels to share a single fiber. While the 180 gigabits per second rate is the highest investigated in this experiment, the researchers note that this is a demonstration of architecture rather than a finished product. Future development must account for practical operating conditions and full network connections to determine the performance of the system in a deployed data-center environment.

Source: https://knowridge.com/2026/11/new-laser-transmitter-could-simplify-high-speed-links-between-data-centers/

Collected: November 15, 2026 | Automated Research System (AI)

#07 KNN Optical Modulators: 180 Gbaud Performance and Specs

Published November 14, 2026 BIOENGINEER.ORG Japan



OVERVIEW

Kyushu University and Sumitomo Chemical have demonstrated a potassium sodium niobate (KNN) thin-film optical modulator capable of ultrafast operation at 180 Gbaud. The device achieves a modulation efficiency nearly three times that of thin-film lithium niobate (TFLN), offering a low-cost, high-speed alternative for photonics-electronics convergence.

IN DEPTH

Key Findings

Researchers from Kyushu University and Sumitomo Chemical have verified that potassium sodium niobate (KNN) thin-film wafers enable high optical modulation efficiency and ultrafast operation at 180 Gbaud. The developed modulator achieved a $V\pi L$ value of less than 0.7 Vcm, representing nearly three times the modulation efficiency of Thin-Film Lithium Niobate (TFLN).

Technical Details

The project utilized a coordinated division of labor where Sumitomo Chemical produced the KNN thin-film wafers, while Kyushu University handled the design, fabrication, and performance evaluations. Key technical advantages of KNN include:

- **Manufacturing:** The material can be formed into thin films via sputtering, ensuring high compatibility with existing semiconductor manufacturing processes.
- **Cost:** KNN is expected to be manufacturable at a lower cost than TFLN wafers.
- **Scalability:** Sumitomo Chemical leverages mass-production capabilities developed through previous work on piezoelectric Micro Electro Mechanical Systems (MEMS).

These results were presented as a post-deadline paper titled “180-GBaud OOK Modulation Using a KNN Crystal-Based Electro-Optic Waveguide Modulator” at the 52nd European Conference on Optical Communications (ECOC 2026) in Spain.

Background & Context

The rise of generative AI has increased demand for faster, larger-capacity data processing in AI data centers, where power consumption has become a global challenge. While silicon-based optical modulators struggle to balance high-speed operation with low power consumption, photonic-electronic convergence offers a solution. Specifically, co-packaged optics (CPO) integrate electrical and optical circuits into a single package to shorten wiring, prevent signal degradation, and reduce power consumption.

Significance & Outlook

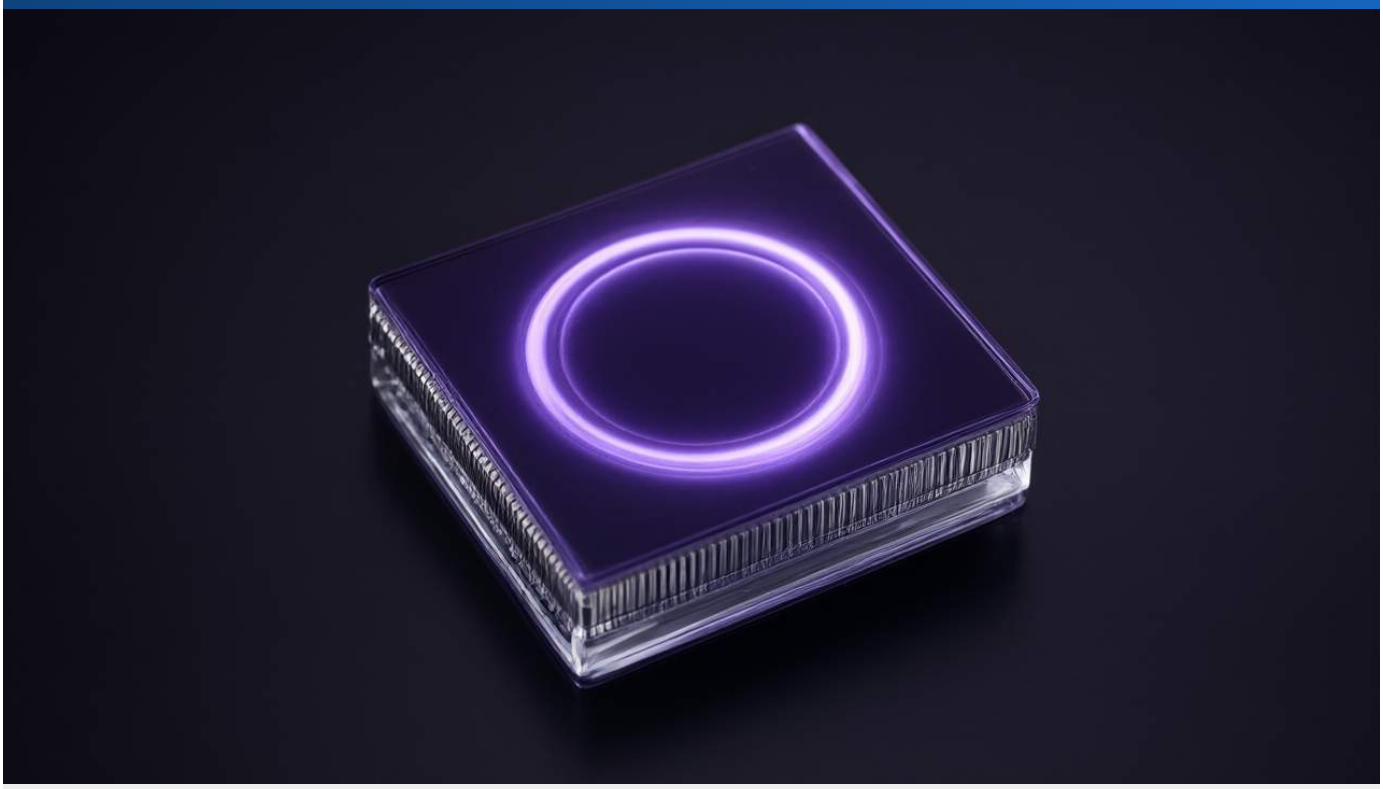
The ability to combine high modulation efficiency with low-cost manufacturing makes KNN a compelling candidate for commercial applications in optical interconnects and CPO. Kyushu University and Sumitomo Chemical intend to accelerate development to bring these devices into practical use for next-generation data communication systems.

Source: https://bioengineer.org/knn-thin-film-optical-modulators-demonstrate-ultrafast-operation-at-180-gbaud/

Collected: November 15, 2026 | Automated Research System (AI)

#08 Thin-Film Lithium Niobate Memristors: All-Optical Specs and Fabrication

Published November 07, 2026 BIOENGINEER.ORG USA



OVERVIEW

Researchers have developed all-optical photonic memristors fabricated directly on thin-film lithium niobate, achieving three-bit multilevel non-volatile memory. The devices feature submicrosecond response times and switching energies at the femtojoule scale, providing a scalable foundation for large-scale photonic neural networks.

IN DEPTH

Key Findings

The developed all-optical photonic memristors demonstrate three-bit multilevel non-volatile optical memory capacity, supporting eight distinct states. Performance metrics include optical switching speeds in the submicrosecond regime and switching energy requirements on the order of hundreds of femtojoules per bit. These devices maintain stable data retention across extended operational cycling.

Technical Details

To achieve these results, researchers utilized an oxygen-ion implantation process compatible with standard complementary metal–oxide–semiconductor (CMOS) manufacturing lines. This process modifies the thin-film lithium niobate to create two spatially separated layers: an oxygen-doped layer and an adjacent defect-rich layer. These microstructural zones enable all-optically controlled refractive index modulation via internal photorefractive mechanisms.

The operational capabilities were validated using an oxygen-implanted thin-film lithium niobate micro-ring resonator. Optical transmission measurements confirmed all-optically controlled shifts in the resonance transmission spectra, which enabled the multilevel non-volatile tuning.

Background and Context

Traditionally, integrating memristive optical functionality into conventional optical waveguide platforms has required heterogeneous integration techniques, involving complex multi-material assembly. This research investigated whether the host waveguide material—thin-film lithium niobate—could be modified directly to support non-volatile, all-optical memristive state switching, thereby creating a homogeneous alternative.

Significance and Outlook

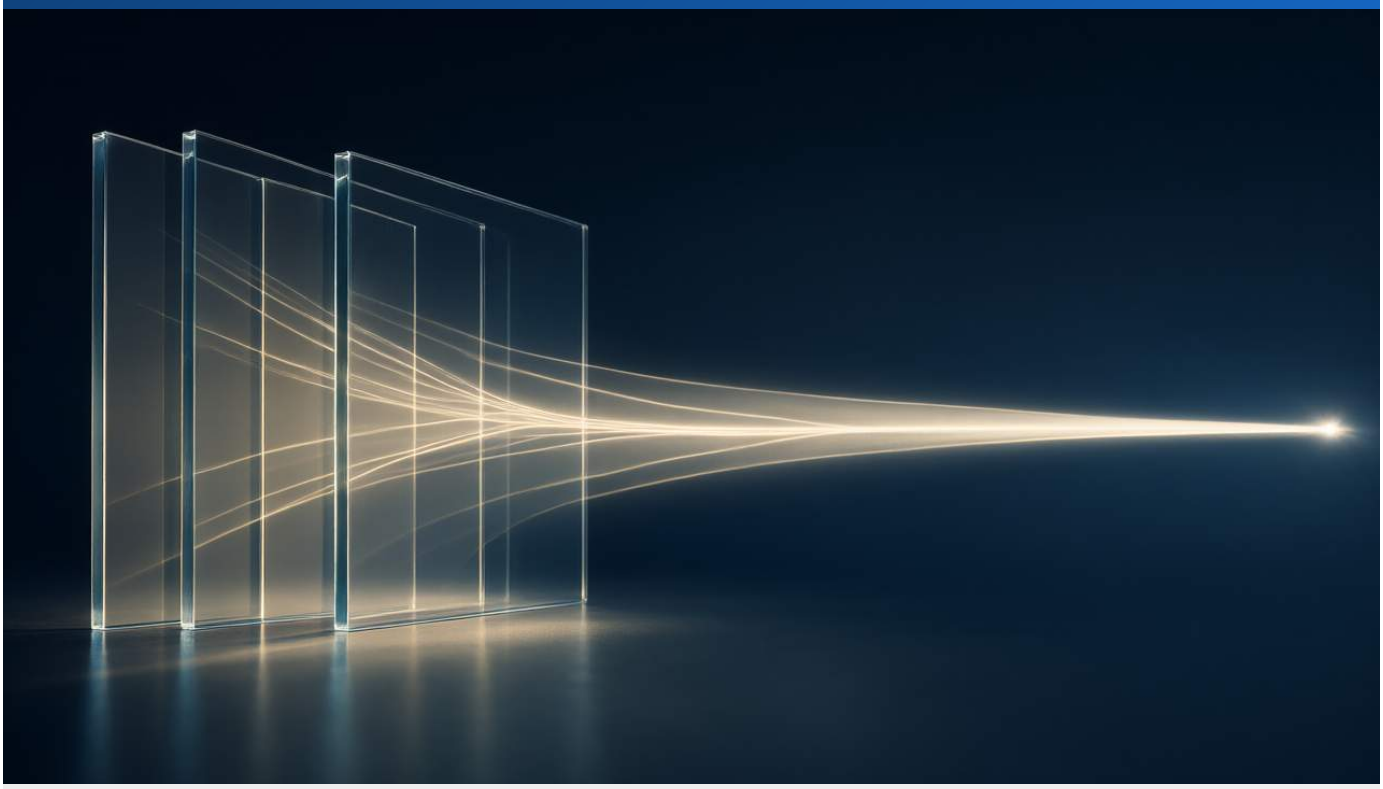
The use of thin-film lithium niobate and oxygen-ion implantation ensures the platform is homogeneous, scalable, and programmable, as both are compatible with wafer-scale and CMOS processing standards. By eliminating the need for heterogeneous integration while maintaining low energy consumption and rapid response times, this platform provides a practical foundation for integrated photonic circuits and future large-scale photonic neural networks.

Source: https://bioengineer.org/all-optical-photonic-memristors-fabricated-directly-on-thin-film-lithium-niobate/

Collected: November 15, 2026 | Automated Research System (AI)

#09 Optical Computing Framework: University of Tokyo's AI Efficiency

Published November 09, 2026 BIOENGINEER.ORG USA



OVERVIEW

Researchers from the University of Tokyo and NTT have developed a physics-based AI framework using optical computing to significantly reduce computational demands. By redesigning learning protocols and simplifying network structures, the system leverages light-based processing to lower energy consumption compared to traditional digital architectures.

IN DEPTH

Key Findings

A research team led by Associate Professor Kohei Nakajima of the University of Tokyo and researchers from NTT has developed an optical computing framework that reduces AI processing requirements while simplifying model structure. Verified through simulations and physical experiments, the architecture matched or outperformed complex neural network baselines in certain tests while requiring substantially less computation.

Technical Details

The framework overcomes the technical demands of standard AI algorithms—such as extensive measurement and large data storage—through two primary innovations:

- **SS-DFA Learning:** The "state-skipping direct feedback alignment" method avoids recording most intermediate system states. Instead, it uses the final system error and structural system dynamics to guide learning updates.
- **Single-Map Network:** The team replaced complex internal connection topologies with a simplified single-map framework, where processing units follow unified general governing rules.

The physical platform processes information by converting data into optical signals, circulating them through a 200-meter optical fiber loop, and converting them back into electrical signals using electronic components for analysis.

Background & Context

Conventional AI relies on digital chips that transmit electrical signals through transistor networks, a process that consumes significant energy and generates heat. While optical computing offers high-speed parallel transmission and lower energy potential, standard learning algorithms are designed for digital computers and cannot operate effectively on physical substrates without redesign.

Significance & Outlook

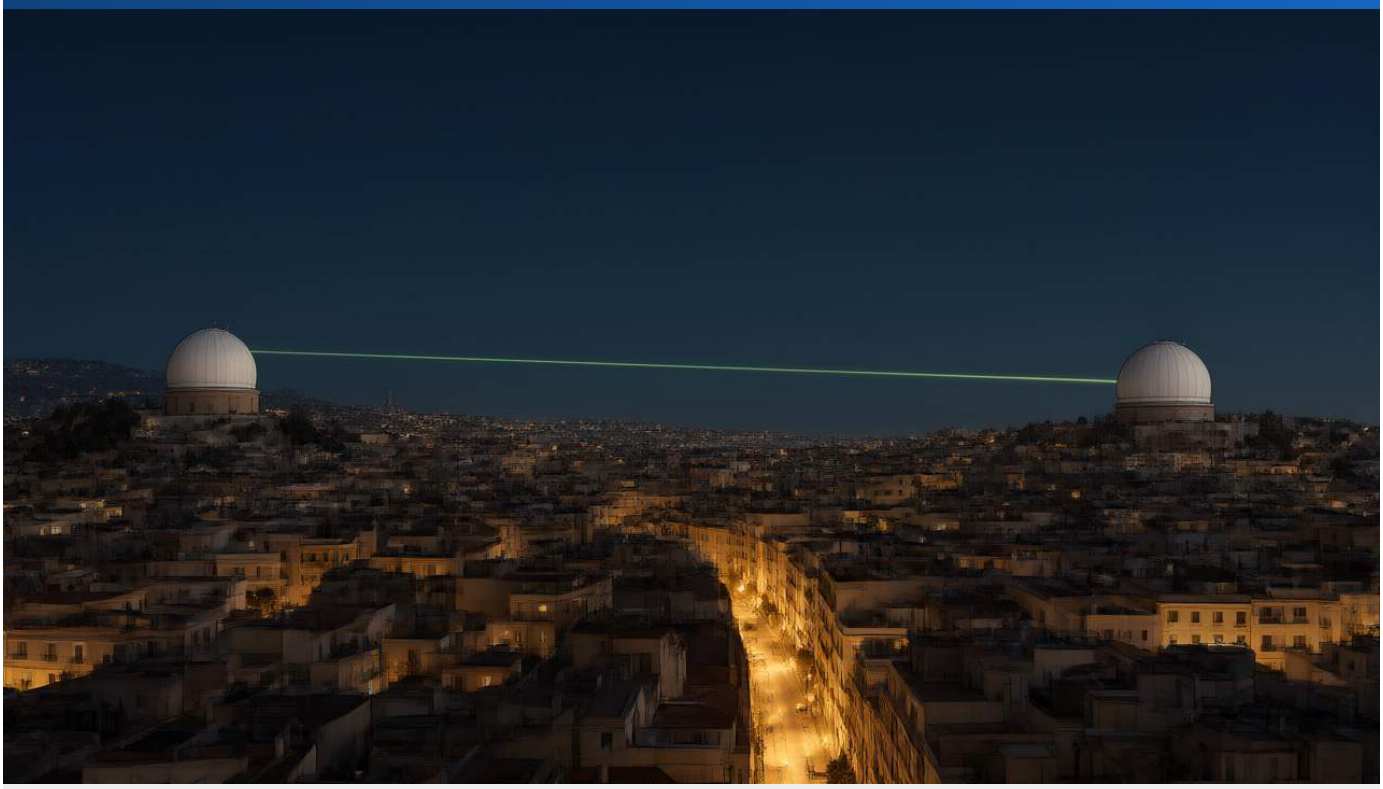
The team has currently integrated the single-map architecture as modular blocks into baseline neural network designs. Future research will focus on scalability to larger multimodal models and diverse data types. If successfully miniaturized, this modular architecture could reduce energy and water usage in data centers by utilizing low-heat hardware, or be integrated into smartphones, cameras, and onboard vehicle systems.

Source: https://bioengineer.org/optical-computing-framework-slashes-ai-processing-demands-using-light-based-learning/

Collected: November 15, 2026 | Automated Research System (AI)

#10 Free-Space QKD: ICFO's 18.9km Urban Quantum Key Exchange Specs

Published November 13, 2026 Quantum Zeitgeist スペイン



OVERVIEW

Researchers at ICFO have demonstrated a free-space quantum key distribution (QKD) link spanning 18.9 kilometers across Barcelona. The system achieved a quantum bit error rate (QBER) of 1.31% and a secret key rate exceeding 11 kbit/s without using adaptive optics. This proves the feasibility of integrating hybrid fiber-free-space quantum networks within densely populated urban environments.

IN DEPTH

Key Findings

Researchers at ICFO-Institut de Ciències Fotòniques successfully implemented a free-space quantum key distribution (QKD) link covering 18.9 kilometers between Castelldefels and Barcelona. The system achieved a quantum bit error rate (QBER) of 1.31% and an attenuation of 19 dB. The team estimates an average finite-size secret key rate exceeding 11 kbit/s, demonstrating stable performance in a crowded urban environment where population densities range from 1,500 to 13,000 inhabitants per square kilometer.

Technical Details

The system operates at a wavelength of 785 nm and utilizes a decoy-state BB84 protocol with two decoy levels. Key technical specifications include:

- **Hardware:** Room-temperature single-photon detectors and a modular QKD transmitter.
- **Infrastructure:** A commercial research platform from Quantum Technology Laboratories GmbH (QTLabs), adapted for the 785-810 nm range.
- **Synchronization:** An independent, GPS-disciplined synchronization architecture.
- **Optics:** An aviation-compliant optical architecture designed to operate within the optical-emission restriction zone of Barcelona-El Prat Airport.

Notably, the receiver did not rely on adaptive optics, simplifying the overall architecture. Data collected over three months showed the system consistently operated with a QBER between 1% and 3% and attenuation between 16 and 22 dB.

Background & Context

The receiver node was hosted at the Collserola Tower, a major telecommunications hub in Barcelona, which provided direct fiber connectivity to critical infrastructure. This setup allowed the team to test the integration of a free-space link with existing fiber networks using trusted nodes.

Significance & Outlook

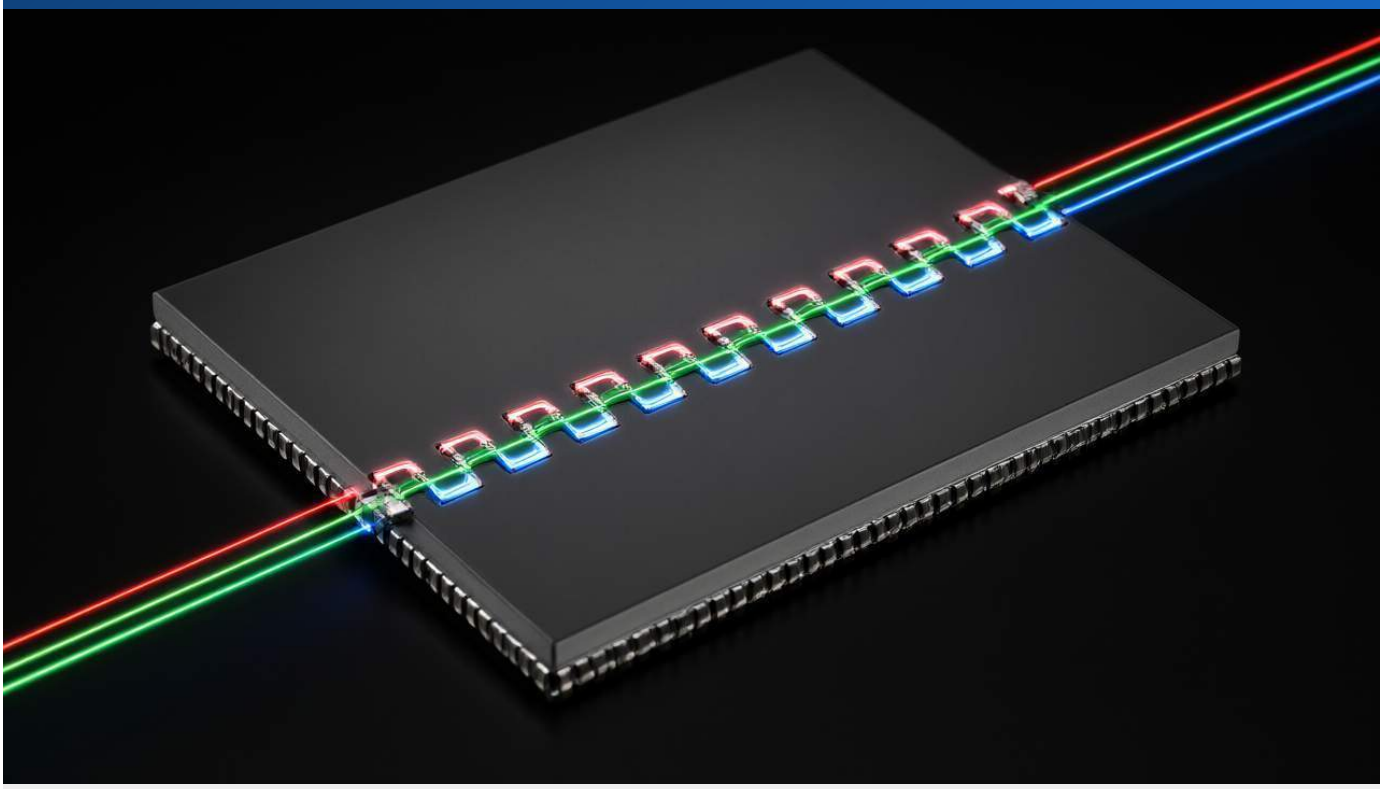
The modular design allows the quantum payload to connect to free-space optical terminals without requiring hardware modifications, facilitating the creation of hybrid quantum networks. By utilizing room-temperature detectors and avoiding complex adaptive optics, the system reduces costs and cooling requirements. Future research will focus on daytime performance, continuous unattended operation, and the correlation between residual pointing errors and QBER.

Source: https://quantumzeitgeist.com/icfo-ciencies-barcelona-quantum-key-exchange/

Collected: November 15, 2026 | Automated Research System (AI)

#11 Photonic Router Architecture: O(N) Scaling via Lithium Niobate

Published November 13, 2026 Quantum Zeitgeist USA



OVERVIEW

Researchers from MIT and the Technical University of Denmark have developed a photonic router that reduces programmable phase shifter requirements from O(N squared) to O(N). This linear scalability enables more compact, energy-efficient interconnects for AI clusters and modular quantum processors.

IN DEPTH

Key Findings

A new photonic circuit architecture achieves signal routing between inputs and outputs using only O(N) programmable phase shifters, a significant reduction from the O(N squared) components required by previous universal transformation meshes. The team demonstrated this via a 3x3 router fabricated on x-cut thin-film lithium niobate, achieving extinction ratios exceeding 11 dB across all output channels.

Technical Details

The architecture centers on signal routing rather than universal transformations, utilizing a passive multimode interferometer that splits light into multiple non-interfering channels coupled with a single row of programmable reflective phase shifters. Key performance specifications include:

- **Footprint:** 100 μm^2 per programmable component.
- **Drive Voltage:** Operation at voltages below 5 volts.
- **Tuning Efficiency:** 1.92 GHz/V resonance tuning efficiency via the Pockels effect.
- **Bandwidth:** An electro-optic bandwidth of 6.2 GHz.
- **Switching Speed:** Sequential routing demonstrated at 10 MHz, though the researchers note this rate was limited by testing equipment rather than the circuit itself.

Background & Context

Current reconfigurable optical switches face scalability challenges; as complexity increases, the number of required components grows quadratically, similar to needing a cable from every house on a street to every other house. This has historically limited the speed, size, and energy efficiency of photonic meshes. The new design addresses these bottlenecks by shifting to linear scaling, allowing for simultaneous low voltage operation and compact designs that were previously unattainable together.

Significance & Outlook

While the architecture represents a breakthrough in complexity reduction, achieving continuous gigahertz-level throughput remains a challenge due to material properties. Specifically, the reliance on the Pockels effect introduces constraints regarding capacitance and radio frequency efficiency. Despite these limits, the transition to O(N) scaling provides a foundation for energy-efficient interconnects critical for high-performance computing clusters and modular quantum processors where bandwidth capacity is essential.

Source: https://quantumzeitgeist.com/photonic-router-fewer-phase-shifters-implementation/

Collected: November 15, 2026 | Automated Research System (AI)