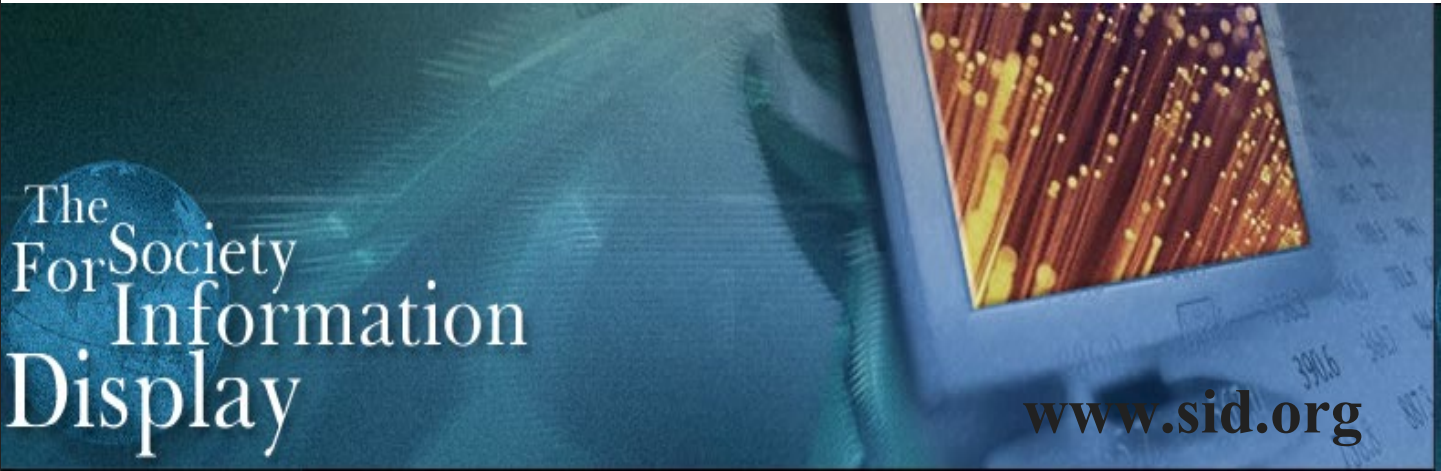


SID



The
For Society
Information
Display

www.sid.org



Publications

- Stay on top of the latest research & developments through **SID's Journal and Technical Digests**
- Stay informed of industry developments and events through **Information Display Magazine**
- **FREE** on-line access to all of the above publications and thousands of technical papers
- Learn through SID's educational publications, including seminar notes, course notes and the SID-Wiley Book Series

Benefits

Join us in influencing the future development of:

- Display technologies and products
- Manufacturing processes and equipment
- Measurement standards and methods
- New markets and applications

Conferences

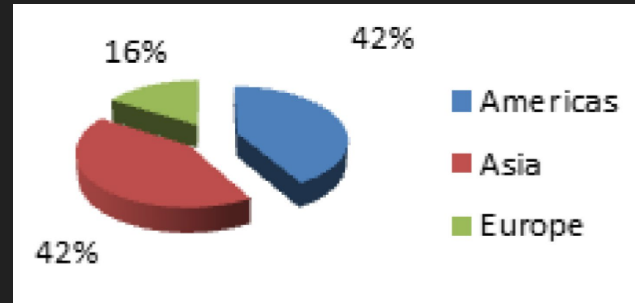
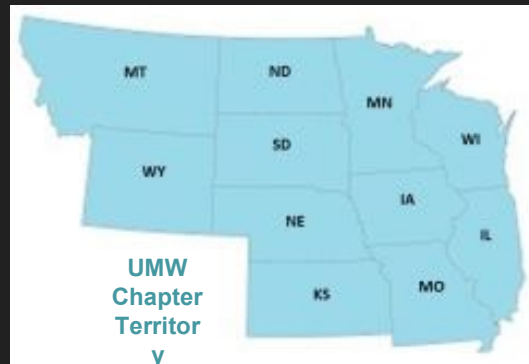
- **Display Week: The SID International Symposium Seminar & Exposition**
- International Display Research Conference
- International Display Workshops
- Many regional conferences, seminars, workshops



Display Week 2025
May 13-15, 2025
San Jose, California



- International organization
- Over 5,000 total members
- Upper MidWest (UMW) Chapter has 95 members



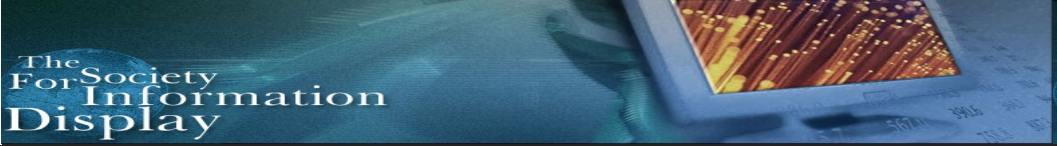
The logo for the Society for Information Display (SID) features the letters "SID" in a large, white, serif font on a blue rectangular background.

SOCIETY FOR INFORMATION DISPLAY

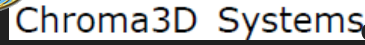
The text "The For Society Information Display" is arranged in a vertical stack. "The" is small and positioned above "For". "For" is medium-sized and positioned to the left of "Society". "Society" is medium-sized and positioned to the left of "Information". "Information" is medium-sized and positioned to the left of "Display". "Display" is large and positioned at the bottom. The background is a blue-toned image of a hand holding a fiber optic cable.

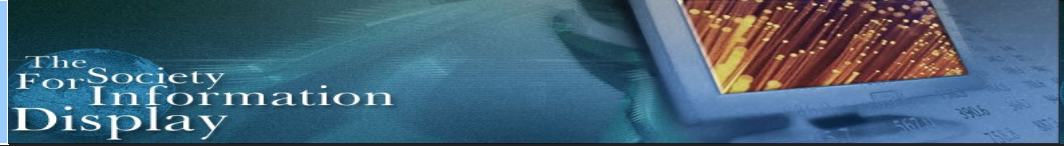
Upper Midwest (UMW) SID Chapter Officers

Position	Chapter Officer	Phone	E-mail
Chair Person	Tracy (TJ) Barnidge	319-295-4764	t.barnidge@hotmail.com
Vice Chair Person	Dr. Hari Atkuri	513-324-1550	hatkuri@gmail.com
Secretary	J.W. Powers	636-300-5066	jw@fifthandvintage.com
Treasurer	James Lupino	715-360-1143	james.lupino@gmail.com
Program Chair	Madhu Reddy	612-386-7955	madhu@usei.com
Membership Chair / Academic Committee Chair	Gautam Rao	847-778-3947	raomgautam@gmail.com
Nomination Chair	Bruce Hufnagel	319-360-9339	bdhufnagel@gmail.com
Ex-Officio	Dr. Birendra Bahadur	319-651-1699	bbahadur@msn.com
	Mike Wilson	636-300-5115	wilson@westar.com
	Bruce Hufnagel	319-360-9339	bdhufnagel@gmail.com



Presenters from a wide variety of organizations:





AUGUST 29, 2014 - UMW SID Chapter Meeting

Introducing Next-Generation Photonic Cooling Technology for High-Performance Computing



MAXWELL LABS
DATA CENTER COOLING AT THE SPEED OF LIGHT



MAXWELL LABS

DATA CENTER COOLING AT THE SPEED OF LIGHT

Company Overview

Presented by

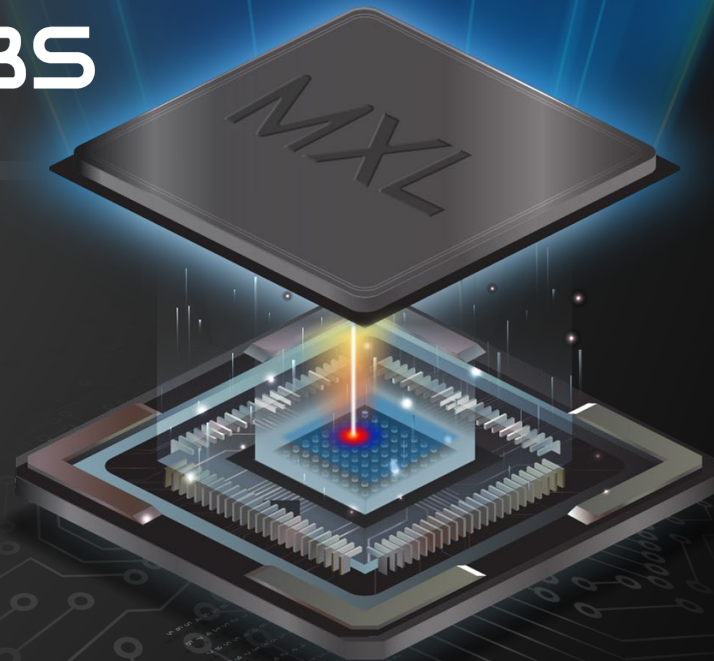
Jacob Balma, Co-Founder & CEO

Alejandro W. Rodriguez, Co-Founder & CTO

Mike Karpe, Co-Founder & CRO

Contact

mkarpe@maxwell-labs.com





Led by the world's top experts
in nanophotonics, our endgame
is to create the **FIRST-EVER,
OPTICALLY COOLED
DATA CENTER**

paving the way for
next-gen, high-performance
computer (HPC) systems.



Sandia
National
Laboratories



PRINCETON
UNIVERSITY



Massachusetts
Institute of
Technology



CRAY
THE SUPERCOMPUTER COMPANY



MAXWELL LABS

Processors powering the AI revolution
operate at breakneck speed **LIMITED**
by heat removal and **INADEQUATE**
cooling solutions.

How are chip architects, data centers
and supercomputers supposed to solve
for rapidly **ESCALATING** energy demands?

ORIGINS OF DATACENTER HEATING

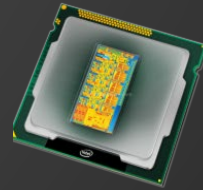
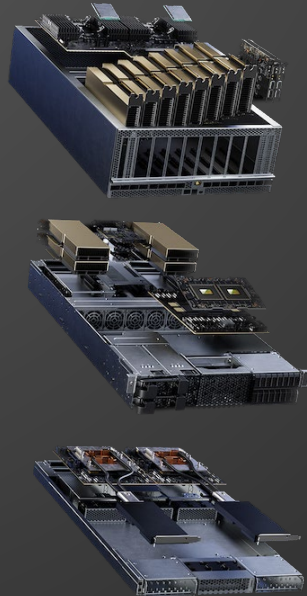
Racks

Servers + Devices

Processors

Cores

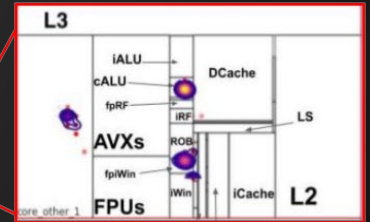
Hotspots



50 mm

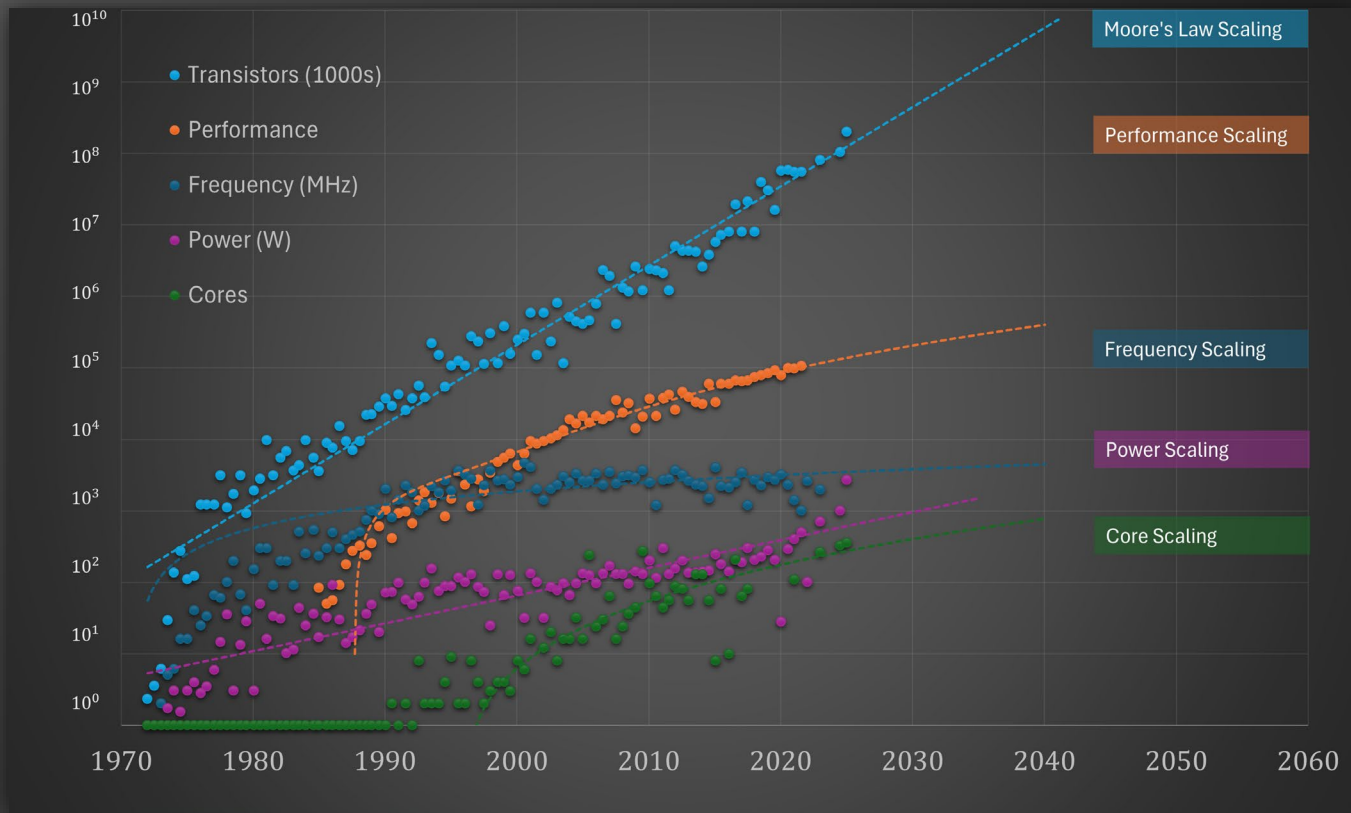


1 mm



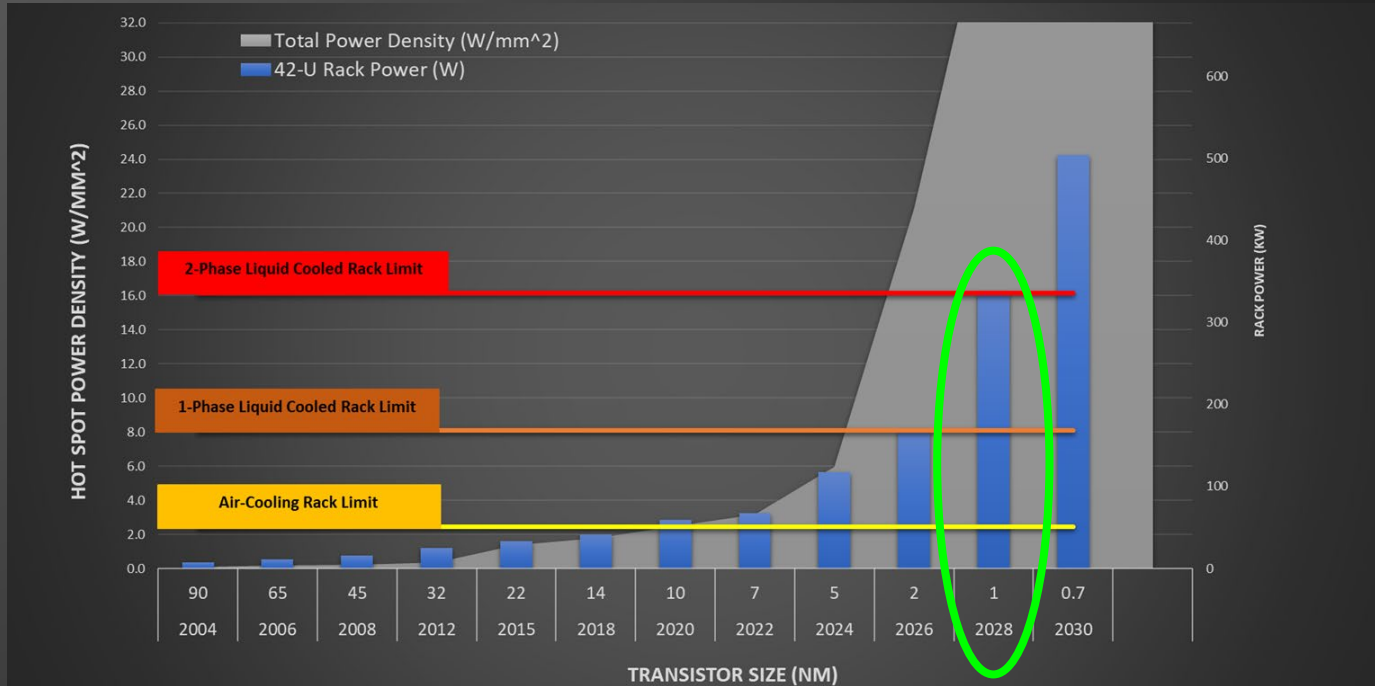
0.01 mm

Changes in Chip-Architecture



DENSITY TRENDS IN COMPUTING

AI Hardware exceeds limits of traditional cooling



SOURCE: Energy Challenges for ICT – intechOpen DATE: April 24, 2024

MAXWELL LABS

What's being applied is

INADEQUATE

because the heat generated by AI processors is so concentrated that it

SURPASSES

the power density found
in the core of a nuclear reactor.

Air Cooling is outdated.

LIMIT PER RACK: 100kW

Liquid Cooling has
reliability implications.

LIMIT PER RACK: 150kW

Photo Credit: Argonne National Laboratories

Immersion Cooling is bulky
and messy.

LIMIT PER RACK: 250kW

Why experts are concerned

Long term, there is no remaining tools to solve the thermal challenges in chip design other than optics.

Alejandro Rodriguez, PhD
Prof. Electrical & Computer
Engineering



We've been living with air-cooling for 70 years. I don't think liquid cooling will be adequate beyond 5-7 years.

Ali Heydari
Distinguished Engineer

NVIDIA



It's not going to be the financials, ROI's or TCO's - it will be the laws of physics that dictates the future of cooling.

Ali Heydari
Distinguished Engineer

NVIDIA



SO WHAT'S REQUIRED?

Today's AI hardware could reach 340kW per rack* if it could be cooled...

Instead, the most ambitious cooling integrator target is 160 kW per rack.

*Assumes 42 servers per rack with each server requiring 8.2 kW

SOURCE: Open Compute Project

~~Air cooling~~

~~Liquid cooling~~

~~Immersion cooling~~

OPTICAL COOLING!

A revolutionary leap forward by converting HEAT into LIGHT

Maxwell Labs has patented

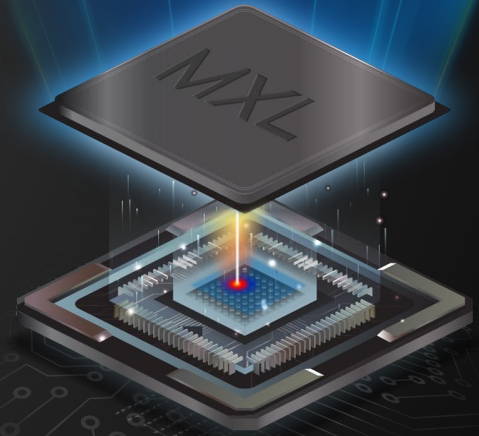
OPTICAL COOLING TECH

Developing a prototype for 3x performance gain on latest NVIDIA hardware

Future iterations enable

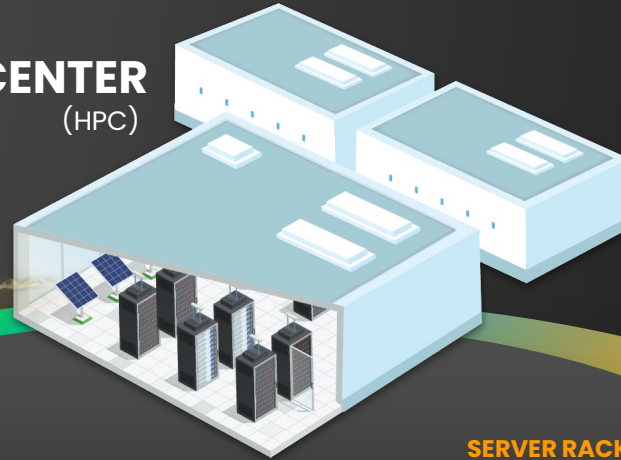
Chip Designs with 1000x +

Performance gains.



How MXL OPTICAL COOLING Works

DATA CENTER
(HPC)



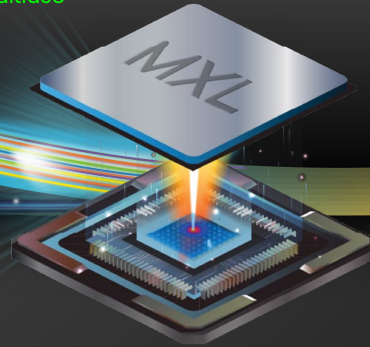
SERVER RACKS



SERVER



**MXL PHOTONIC
COLD PLATE**



RECOVERED ENERGY
Repurposed, multiuse



RELEASED ENERGY
Light travels to space



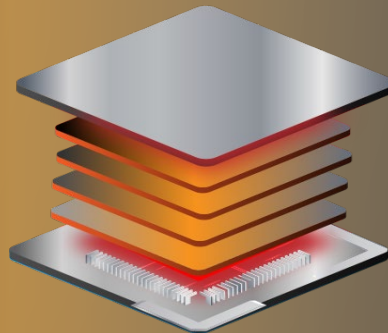
MXL OPTICAL COOLING Comparison

CONVECTIVE COOLING

Speed limitations due to inability to dissipate heat efficiently

Impractical Energy Reuse
Unsustainable Resource Consumption
Blanketed heat dissipation

RESOURCES



COMPONENTS

AIR & LIQUID COOLING

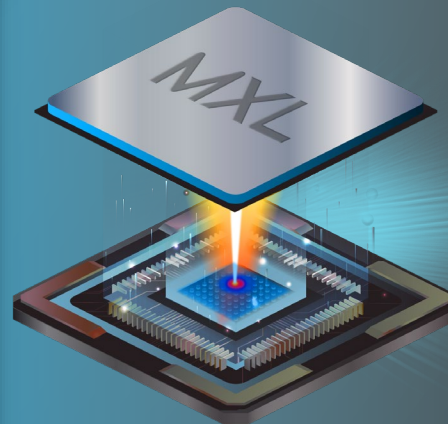
CHILLERS + HVAC
HOSES + COUPLINGS
HEAT SINK + FANS
THERMAL GREASE
SOLDER TIM
HEAT SPREADER

OPTICAL COOLING

Unlocks **1000x** higher performance for future chips

No water or moving parts
Immediate energy recycling
Targeted hotspot cooling

RESOURCES



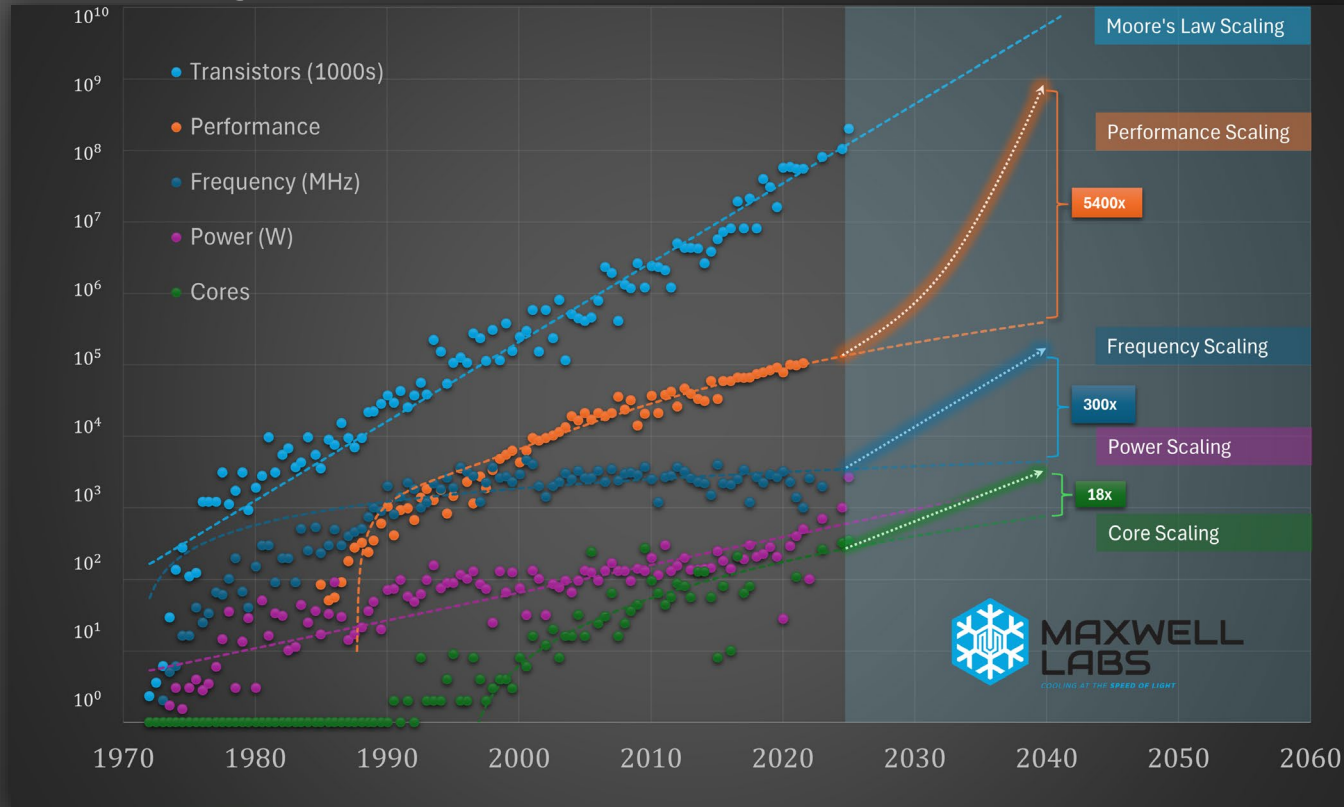
MXL COMPONENT

OPTICAL COOLING

PHOTONIC COLD PLATE
SOLID STATE LASERS
FIBER OPTIC ROUTING

OPTICAL COOLING EXTENDS LIMITS

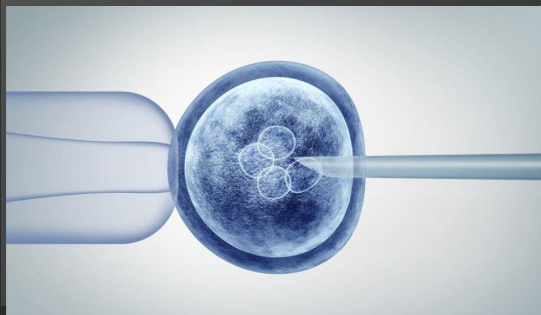
Unlocking previous limits to classical computing



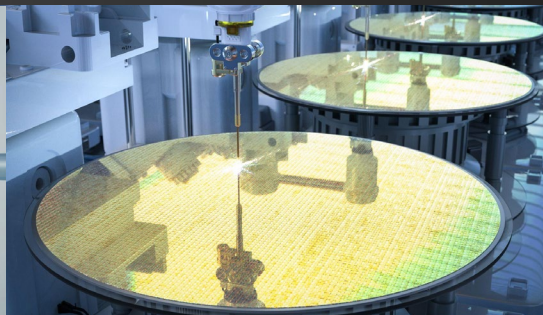
MAXWELL LABS

GLOBAL IMPACT +

Breaking the processor performance barrier by factors of 1,000 times unlocks countless new opportunities.



Unprecedented simulation resolution of human cells for personalized medicine



New computational structures to speed up Materials discovery



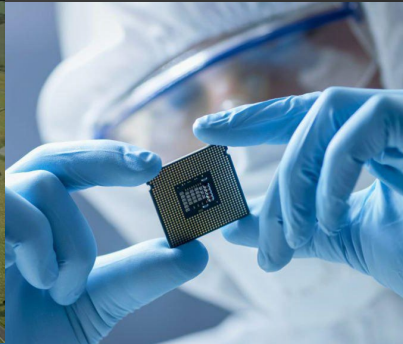
Enables advanced high power hardware to be put into remote and harsh environments

TARGET CUSTOMERS – SUPERCOMPUTERS

Cooling HPC hardware has our immediate focus.



DATA CENTERS



CHIP VENDORS



SUPERCOMPUTING
SITES



Defense

OUR TEAM

Maxwell Labs consists of industrial and academic leaders in supercomputing, nanoscale heat transport, and photonic engineering.



Norm Troullier

Director & Strategic Advisor

- Ph.D. University of Minnesota
- 30 years in HPC & Scientific Computation
- 20 years spent at Cray as a Distinguished Technologist & Performance Engineer
- Pivotal role supporting over 2,000 RFPs amounting to over \$20 Billion in revenue



Igal Brener

Senior Scientist Sandia National Lab

- Ph.D. in Physics
- Distinguished Scientist in metasurfaces and THz technologies
- VLSI at National Semiconductor
- Fellow at IEEE, American Physical Society and Optical Society of America
- Over 830 publications



Pengning Chao

Computational Modeling Expert

- Ph.D. in Physics, Princeton University
- Professor Department of Mathematics MIT
- Pioneer in large-scale optimization
- Performance bounds in photonics
- 285 Citations since 2018



Henry Newman

HPC Thought Leader & Strategic Advisor

- Bachelor's degree in International/Global Studies
- Over 40 years in HPC industry
- Former CEO of Instrumental Inc.
- Former CTO of Seagate Government Solutions



Riccardo Messina

Computational Modeling Expert

- Ph.D. in Mathematics and Computer Science
- Expert in Near-field Radiative Heat Transfer
- Expert in Thermophotovoltaic cells
- Authored over 70 academic papers, over 2,500 citing's



Raktim Sarma

Principle Scientist at Sandia National Lab

- Ph.D. in Physics, Yale University
- Project lead developing photonic systems
- Fabrication and experimental photonics
- Nonlinear metasurfaces, optoelectronics, and silicon photonics.
- extensive experience in nanofabrication of silicon and III-V systems, and optical characterization.
- 107 Publications



JACOB BALMA

CO-FOUNDER & CEO

Background Theoretical & Mathematical Physics

Expertise in large-scale machine learning, code optimization, statistical physics, and dynamical systems modeling

Performance Modeling & AI at Cray

15 years in High Performance Computing



ALEJANDRO RODRIGUEZ

CO-FOUNDER & CTO

Ph.D. Massachusetts Institute of Technology

Postdoctoral Fellow, Harvard University

Professor of Electrical & Computer Engineering at Princeton University

Expertise in Condensed Matter Theory, Near-field Radiative heat transfer and Nanophotonics

Authored 190+ academic papers and 8,000+ citations



MIKE KARPE

CO-FOUNDER & CRO

20 years in sales and business development

Expertise in Sales Strategy and Market Penetration

Pivotal role in the successful launch and development of multiple startups

Successful track record of sales growth

Experience leading and building out sales teams

SUMMARY: WHY OPTICAL COOLING

This innovative approach **BYPASSES** inadequate cooling methods, unlocking scalable **PERFORMANCE** and **EFFICIENCY** gains for decades to come.



Remarkable Performance

Enables increased parallel and synchronous processing by 10x, clock speeds by 300x.



Major Energy Savings

Improving energy efficiency by 3x to 5x, leveraging the high efficiency of photonic systems like lasers and LEDs.



Increased Reliability

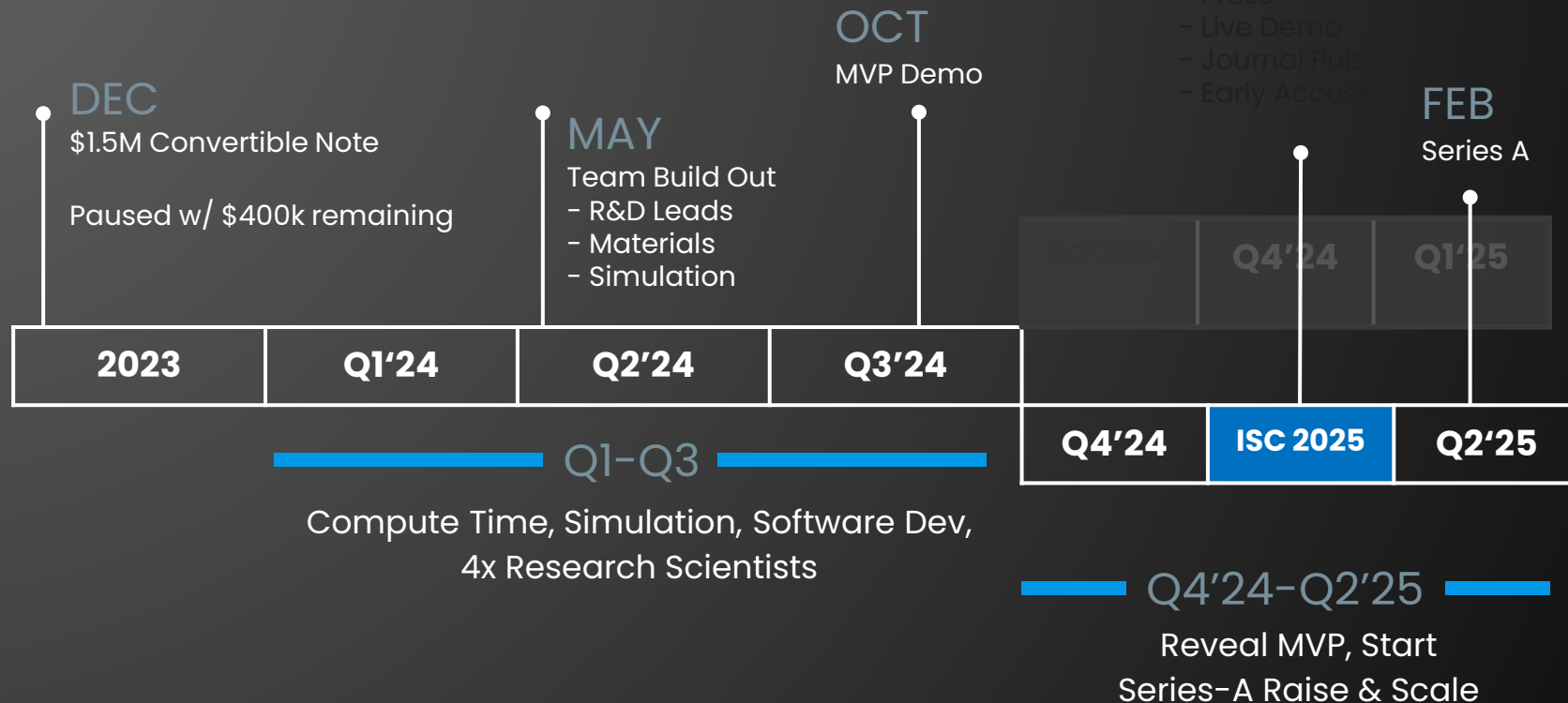
No moving parts or working fluids, greatly impacting the reliability, maintenance, and operational simplicity



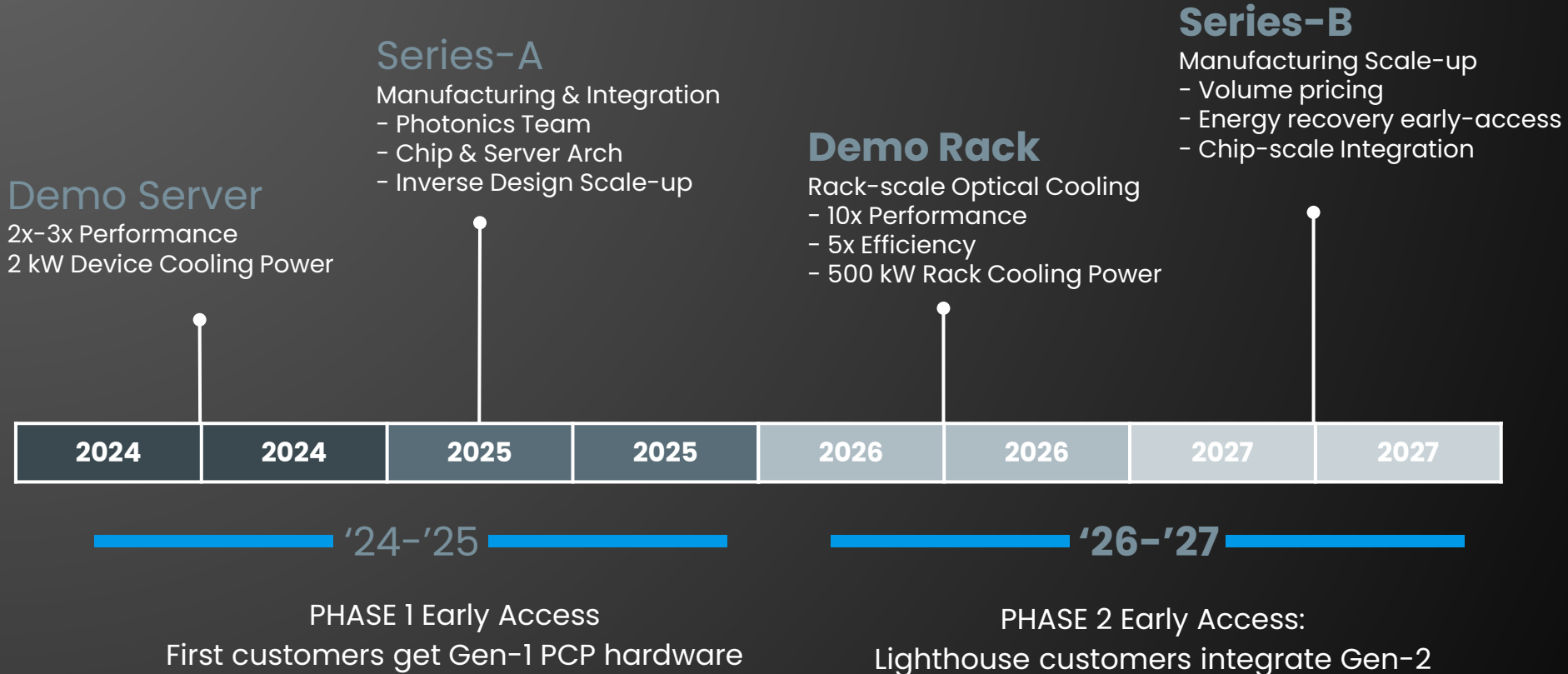
No Spatial Constraints

Leads to 18x increase in computational density, simplifying power management and connectivity within chip architectures.

1-YEAR TIMELINE



4-YEAR TIMELINE



THANK YOU



MAXWELL LABS

DATA CENTER COOLING AT THE SPEED OF LIGHT

Presented by

Jacob Balma, Co-Founder & CEO

Alejandro W. Rodriguez, Co-Founder & CTO

Mike Karpe, Co-Founder & CSO

Contact

mkarpe@maxwell-labs.com

