



How AI, Semiconductors and Photonics Are Coming Together to Create the New Spatial Computing Era

GSA Asia Pacific Executive Forum
November 2025



We Are at the Beginning of the AI + Spatial Computing Era



Mobile Computing



Personal Computing



AI Smartglasses



Head Up Displays



Volumetric Displays



Holographic Walls

AI + Spatial Computing

Combining the physical and digital worlds, allowing users to interact with computing in more immersive and natural ways

But....Existing Display Technologies Are Not Suited for AI + Spatial Computing



Bulky

Geeky

Power Hungry

Expensive

Socially Isolating

Claustrophobic

Difficult to Manufacture

Brain Confusing

Low Resolution

Nauseating

**NOT SPATIAL
and
NOT ADAPTED TO HUMAN VISION**

The Vision for AI Smartglasses – Fashion, Rx, Depth



Fashionable

- Light-Weight
- Thin Frame
- Curved Lenses

Prescription

- 60% need Rx
- Keeps thin lenses

Human Vision Friendly

- Binocular AR
- Dynamic depth
- No VAC



Convergence of 75+ Years of Innovation

1947

The first transistor was **successfully demonstrated on December 23, 1947**, at Bell Laboratories in Murray Hill, New Jersey



Turing lecture to the London Mathematical Society on 20 February 20, 1947



Denis Gabor patents Holography in December 1947 while working at Thomson Houston



Semiconductors

AI

Holography

2025



- Spatial Computing
- AI at the Edge
- Computational Optics

Why Holography?

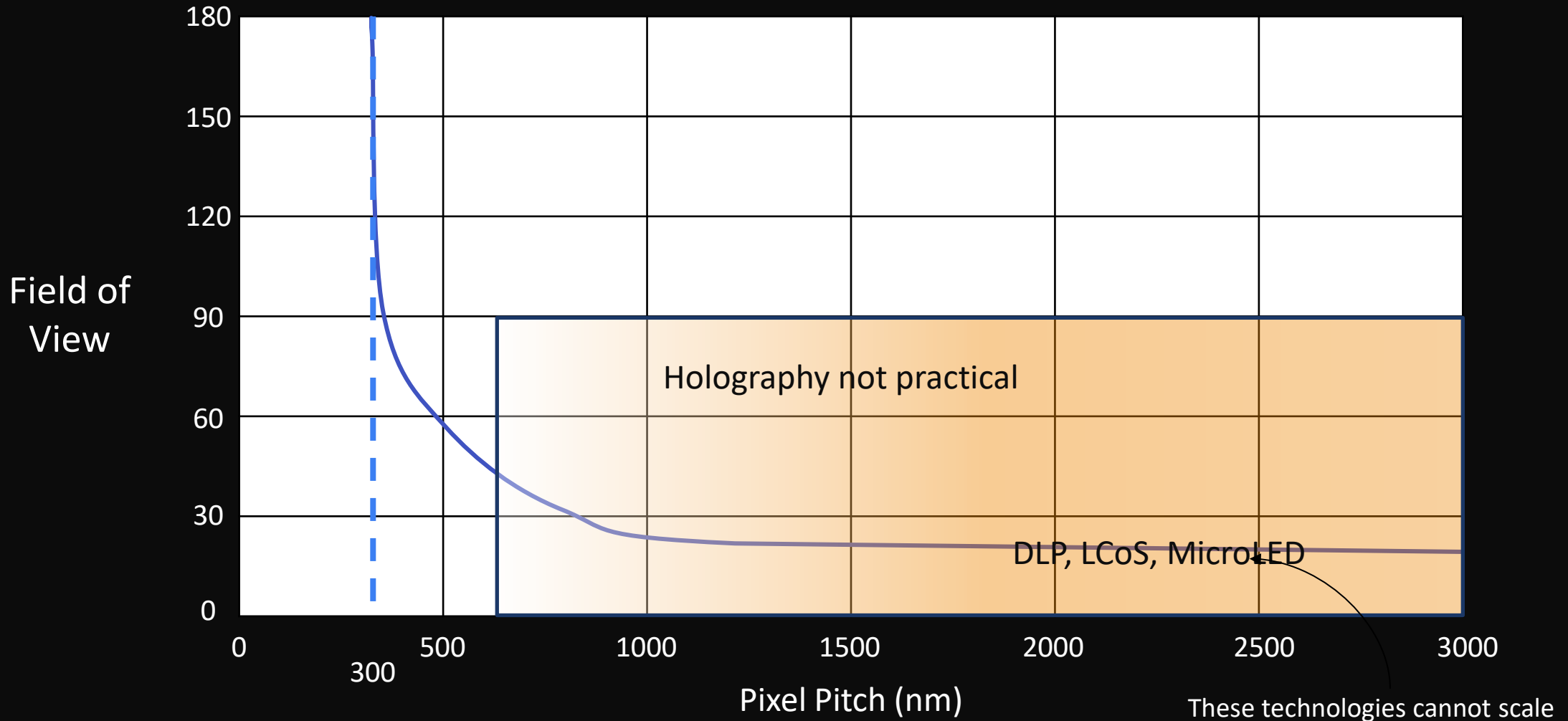
It is the ultimate in 3D
visualization

Replacing Optics
With Pure Compute

& Behaves the Way the
Human Vision Expects



But True Holography Requires a Pixel-pitch $\frac{1}{2}$ the Wavelength of Light...Existing Display Technologies Are an Order of Magnitude Too Large

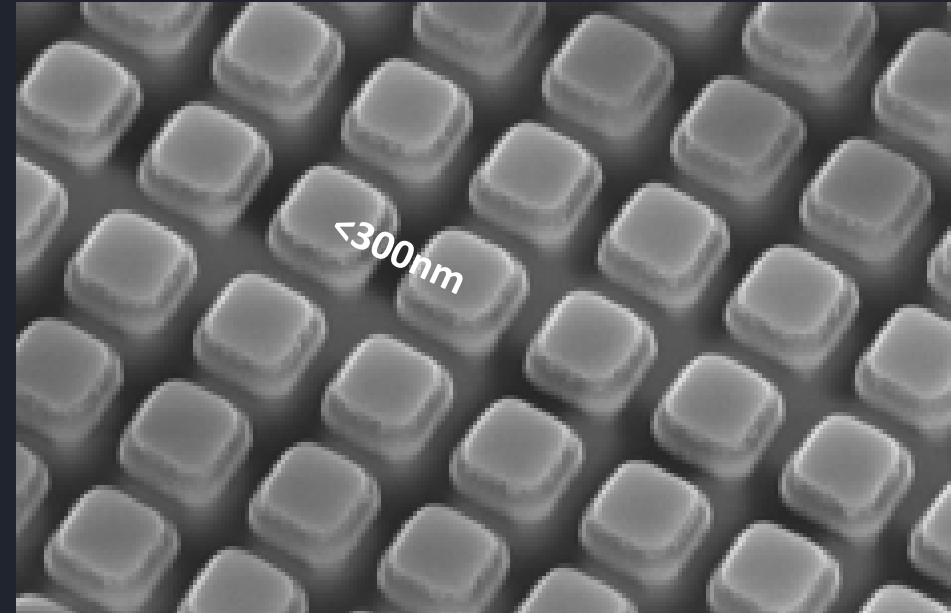


Swave and imec Have
Invented a New Display
Technology

Uses Phase Change Materials as
a Pixel

Low-cost CMOS Foundry Process

1st True Holographic Color
Display with <math><300\text{nm}</math> pitch
nano-pixels

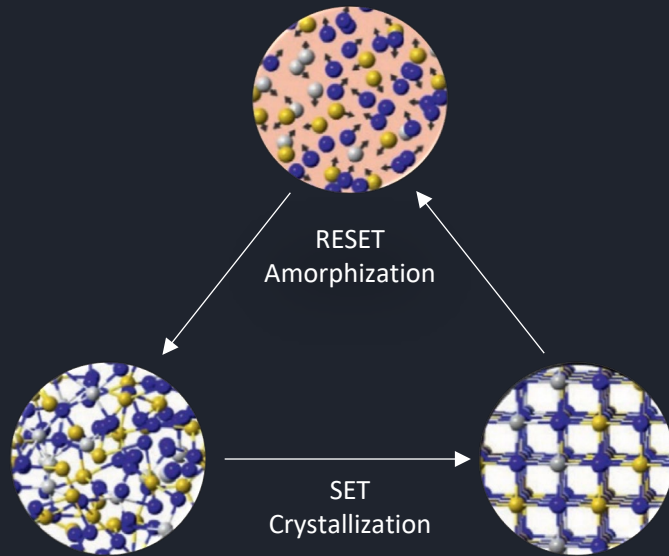


Holographic eXtended Reality (HXR)

A Photonics Breakthrough with CMOS
Economics

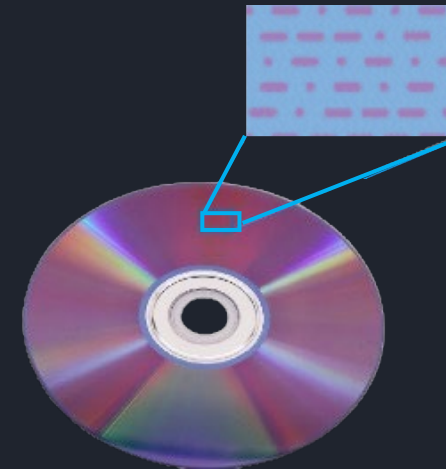
What Are Phase-change Materials?

Phase Change Materials Exhibit at Least Two Distinct Phase States Switched Through Heating

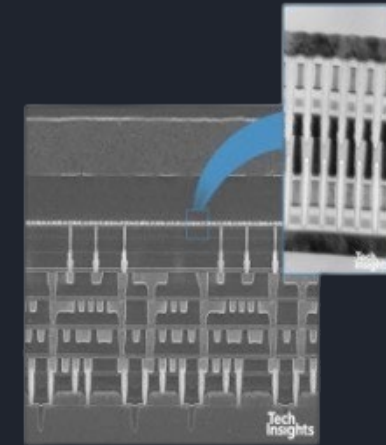


The Phase State Changes Optical Properties Such as Refractive Index

Phase Change Material Has Been Used in Many High-volume Products

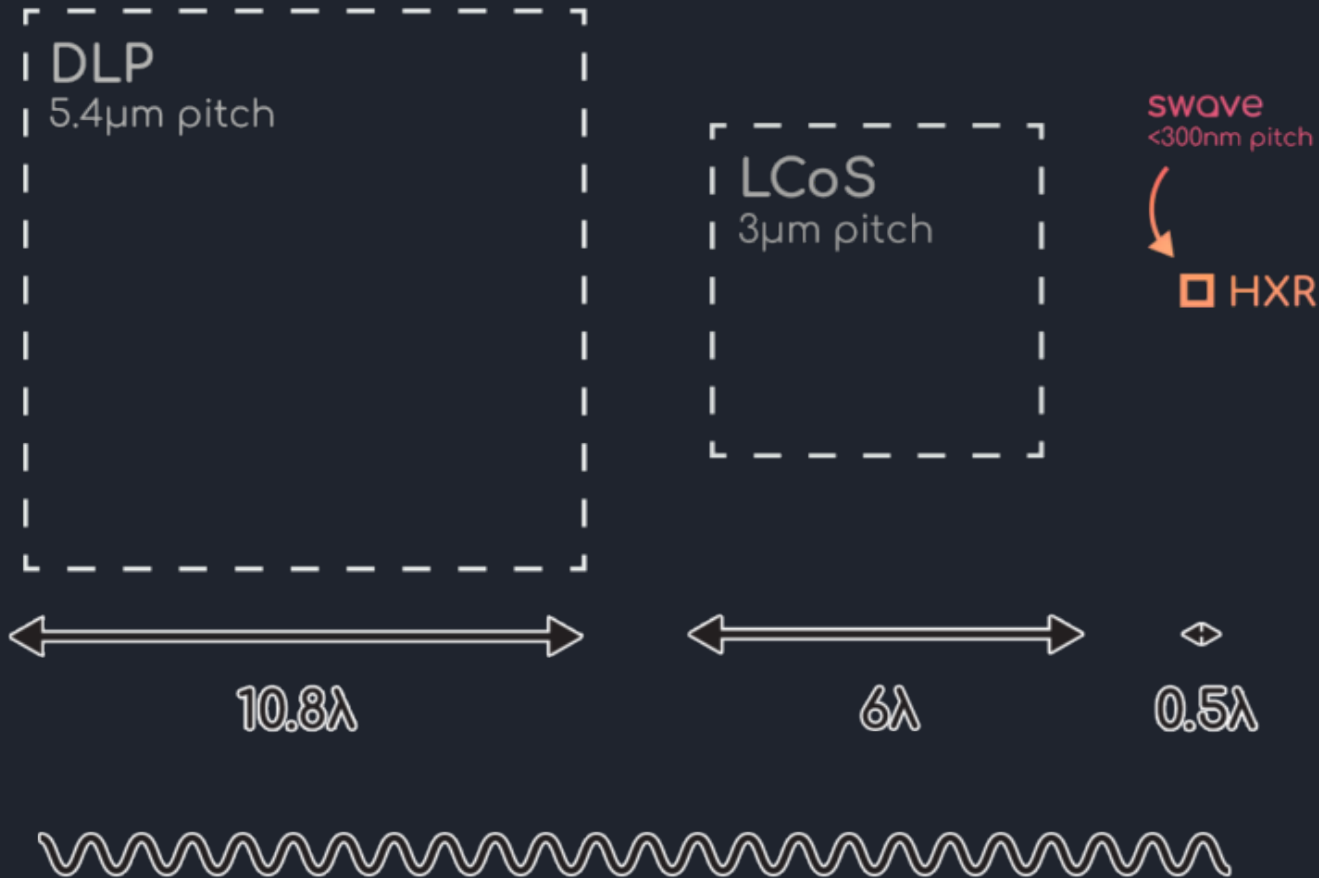


2000's
DVD-R/RW



2010's
Semiconductor Memory

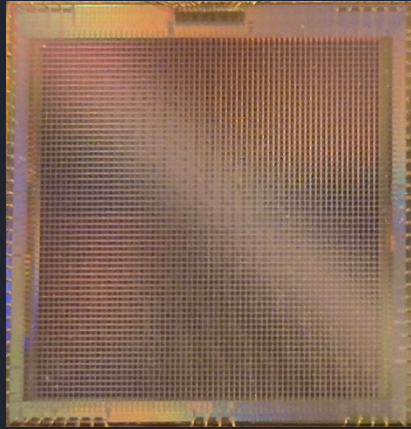
HXR Has the World's Smallest Pixels



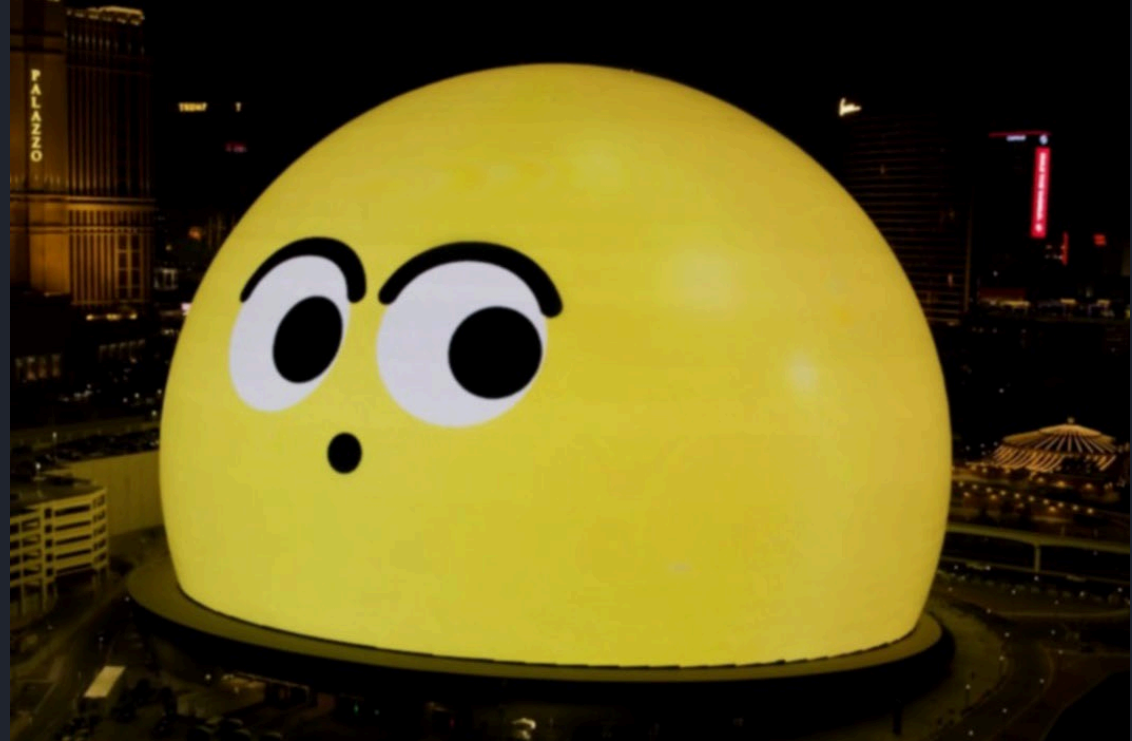
Swave Nano-Pixels are
>450x smaller than DLP and
>170x smaller than LCoS

The only pixel small enough to steer
light and enable true holography.

>120° beam-steering ability



HXR "Onyx" SLM
256 Million nano-pixels
7 x 7 mm die
UMC 22nm
300mm Wafers



As Many Pixels as the
Sphere in Las Vegas

HXR Will Make AI Smart Glasses a Mass Market Reality



Fashionable,
Lightweight,
Comfortable, Truly
Useful

Delivering
Breakthrough
Performance &
Features

At Breakthrough
Cost

- < 50g
- > All-day battery life
- Binocular
- 3D Without VAC
- Dynamic Focal Distance
- Prescription Glass Compatibility
- Curved Lenses Compatible
 - No waveguide

<\$50 BOM

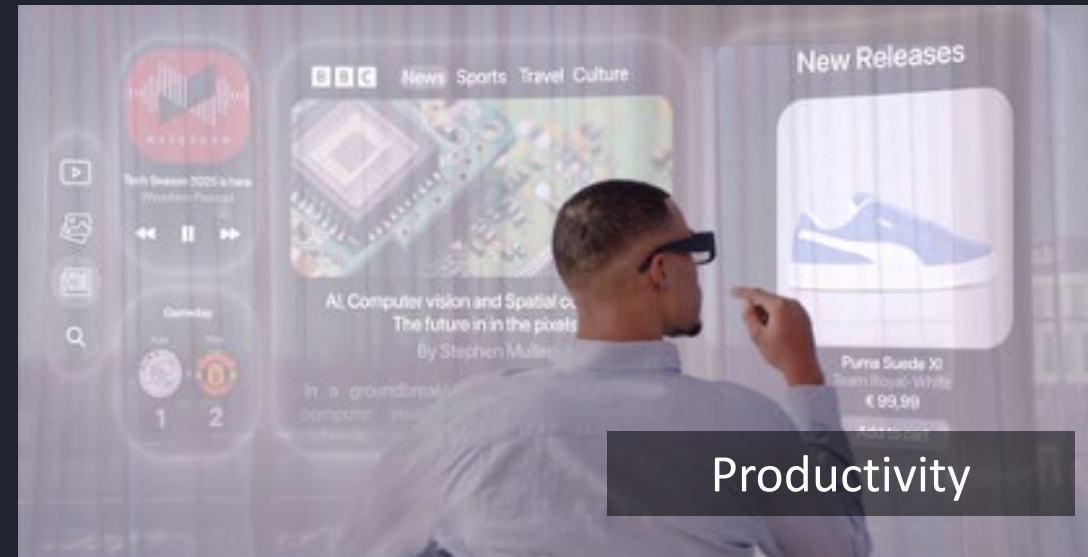
Today, we experience the world through the lens of the camera...



the lens will become AI Smartglasses



AI Smartglasses Will Enable Visual “Superpowers”



HXR is not Just for AI Smartglasses

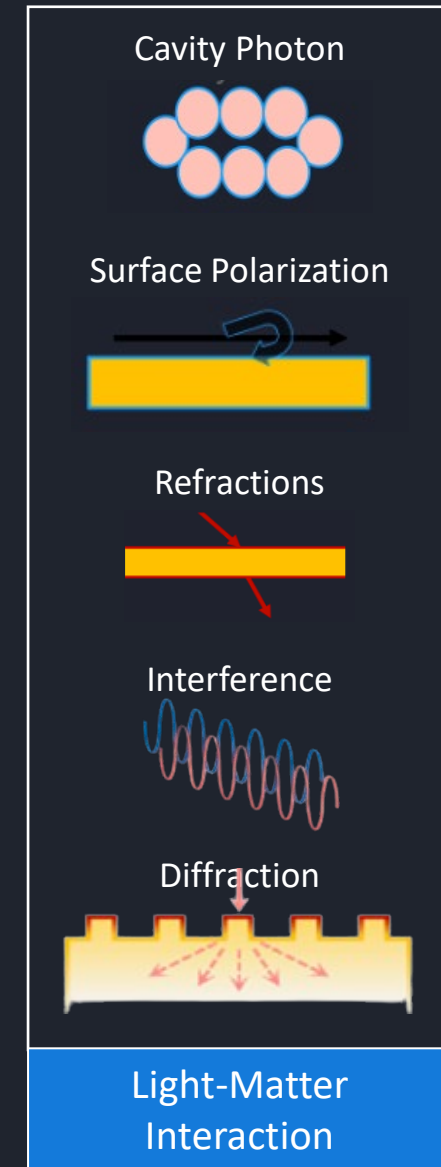
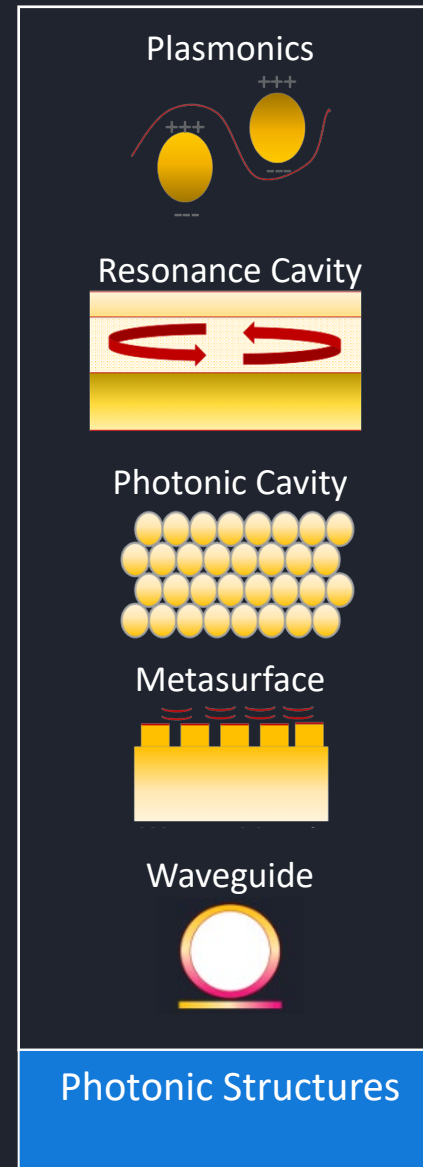
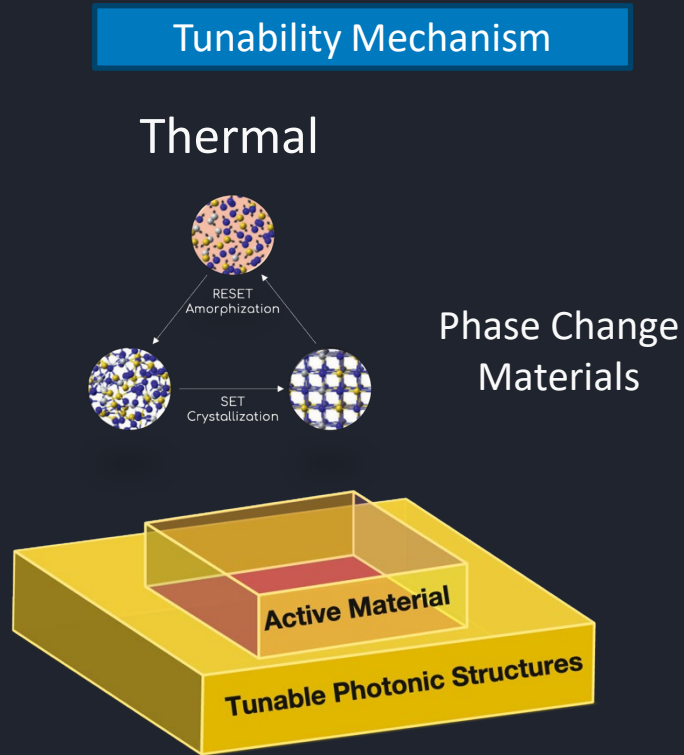


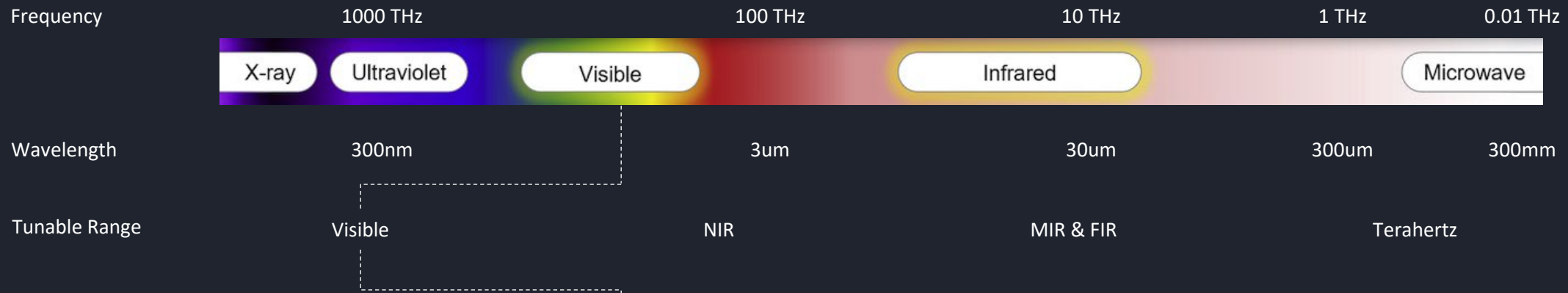
Projection Mapping for
Physical AI



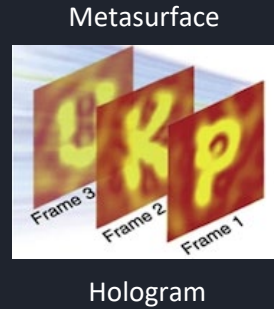
Heads-up Displays for
Automotive

This is the Beginning of the “Tunable Photonics” Era

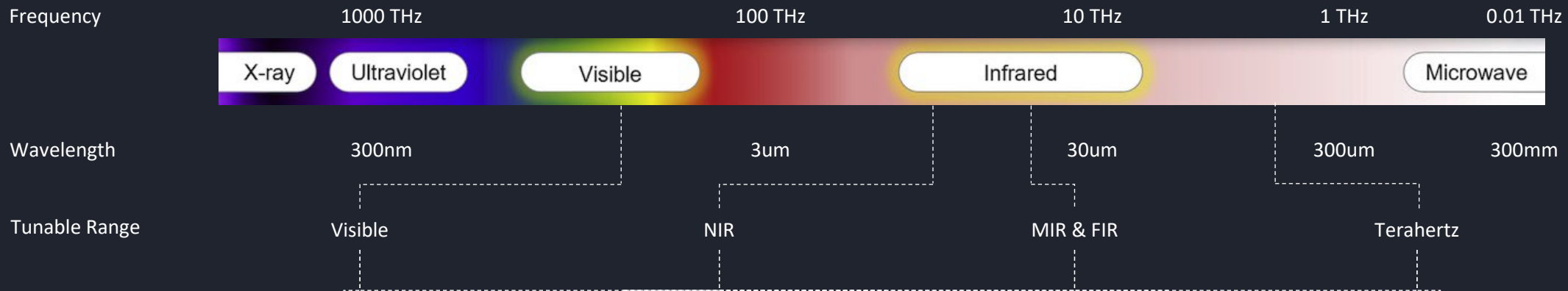




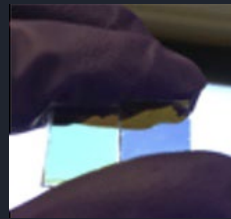
Phase Change Tunable Photonics Have Many Applications Beyond Holography



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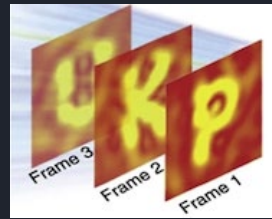


Structural Color



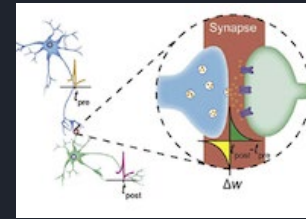
Tunable Color Filter

Metasurface



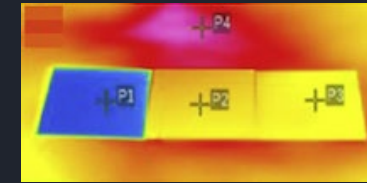
Hologram

Photonic Memory



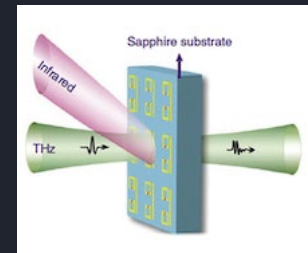
Photonic Synapse

Thermal Radiation

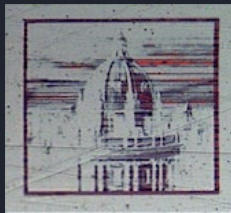


Infrared Regulator

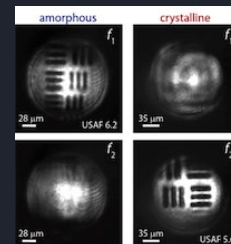
Terahertz Plasmonic



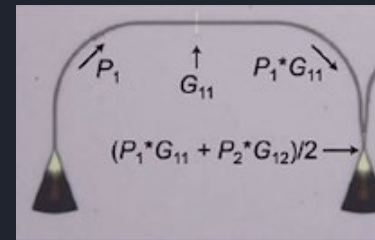
Phase / Amplitude Modulation



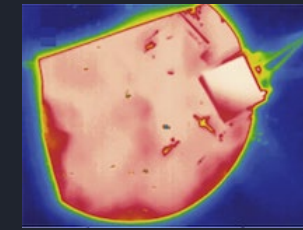
Dynamic Display



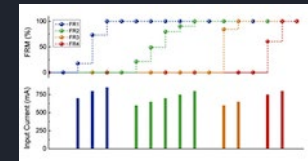
Metalens



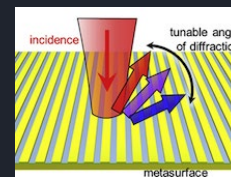
In-memory Compute



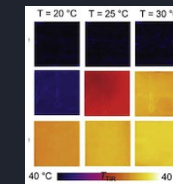
Thermal Camouflage



Multidimensional Manipulation



Wavefront Engineering



Self-adaptive Cooling

We are at the Beginning of the
AI + Spatial Computing Era

Convergence of 75+ Years of Semiconductor, AI, and
Holographic Innovation

AI Smartglasses Will Enable Visual “Superpowers”

This is Also the Beginning of the “Tunable
Photonics” Era

Photonics Breakthroughs with
CMOS Economics





Thank You