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World s First Optoelectronic Fusion Chip



Overview

To this end, the research team proposed the concept of a "universal optoelectronic fusion wireless transceiver engine."

Key Takeaways

The world's first optoelectronic fusion chip, developed by Chinese researchers, integrates optical and electronic technologies to achieve unprecedented computing power and ultra-wideband communication capabilities.Overview

Chinese scientists have developed the first fully analog optoelectronic intelligent computing chip, known as ACCEL, which combines optical and electronic components into a single integrated system, breaking the physical limitations of traditional chips (EEWorld, Nature) . This chip leverages thin-film lithium niobate photonic materials and advanced CMOS processes to enable high-speed, broadband signal processing and intelligent computing tasks (Global Times) .

Technical Features
• Ultra-High Computing Power: ACCEL achieves system-level computing performance over 3,000 times that of current high-performance commercial chips, particularly in intelligent visual recognition tasks .

• Energy Efficiency: The chip operates at 74.8 Peta-OPS/W, approximately 4 million times more efficient than existing GPUs and TPUs, meaning the energy that powers a conventional chip for one hour could power ACCEL for over 500 years .

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• Fabrication: The optical components are fabricated with line widths of a few hundred nanometers, while the electronic circuits use a 180nm CMOS process, achieving performance improvements far beyond chips made with 7nm technology .

• Ultra-Wideband Communication: The chip supports real-time, flexible, and rapid reconfiguration of center frequencies from 0.5 GHz to 115 GHz, spanning nearly eight octaves, enabling broadband wireless and optical signal conversion for next-generation 6G networks .

• Integrated Optoelectronic Oscillator (OEO): Using high-precision optical micro-ring resonators, the chip generates low-noise carrier and local oscillator signals across ultra-wideband frequencies, overcoming traditional limitations of frequency multipliers .
Applications
• Artificial Intelligence: ACCEL significantly accelerates AI tasks such as visual object recognition, enabling real-time processing at unprecedented speeds .

• Wireless Communications: The chip's ultra-wideband capabilities allow efficient utilization of full-spectrum resources, supporting emerging high-data-rate applications like extended reality (XR) and remote surgery .

• Energy-Efficient Computing: Its extreme energy efficiency makes it suitable for large-scale data centers and edge computing where power consumption is critical .
Significance

This breakthrough represents a milestone in chip technology, merging optical and electronic systems to overcome the limitations of traditional electronics. It enables ultra-high-performance computing, low-noise broadband communication, and energy-efficient AI processing, potentially reshaping the future of computing and wireless communication infrastructure . The development of the optoelectronic fusion chip marks a leap from conventional electronic chips to integrated photonic-electronic systems, positioning it as a key technology for next-generation AI, 6G networks, and ultra-fast computing applications.

Article Content

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Chinese scientists develop world''s first intelligent chip enabling full ...

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Stacking the future of heterogeneous optoelectronics

Although integrated optoelectronic systems, which include transmitters, modulators, and

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Photonic processor could enable ultrafast AI computations with

Researchers developed a fully integrated photonic processor that can perform all the key computations of a deep

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A heterogeneous optoelectronic fusion integrated chip based on wafer-to-wafer bonding is from bottom to top: silicon substrate layer,

65 TOPS optoelectronic multi-core computing unlocking multi-feature ...

Integrating coherent interference and wavelength-division multiplexing, a four-core optical computing chip is

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This achievement not only signifies the development of China''s first fully integrated chip for optoelectronic fusion, capable of

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This breakthrough in optoelectronic fusion chips further enables China to exert direct influence on 6G standards at the

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Evolving Record-Fast Optoelectronic Chips for Data Center Networks

The innovative technologies developed in the plaCMOS project provide the foundation for the evolution of optical

Photonic communication comes to computer chips

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MIT spinout Ayar Labs — now partnered partnership with Global Foundries semiconductor manufacturer — has

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Ultrabroadband Integrated Photonics Empowering Full-Spectrum

A broadband optoelectronic oscillator generates frequency-tunable signals covering the full band with a consistently low noise level.

First Electronic-Photonic Quantum System-on-Chip

The quantum-correlated photon-pair sources are stabilized via on-chip feedback control circuits that calibrate and

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World''s first quantum light factory chip built on standard ...

New chip merges quantum light factories with on-chip control, enabling real-time stabilization of photon generation

Fast, efficient optoelectronic chips to hit market next year

MIT spin off company Ayar Labs is combining electrons and light in new optoelectronic chips to speed up data transmission and

BIT achieves new world record in intelligent optoelectronic imaging

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Academician Zhang Jun from Beijing Institute of Technology (BIT) has led a team to pioneer an on-chip spectral

Fusion magnets could lead to improved microchip production

Swooping magnetic fields that confine plasma in doughnut-shaped fusion facilities known as tokamaks could help

World''s First Full-Band High-Speed Communication Chip Debuts in

Unlike traditional chips limited to specific frequency bands, this device integrates optoelectronic fusion technology,

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Bill Gates-backed Commonwealth Fusion Systems hits key reactor ...

Commonwealth Fusion Systems (CFS) marked a major milestone Tuesday morning, announcing the installation of a

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