



LIGHTWAVELOGIC®

*Faster by Design*

NASDAQ  
**LWLG**

Investor Presentation  
April 2024

The information in this presentation may contain forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. You can identify these statements by use of the words "may," "will," "should," "plans," "explores," "expects," "anticipates," "continue," "estimate," "project," "intend," and similar expressions. Forward-looking statements involve risks and uncertainties that could cause actual results to differ materially from those projected or anticipated. These risks and uncertainties include, but are not limited to, general economic and business conditions, effects of continued geopolitical unrest and regional conflicts, competition, changes in technology and methods of marketing, delays in completing various engineering and manufacturing programs, changes in customer order patterns, changes in product mix, continued success in technological advances and delivering technological innovations, shortages in components, production delays due to performance quality issues with outsourced components, and various other factors beyond the Company's control.

# Corporate Overview



LIGHTWAVE LOGIC<sup>®</sup>

NASDAQ  
**LWLG**

**Lightwave Logic develops a platform leveraging its proprietary engineered electro-optic (EO) polymers to transmit data at higher speeds with less power**

- **Large Addressable Market:** Optical transceivers market expected to grow to at least \$100B by 2030 chiefly driven by data centers, fiber comm & AI requirements
- **Proprietary EO Polymer Technology:** Supports >3x faster data transmission speeds with ~10x lower power, relieving key bottlenecks in internet infrastructure
- **Robust Patent Portfolio:** Composed of 70+ patents and patents pending
- **Commercialization Underway:** Secured initial licensing agreement in May '23
- **Robust Balance Sheet:** \$31M+ cash position provides significant optionality
- **Building a Foundation:** Expanded facility and team with in-house control of material supply, device fabrication & package design enables Lightwave to control its own destiny and maintain key trade secrets in-house
- **Experienced Leadership:** Management and Board are composed of technology and finance experts with 200+ years of combined experience

Share Price <sup>1</sup>	\$4.36
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Market Cap <sup>1</sup>	\$519.7M
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Cash & Cash Equivalents <sup>2</sup>	\$31.4M
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Debt <sup>2</sup>	\$0
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Shares Outstanding <sup>3</sup>	119.2M
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Headquarters	Englewood, CO
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1) As of April 5, 2024  
2) At Dec. 31, 2023  
3) As of Feb. 29, 2024



# Existing Internet Infrastructure

Innovation is needed to keep up with data traffic

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'Traffic jams' within internet infrastructure are increasing, because the data "pipes" inside data centers, between data centers, and from data centers to consumers have **not kept pace** with the immense growth of data traffic

*Existing Infrastructure*



How many times have we seen this?

**Radical innovation is needed** to enable tomorrow's data services within the current framework of existing internet infrastructure



# Industry Demand Drivers

## Macro-tailwinds driving adoption of next-generation components

### Switch Density



*Need For Space*

Real Estate Efficiency

Space is limited in data centers and competing solutions generally require a larger footprint than EO polymers

### AI, Cloud & Streaming



*Need For Speed*

Artificial Intelligence  
Cloud Services  
Streaming/Gaming

Computing power required to train and utilize AI systems has been doubling every 2-4 months

### Energy Usage



*Need For Green*

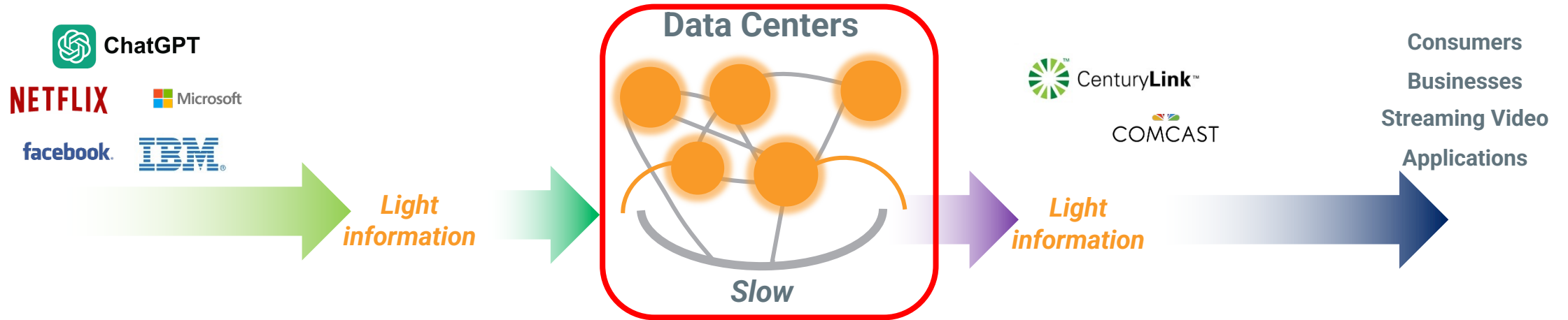
Energy Demand

Traffic and computing power is driving power consumption in data centers to extreme levels

Supporting the big macro trends today...and in the future

# Data Speed Choke Points

Data centers are the bottleneck in legacy internet infrastructure



Legacy digital technology in data centers is the choke point – our technology addresses increasing optical data speeds with lower power consumption in tiny form factors



The goal is a higher performing optical network (or internet), where speed and low power consumption are key drivers. Lightwave's technology can vastly improve the incumbent technology used today...

A digital illustration of a server room aisle. The perspective is looking down a long corridor lined with dark server racks on both sides. The floor is a light blue-grey color. The ceiling has several rectangular light fixtures. A network of glowing orange lines and dots is overlaid on the scene, representing data flow. A thick, wavy orange line curves across the middle of the image. The text "What we do..." is centered in a white, italicized font within a semi-transparent grey rectangular box.

*What we do...*

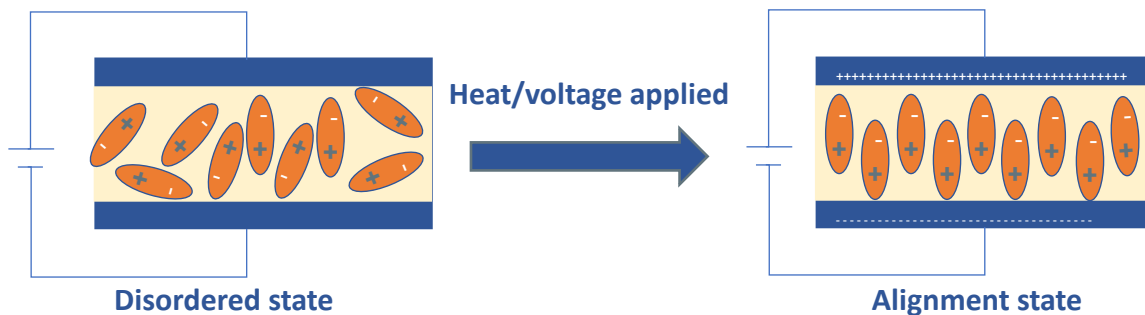
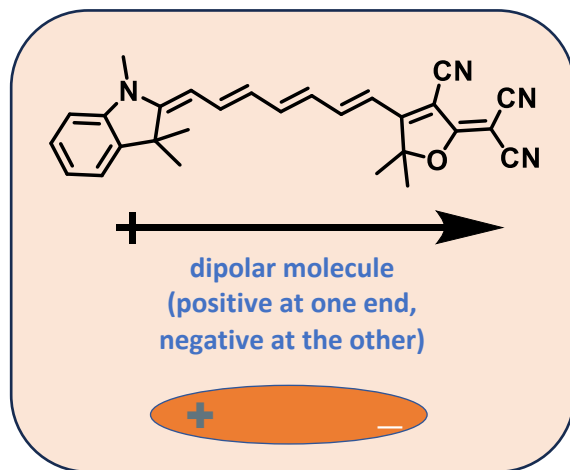


# Perkinamine<sup>®</sup> Electro-Optic polymers

LIGHTWAVE LOGIC<sup>®</sup>

**Our polymers are world-class and proven by third parties**

Electro-optic polymers can be used to fabricate optical modulators



## We create organic chromophores...

- Designed, simulated and modeled in Denver, Colorado
- Manufacturing chemistry facility that can scale volume
- Deep experience with material characterization, testing, lifetime, and reliability

# Award winning polymers...

## Polymers provide unique advantages over legacy technologies

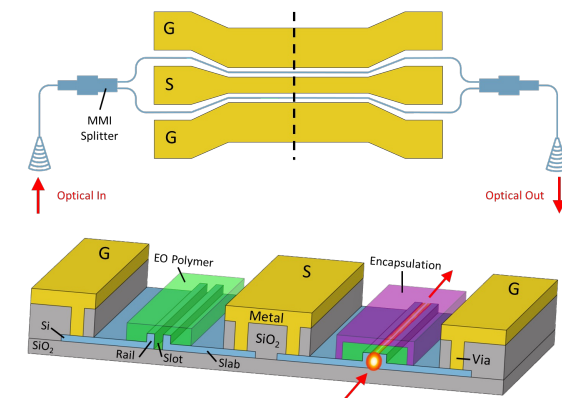
- Materials are **polymers**
  - Like OLEDs – Organic LEDs used for TVs where their polymers generate light: **ours switch light**
- Modulators are **very small**
  - So small that they fit easily into pluggable transceivers, the critical devices used to transmit and receive data in data centers
- Polymer modulators have **transformational** performance head-room for the next decade
- Can **integrate** other devices with polymer modulators
  - Adding to existing silicon photonics infrastructure as well as multi-channel solutions for higher aggregate speeds

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Lightwave Logic Voted  
ECOC 2023 Industry  
Innovation Award Winner



Perkinamine®  
Electro-Optic  
Polymer



Electro-Optic Polymer slot  
modulators

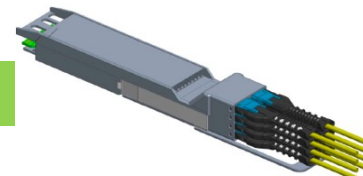
# Polymer modulator opportunities



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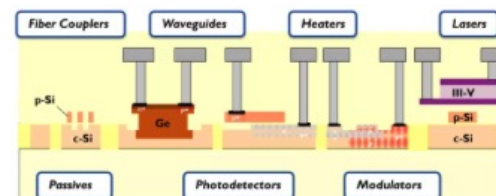
Electro-optic polymer modulators for transceivers suppliers

Upgrading to a 'V8'...



Electro-optic polymer modulators for Silicon Photonic platforms

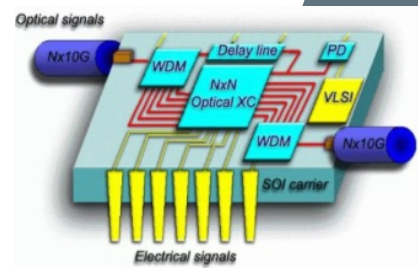
'Turbo-boosting' SiPh...



Source: ePIX Fab

Electro-optic polymer modulators for "Other" platforms including optical/quantum computing, HPC, and RF applications

Faster,  
lower  
power,  
smaller...



E0 polymers  
*enable* higher  
performance data  
communications

Electro-optic polymer engines for fiber optic communications

Source: Ethernet Alliance, OSFP MSA, [https://www.researchgate.net/figure/Schematic-of-an-on-chip-optical-network-with-various-components-illustrated-including\\_fig2\\_239929876](https://www.researchgate.net/figure/Schematic-of-an-on-chip-optical-network-with-various-components-illustrated-including_fig2_239929876), ePIXfab, corning



The background is a perspective view of a server room with rows of dark server racks on both sides. A glowing orange wave, composed of many thin lines, curves across the middle of the image. A network of white dots connected by thin lines is overlaid on the entire scene, creating a digital or data network aesthetic. The ceiling has a series of rectangular light fixtures.

*Exciting and growing markets*

# Initial Target Markets

Polymers address a large, rapidly growing market

## Fiber Communications

Photonics Applications	Photonics Components Market 2030*	Optical Transceivers* TAM (2022)	Optical Transceivers* TAM (2030)	Partner Type	Opportunity for Integrated Photonics (PICs) (Polymer, SiPh, InP)
Fiber comms	~\$60-80B	\$7B	~\$40-60B	Foundry, OEM/CM (TxRx)	Existing/very strong growth
HPC/compute/AI	~\$10-20B	\$1B	~\$10-15B	Foundry, OEM/CM (TxRx)	Existing/very strong growth
DCI/datacenter	~\$20-30B	\$9B	~\$20-30B	Foundry, OEM/CM (TxRx)	Existing/strong growth
5G systems/back haul/RF	~\$5-10B	~\$1-2B	~\$4-8B	Foundry, OEM/CM (TxRx)	Existing/strong growth
Display/project	~\$10-20B	<\$1B	~\$5-15B	Foundry, OEM/CM (panel)	High-volume/strong forecast
Automotive (LIDAR)	~\$30-50B	~\$1-2B	~\$20-30B	Foundry, OEM/CM (LIDAR)	High-volume & very strong forecast
Optical sensing/3D	~\$4-10B	~\$1-2B	~\$2-5B	Foundry, OEM/CM (sensor)	High-volume & solid forecast
Bio-photonic sensing	~\$2-5B	<\$1B	~\$2-3B	Foundry, OEM/CM	Strong forecast
Medical	~\$5-10B	<\$1B	~\$5-8B	Foundry, OEM/CM	Strong forecast
Instrumentation	~\$2-3B	<\$1B	~\$1-2B	Foundry, OEM/CM	Strong forecast



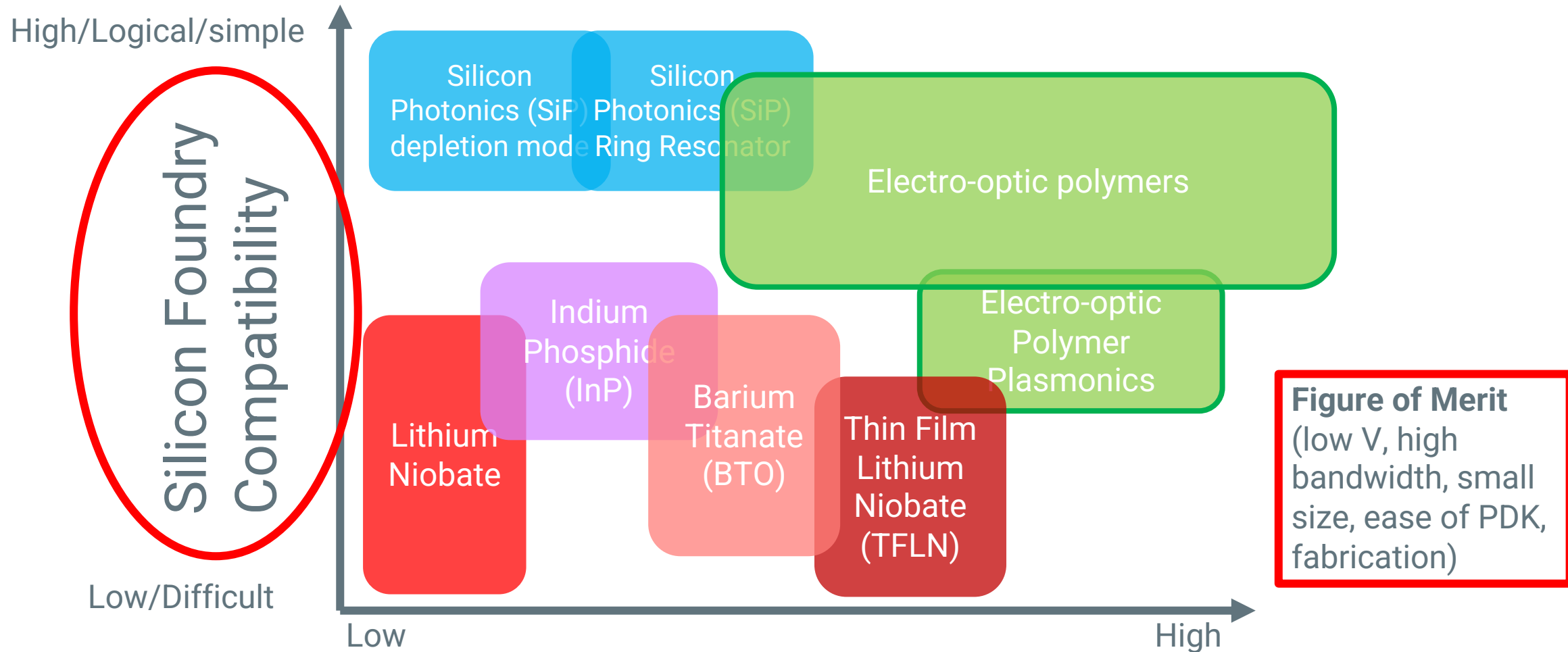
The background is a perspective view of a server room aisle. On both sides are rows of dark server racks. The floor and ceiling are dark, with the ceiling having rectangular light panels. A network of glowing blue dots connected by thin lines is overlaid on the scene. A thick, wavy, orange-gold line, composed of many parallel lines, curves across the middle of the image from left to right.

*Silicon foundry compatible...*





# Polymers are ideal for silicon foundries...

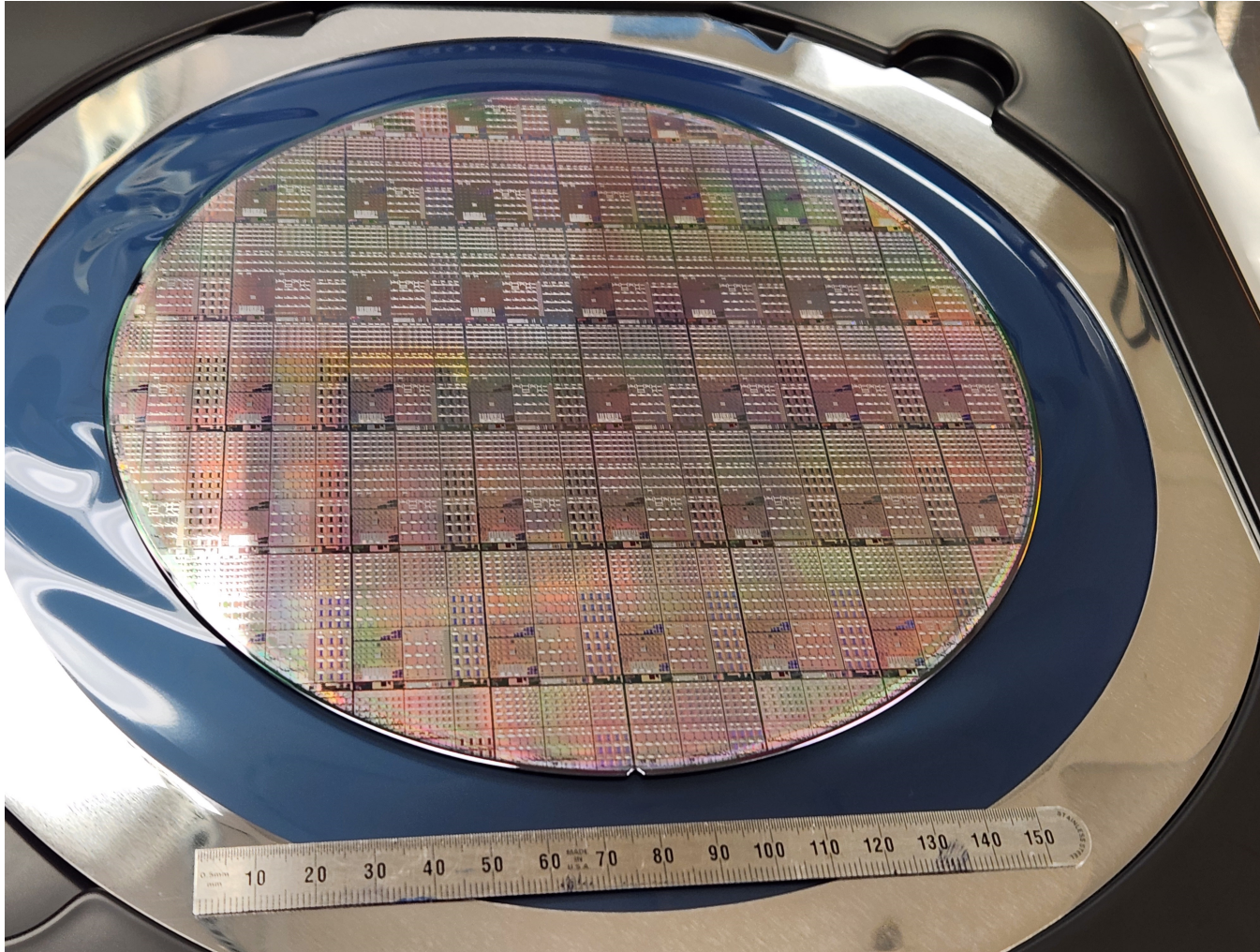


Polymer positioning for heterogeneous integration is aligns with silicon foundries very well

# Scalability with 200 mm Wafers



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Commercial Foundry

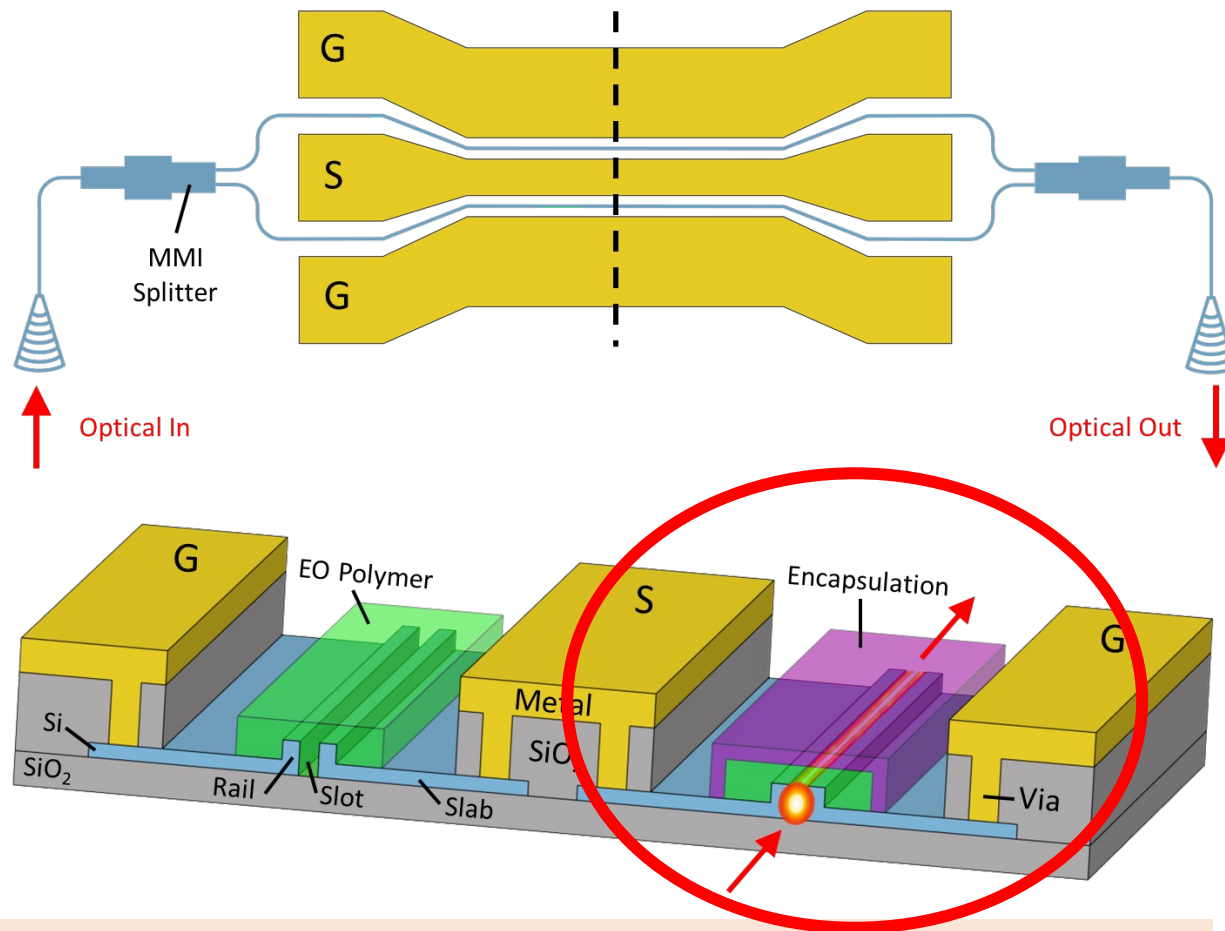
200 mm Wafer

Volume scale silicon slot designs on 200mm wafers



# Heterogeneous Polymer Slot Modulator

Our polymers are **easily fabricated** in silicon fabs → ideal for heterogeneous integration



EO polymer heterogeneous integration onto silicon wafers

- Heterogeneous integration of polymer on Silicon Photonics Platform
- Low drive voltage and small form factor for **low power consumption** and high density
- Very high bandwidth (**70-100GHz**)
- Fabricated onto **200mm** silicon wafers

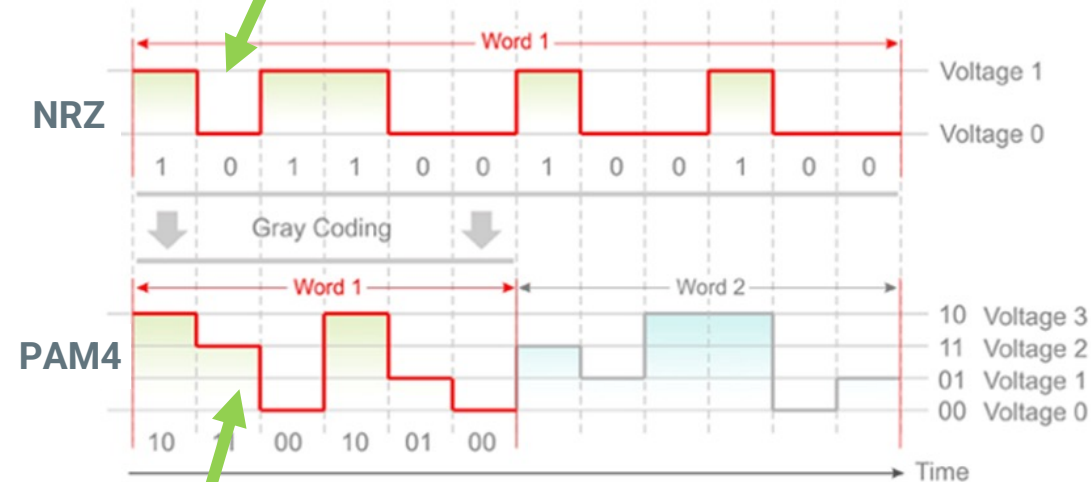




# Commercial Modulation and Eyes

NRZ = Non-return to Zero  
(i.e. castellated waveform)

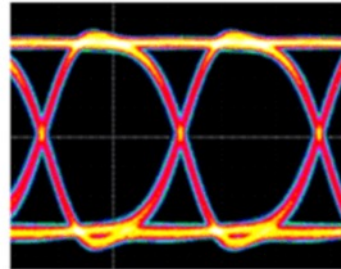
NRZ and PAM4 Encoding



PAM4 = Pulse Amplitude  
Modulation at 4 levels  
(step waveform)

Open eyes mean no errors

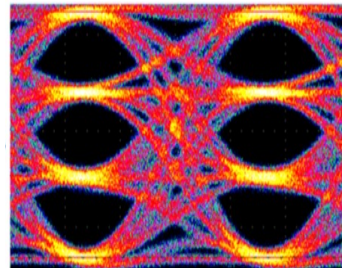
2 levels → 1 bit



NRZ

1 bit per symbol

4 levels → 2 bits



PAM4

2 bits per symbol

- Open Eyes mean high quality transmission and no errors
- For Same Bandwidth PAM4 as Double the Capacity
- Eyes show superposed traces for many sequential bits
- Show the levels and the transitions for any different data pattern, i.e. any different sequence of 1's and 0's

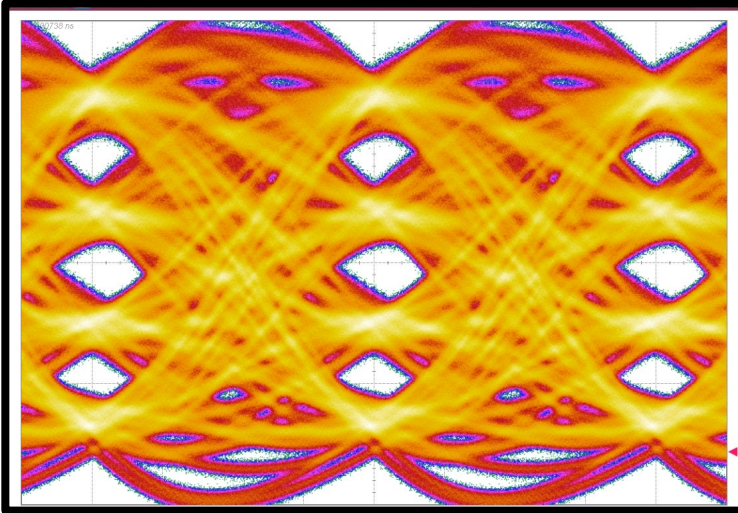
PAM4 has X2 the capacity for the same bandwidth

# World-class performance...

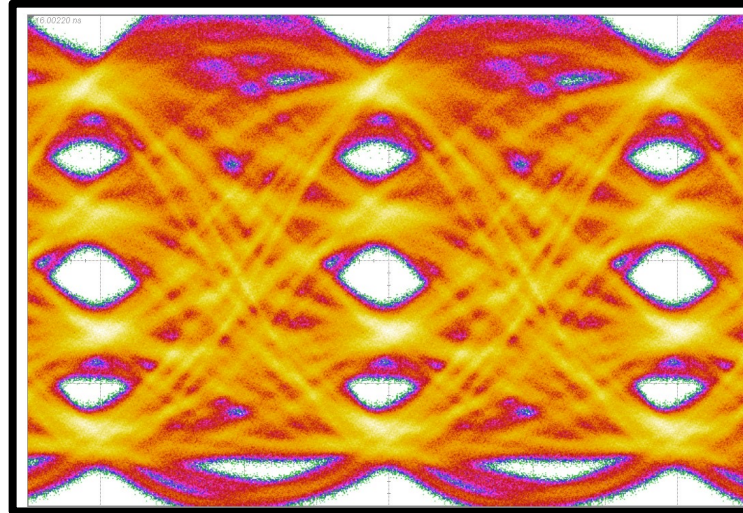


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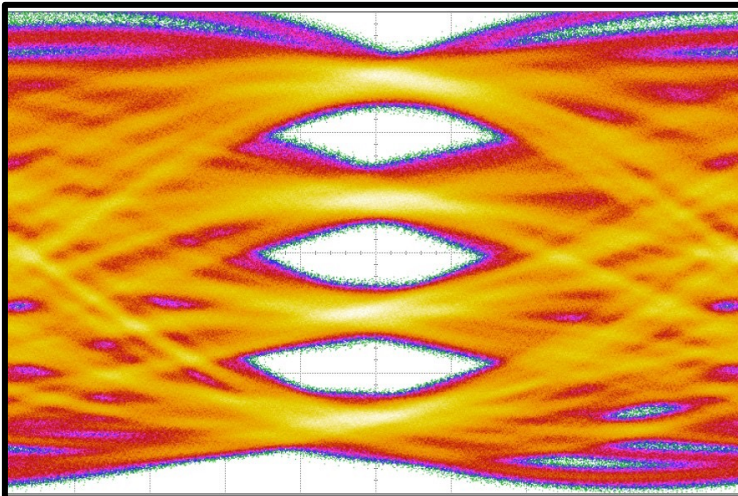
90 Gbaud, 180 Gbit/s,  $V_{\text{drive}} < 2 \text{ V}$



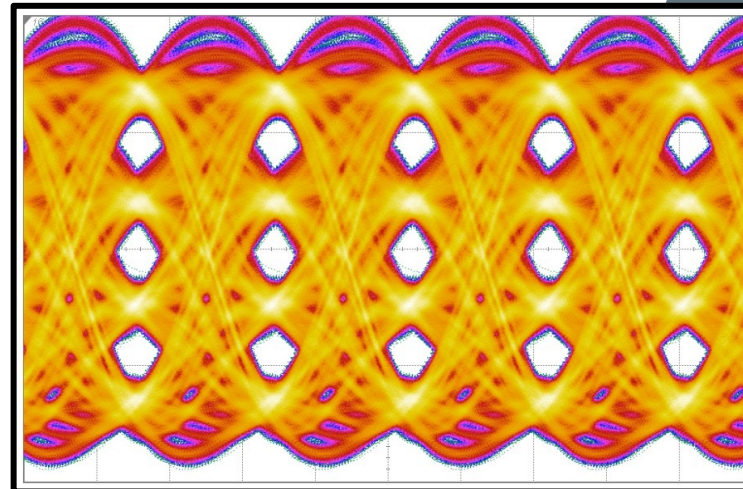
100 Gbaud, 200 Gbit/s,  $V_{\text{drive}} < 2 \text{ V}$



53 Gbaud, 106 Gbit/s,  $V_{\text{drive}} < 2 \text{ V}$



53 Gbaud, 106 Gbit/s,  $V_{\text{drive}} < 2 \text{ V}$



Drive Voltage  $\sim 1 \text{ V}$

Up to 100GBaud PAM4  
(200Gbps)

Open eyes...

Open eyes...

Ideal for low voltage  
800Gbps 4 channel  
pluggable transceivers

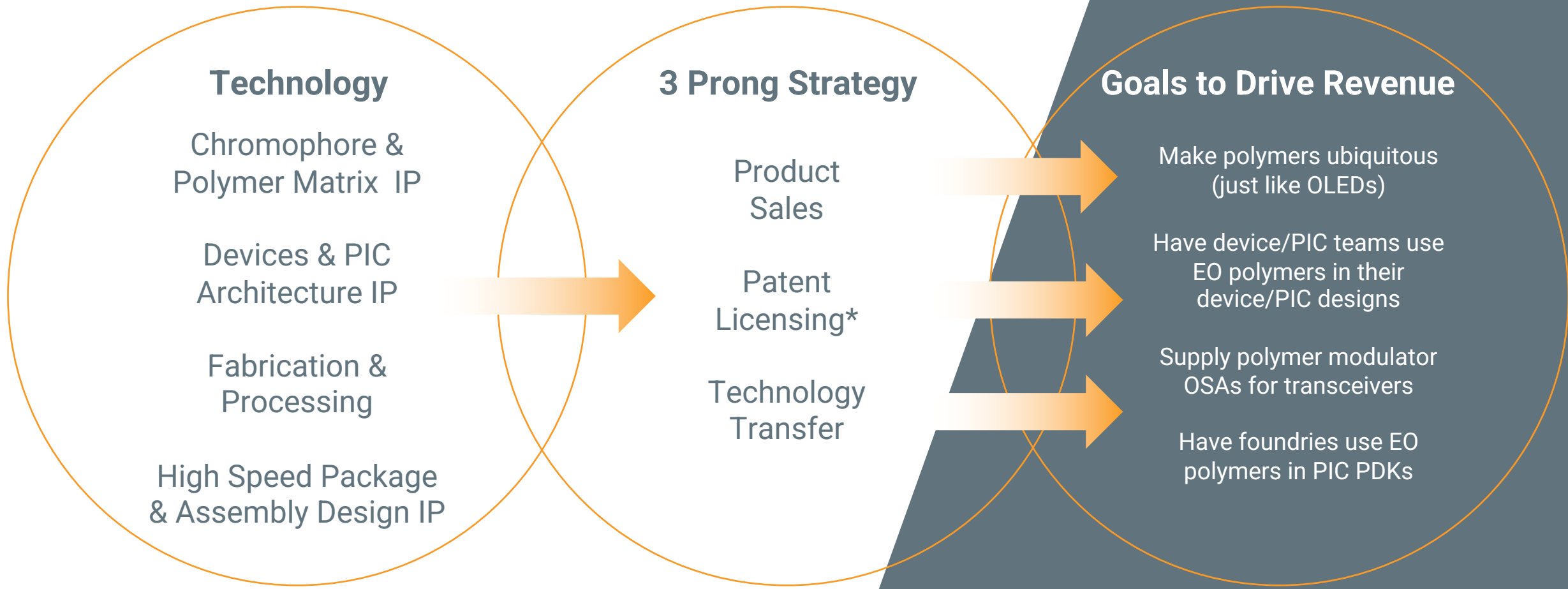


The background is a dark, atmospheric illustration of a server room. Rows of server racks stretch into the distance, illuminated by a cool blue light from the ceiling. Overlaid on this scene is a complex network of thin, glowing orange lines that connect various points, suggesting data flow or a global network. A thick, wavy orange band also curves across the middle of the image. The overall aesthetic is high-tech and futuristic.

*Business plan: licensing our material  
and selling polymer modulators*

# Implementing a New Technology Platform

Licensing model provides inherent scalability



\*1st commercial material supply license agreement 2Q23 → market acceptance



# Patents Drive Licensing Opportunities



LIGHTWAVELOGIC®

**Robust intellectual property (IP) portfolio enables licensing & tech transfer for long term revenue generation**



- Develop and license polymer-based technologies that are engines for the internet, optical networking, data centers
- Patent portfolio creates a strong moat and know-how to carve out a leadership position with high speed, low power EO polymers
- Proprietary EO polymers are continually strengthened to fortify the patent moat, currently with over 70 patents issued and pending

# Initial Licensing Agreement

Secured initial market acceptance for polymer technology

**First Perkinamine® customer licensing agreement secured in May 2023**



Represents commercial market acceptance of our polymers, with follow-on licensees in progress

## Agreement Structure:

- LWLG to supply EO material
- License initiation fee
- Royalties (% per unit)
- Minimum royalty
- Minimum sales volume (units)



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# Chromophore Commercial Plan



Next-gen polymers continue to improve, providing performance headroom for years to come

## Chromophore Material Roadmap

	2023	2024	2025
Perkinamine <sup>®</sup> 2	License	License	License
Perkinamine <sup>®</sup> 3	License	License	License
Perkinamine <sup>®</sup> 5	License	License	License
Perkinamine <sup>®</sup> 6	Development	License	License



# Near Term Commercial Activities & Goals

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Initial commercial activity developing well and is expected to grow in 2025





# Commercial interest growing

## Recent demonstrations of our polymer modulators

### World class results

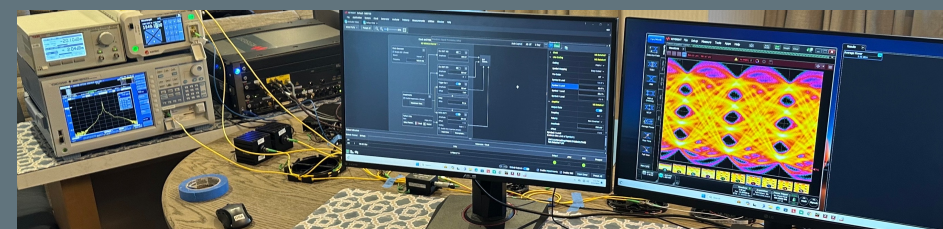
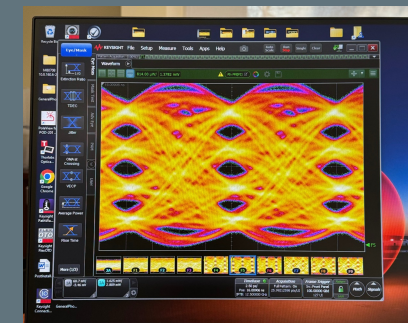
- Ideal for 800Gbps pluggable transceiver market with 200G lanes

### Types of visitors

- Commercial Tier 1 companies include:
  - Hyperscaler/Datacenter companies
  - Telecom system companies
  - Optical system corporations
  - Optical component/transceiver corporations
  - OSATs (Outsources Semiconductor Assembly and Test)
  - CMs (Contract Manufacturers)
  - Silicon Foundries
- Research analysts
- Universities
- Defense industry

### Combined licensing/product interest

Over 20 commercial visitors this year







*Expanding manufacturing facility*



# Scaling Growth...

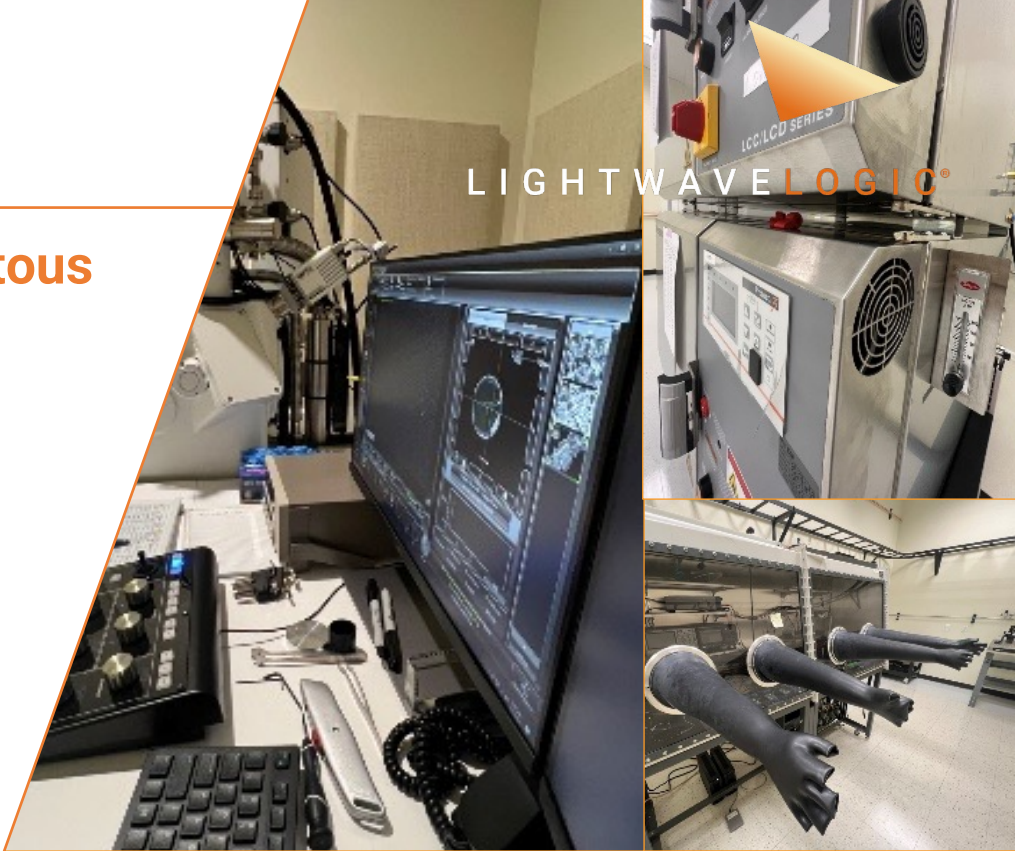
**We now have the team and facilities to make polymers ubiquitous**

## **Expanded Lightwave Logic facility is complete and operational:**

- Acquired almost 10,000 sq ft adjoining current facility, representing a 70% increase in available space
- New space is being used for:
  - Production device test and evaluation center
  - Production reliability center
  - Laser characterization center
  - SEM analysis center
  - Expansion of chemical synthesis production line
  - Office and meeting space for additional staff

## **New space supports notable recent hires, including:**

- Organic and computational chemists
- Material science and device engineers
- Packaging and reliability engineers





The background is a perspective view of a server room with rows of dark server racks on both sides. A glowing orange wave, composed of many thin lines, curves across the middle of the image. A network of white dots connected by thin lines is overlaid on the entire scene, particularly concentrated around the orange wave. The ceiling has a series of rectangular light fixtures.

*Experienced leadership...*

# Experienced Management & Board

LIGHTWAVELOGIC®



**Dr. Michael S. Lebby**  
Chairman & CEO

35+ years experience in photonics & semiconductors



**Mr. Jim Marcelli**  
President & COO

35+ years experience in finance & operations



**Ronald A. Bucchi**  
Independent Director

35+ years experience in accounting & finance



**Craig Ciesla**  
Independent Director

25+ years experience in technology and engineering



**Dr. Fred Leonberger**  
Independent Director

35+ years leadership in optical modulators & systems



**Laila Partridge**  
Independent Director

30+ years experience in technology, corporate innovation and finance



**Siraj Nour El-Ahmadi**  
Independent Director

30+ years leadership experience in telecom network equipment





# Key Takeaways

## We believe our polymers are positioned to become ubiquitous

- **Large Addressable Market:** Optical transceivers market expected to grow to at least \$100B by 2030 chiefly driven by data centers, fiber comm & AI requirements
- **Proprietary EO Polymer Technology:** Supports >3x faster data transmission speeds with ~10x lower power, relieving key bottlenecks in internet infrastructure
- **Robust Patent Portfolio:** Composed of 70+ patents and patents pending
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- **Experienced Leadership:** Management and Board are composed of technology and finance experts with 200+ years of combined experience



## Investor Relations Contact

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# LIGHTWAVELOGIC®

*Faster by Design*

[lightwavelogic.com](http://lightwavelogic.com)

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