The Role of New York Photonics in Upstate Revitalization

Visitor Industry Council

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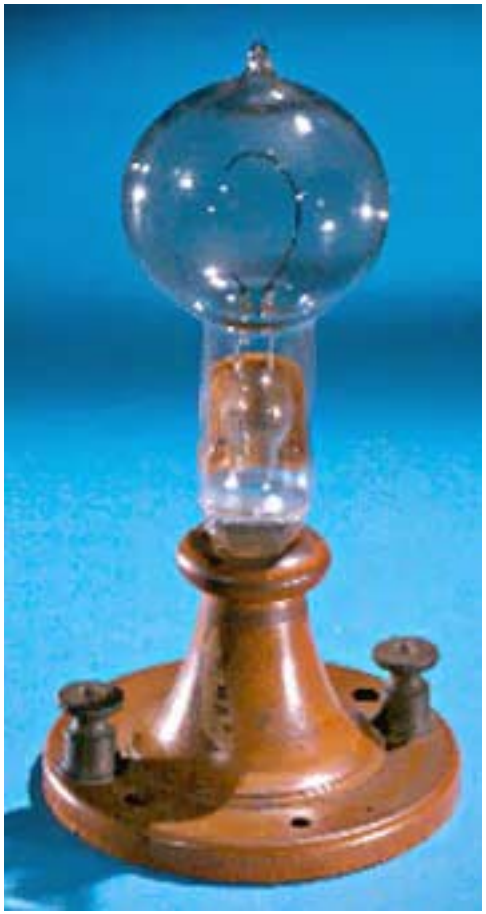

"We are striking it big in the electric light, better than my vivid imagination first conceived. Where this thing is going to stop Lord only knows."

-Thomas Edison,1879

Electric Light, 1882

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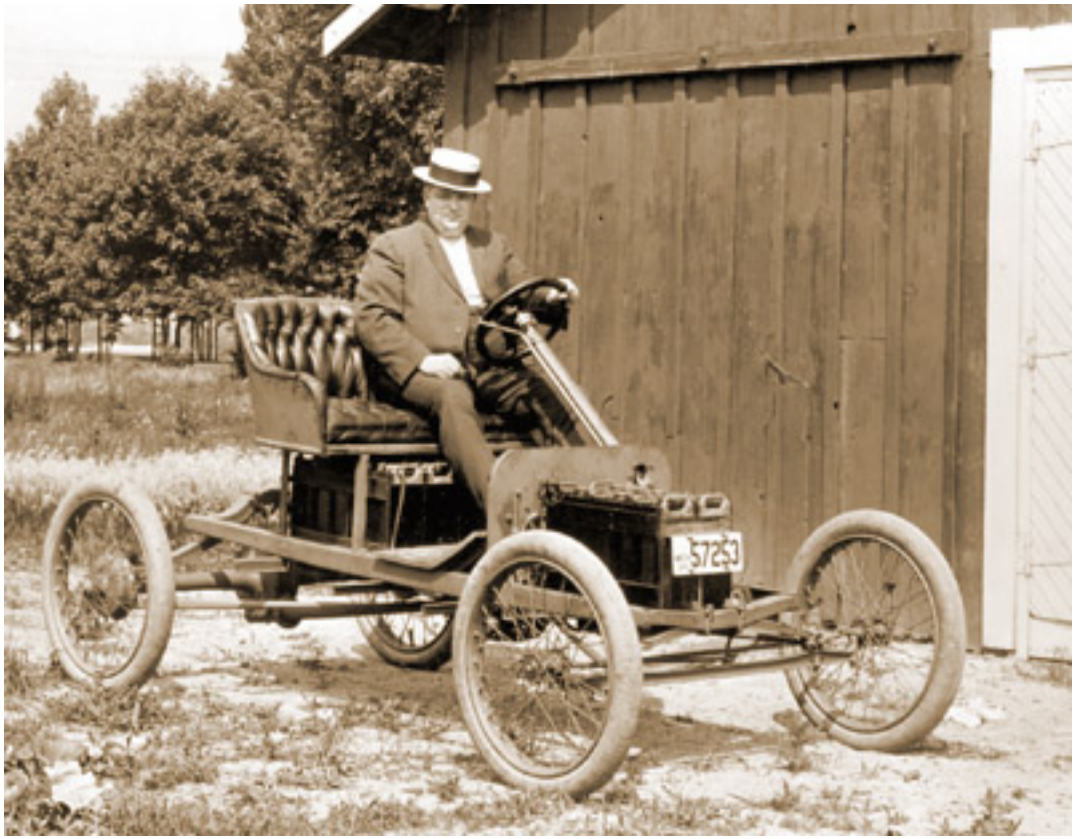

Electric Car, 1914

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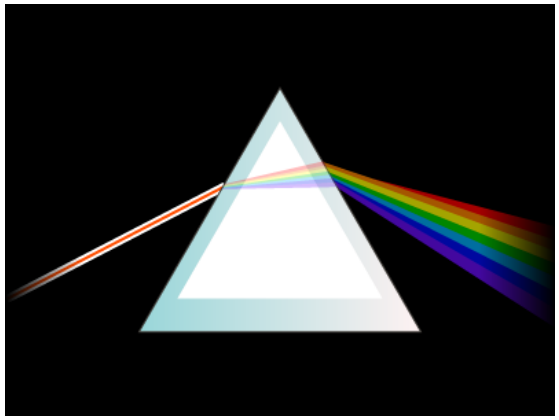
- Electron – Electronics
- Photon – Photonics



- Electronics: the generation, transmission and management of electrons.
- Photonics: the generation, transmission, detection and sensing of light (photons).

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Words to live (and profit) by

- The 20th century was the century of the electron
- The 21st century is the century of the photon!

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Photonics

Everything that we accomplished with electrons we are now trying to do with photons, or a combination of the two

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What is a cluster?

"A Cluster is a concentration of firms across *several* industries that create quality jobs, export, share common economic foundation needs, the public sectors of economic development, legislators, universities, community colleges, K-12 educational community, workforce development, ***support foundations***, and all community economic stake holders."

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BITS OF REGIONAL HISTORY

- Bausch & Lomb 1853
- Eastman Kodak 1880
- Optical Society of America (OSA) 1916
- Institute of Optics 1929
- XEROX 1946 (Haloid 1906)
- Laboratory for Laser Energetics 1970
- Center for Optics Manufacturing (COM) 1989
- Center for Electronic Imaging Systems (CEIS) 1993
- New York Photonics / RRPC 1998
- Center for Freeform Optics (CeFO) 2013
- AIM Photonics 2015
- Upstate Revitalization Initiative 2015

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NATIONAL PHOTONICS EFFORTS

- Harnessing Light 1998
- Optics & Photonics, Essential Technologies for Our Nation 2012
- NNMI Rochester Photonics Charrette (POMATEC) 2013
- National Photonics Initiative (NPI) 2013
- AIM Photonics 2015

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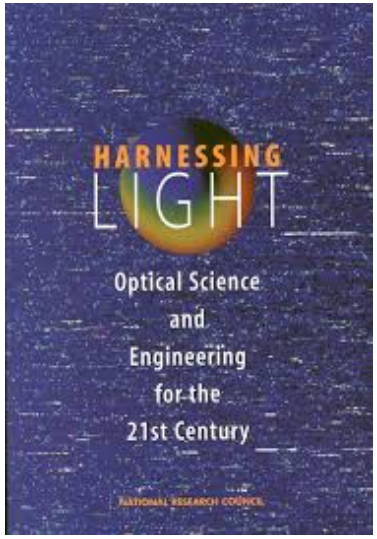
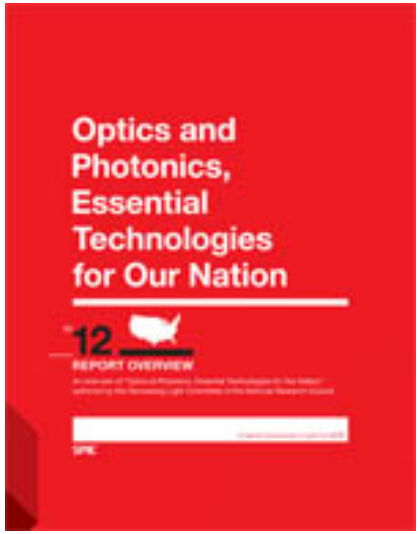
Photonics for the Nation



1998



2012

2013

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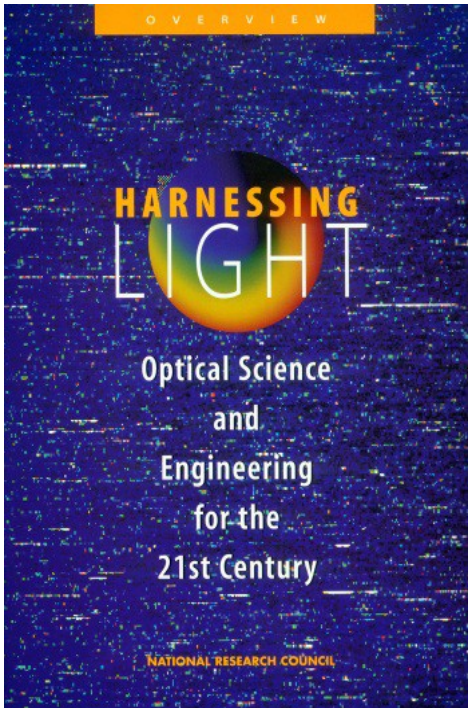
Harnessing Light - 1998



1998 study commissioned by Congress described optics as a critical enabler for technology that promised to revolutionize the fields of communications, medicine, energy efficiency, defense, manufacturing, and science.

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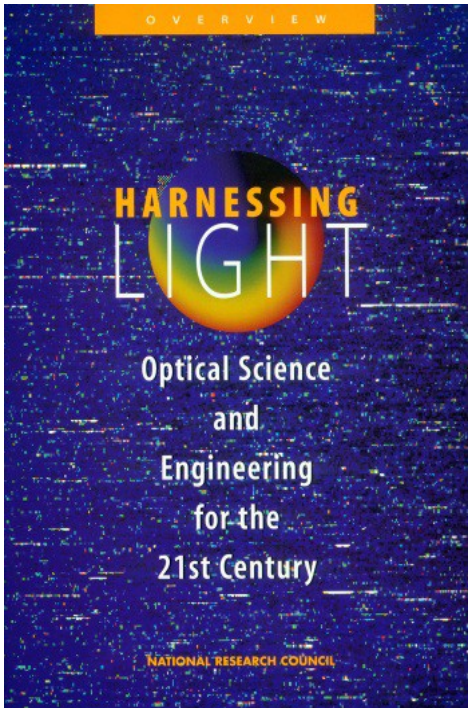
Harnessing Light - 1998



- Some nations saw the Harnessing Light study as a call to action
- In the United States, where Optics and Photonics are not clearly defined as an industry sector, not so much
- NY Photonics companies and universities played important roles in continued development

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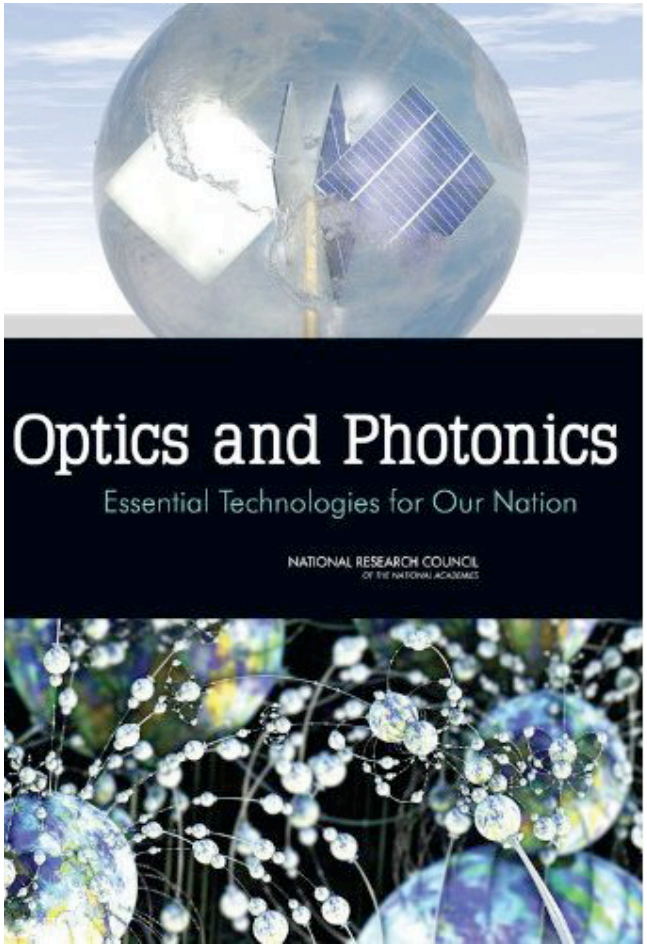
NRC Report - 2012



- 2012 National Research Council report highlights the importance of Optics and Photonics to the U.S. economy and national security. Critical application areas include:
  - ✓ National defense
  - ✓ Healthcare
  - ✓ High speed data communication
  - ✓ Precision metrology
  - ✓ Advanced manufacturing
  - ✓ Energy
- **Optics and Photonics is key to 2% of U.S. public companies:**
  - ✓ **10% of public co. revenues (>$3 trillion)**
  - ✓ **6% of public co. jobs (~7.4 million)**

Data: SPIE

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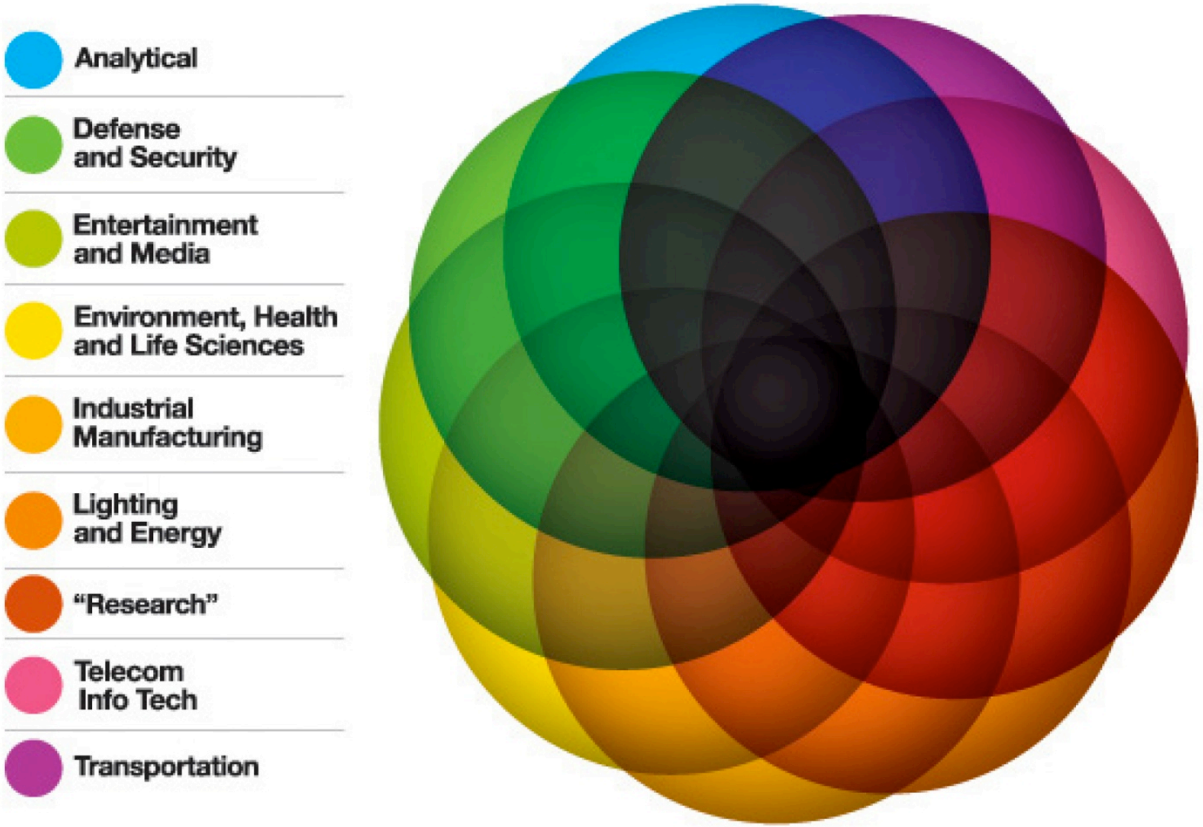
Where are optics and photonics?



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Medical

Automobile

Ophthalmology

Communication

Lasers

Computers

Ground-Based & Space-Based Telescopes

Defense

Homeland Security

Image Processing

Environmental

Security

Scanners, Bar Chart Readers

Door Openers

Optical Fiber Local Area Networks

Laser Printers

Optical Data Storage

Optical Inspection for Labeling and Packaging

Optical Scanners

Infrared Remote Controls

Optical Switches

Phototypesetting

Energy-Saving Fluorescent Lamps

Optical Motion Sensors for Security

Overhead Projectors

Credit Card Holograms

Rapid prototyping (3D printing)

Laser Welding and Cutting

Fiber Optic Telephone Cables

Internet Communication

The Microchip

HDTV

Lasers Diodes

LED displays

Satellite-based Weather Imaging

The Hubble Space Telescope and its retro fittings

Digital Video Cameras

Digital Still Cameras

Television Displays

Optical switches in petroleum industry

Fax Machines

Photo Scanners

Compact Disc Players

Laser Pointers

Electron Microscopes

Optical Inspection

Wireless mouse

Projector Lenses In Integrated Circuits

iPhones, Ipads

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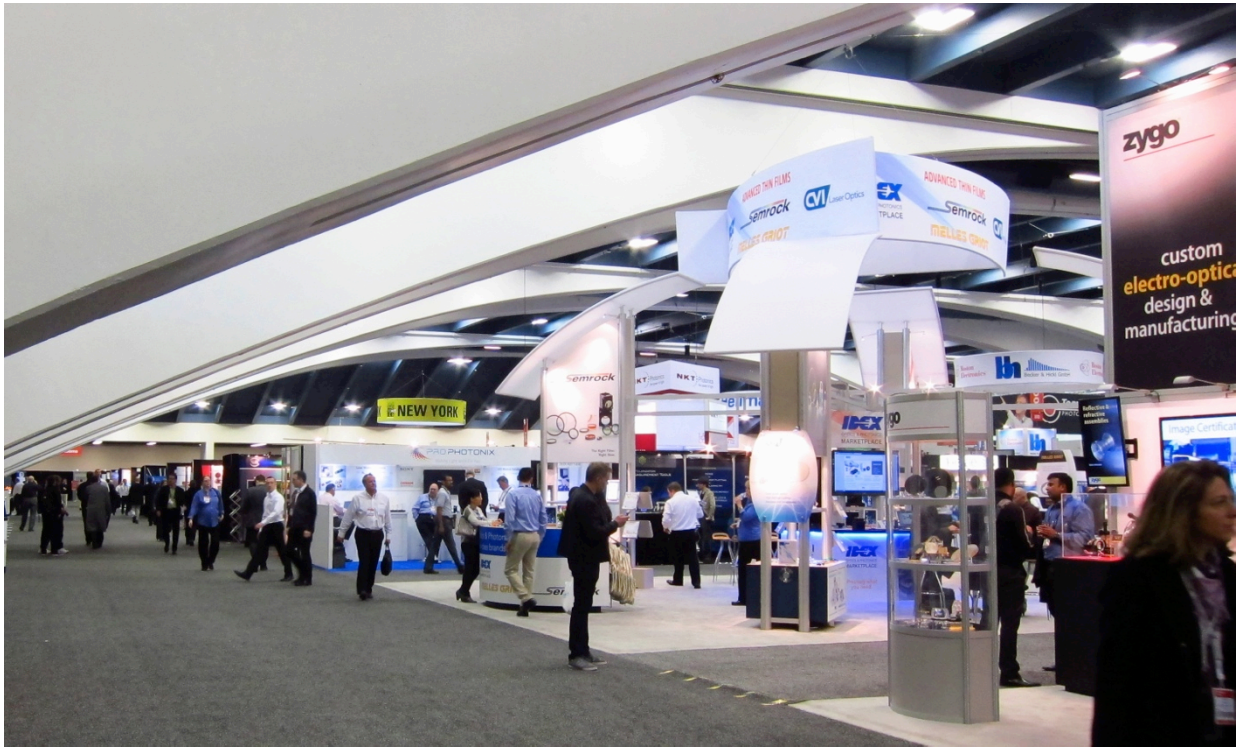
Photonics West, San Francisco

- Largest Photonics Conference in the world: 1260 exhibitors; 21,000 attendees; six days of meetings, conferences and technical meetings.
- 76 exhibitors from New York State, most from Finger Lakes



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Photonics West, San Francisco

1008 companies represent $84 bn of global photonics core components sales

Total Global Photonics Sales of Core Optics & Photonics Suppliers at PW 14	
Companies	1008 [1]
Annual Revenues	$83,738 M [2]
Employees	337,049 [2]
Average Sales/Employee	$248,446

[1] *Photonics firms at PW that ship optics and photonics components and for which D&B data are available.*

[2] *Company revenues and employment are prorated based on estimates of actual photonics-related sales* ("Photonics Factor"). *Companies with sales of less than $10 M are assumed to be 100% photonics; all revenues and job data are for 2012.*

SPIE

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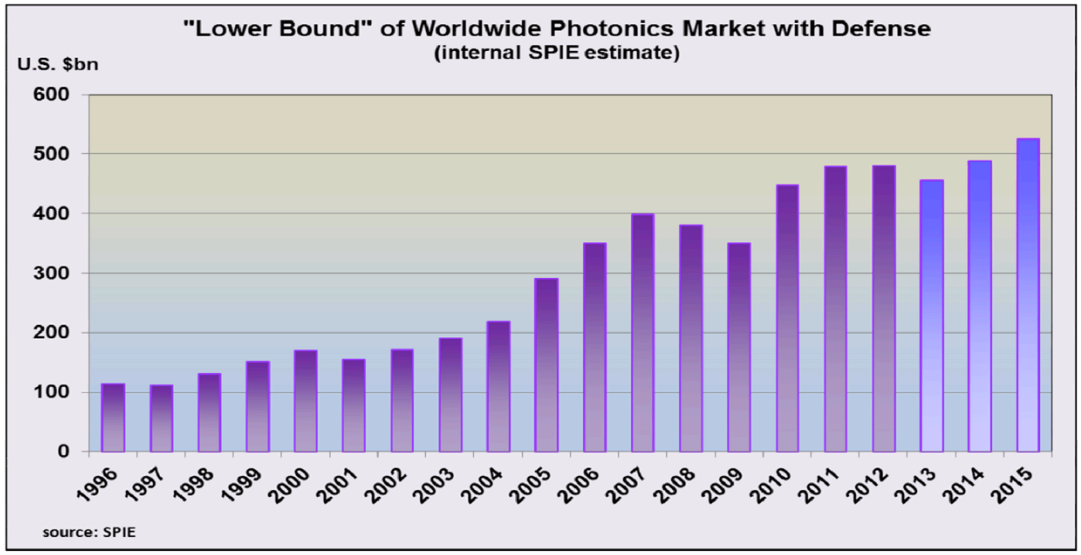
Photonics West, San Francisco

Photonics West exhibitors represent ~18% of the WW market for photonics products: $480 Billion



SPIE.

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Photonics in the Rochester Region

- Independent research by SPIE says that 56 photonics **companies from the New York State** account for:

  $8,854,446,962 in sales
  33,028 employees

- Independent research by UR says ~60 **companies from the Rochester** region account for:

  $~ 3,000,000,000 in sales
  17,000 employees

SPIE: International Society of Photonics Engineers
UR: CEIS, Center for Emerging and Innovative Science

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Photonics in the Rochester Region

- 120 OPI Companies, 17,000 employees
- Over $3B in annual sales
- 5% - 7% annual employment growth in OPI SME's < 500 people
- Monroe Community College Optical System Technology Program, developing technicians for the optics and electro optics workforce
- Responsible for educating 70% of the Optics PhD's in the nation
- **1 in 14 households supported by the industry**

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Photonics in the Rochester Region

- Home to the nation's Laboratory for Laser Energetics
- University of Rochester Institute of Optics
- Rochester Institute of Technology Imaging Sciences and Microelectronics
- Bi-Annual Navy SBIR optics conference
- OptiFab, the only optical fabrication conference in the U.S.

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Photonics in the Rochester Region

- Responsible for generating a vast numbers of the nation's patents in optics, photonics and imaging technologies
- Very high per capita patent rate, among the highest in the nation
- 95% of OPI patent holders still live in Rochester

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Photonics in the Rochester Region

- The most robust, sophisticated and highly integrated optics, photonics and imaging supply chain in the nation
- Top suppliers and builders for machine manufacturing, metrology, nanotechnology, semiconductor, biomedical, consumer electronic, military / defense, laser, research, automotive, mapping, geospatial imaging, entertainment, unmanned systems and other OPI products

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Photonics in the Rochester Region

All of this existed *prior to* the announcement of AIM Photonics and the Upstate Revitalization Initiative.

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AIM Photonics Partners

Government

Industry

Tier 1

intel · United Technologies · GE · infinera · hp · IBM · ACACIA Communications · AnalogPhotonics · SYNOPSYS · CISCO · IQE · cadence · Mentor Graphics

Tier 2

CORNING · aurrion · TE connectivity · LOCKHEED MARTIN

Tier 3

4D · HARRIS · BOEING · Nistica · KEYSIGHT TECHNOLOGIES · NORTHROP GRUMMAN

Academic

Tier 1

SUNY Polytechnic Institute · UCSB · MIT Massachusetts Institute of Technology · Columbia University · UC Davis University of California · RIT · University of Rochester · The University of Arizona

Tier 2

Berkeley · UC San Diego

Tier 3

Caltech · Stanford University · Boston University · University of Virginia

Trade Associations

NEATEC · SPIE · semi · OSA · Institute · OP-TEC · PHOTONICS

Committed Participants and Supporters

Photonics · Rockwell Collins · Honeywell · ficontec · Raytheon · samtec · PROMEX Industries · OPTIMAX · OptiPro · SYDOR · Juniper · Texas Instruments · Seagate · NAVITAR · CISCO · LaserMax · Micron · NEW SCALE TECHNOLOGIES · Chiral Photonics · FREEDOM PHOTONICS · RPC Photonics

- 55 companies, 21 States, 20 universities, 33 Community Colleges, 16 other organizations
- $110M federal investment and ~$500M cost share
- Strong tech transfer, workforce education & STEM focus

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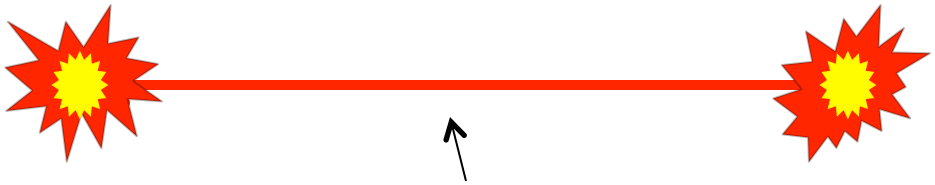
What are they all doing?

Information:

- “The cloud”
- Netflix
- Facebook
- Sum total of human knowledge
- A percentage of 657 billion photos per year



Internet backbone: fiber
Data transmitted on light

You:

- Smart phone
- iPad
- Computer
- IOT

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AIM Photonics

Information:

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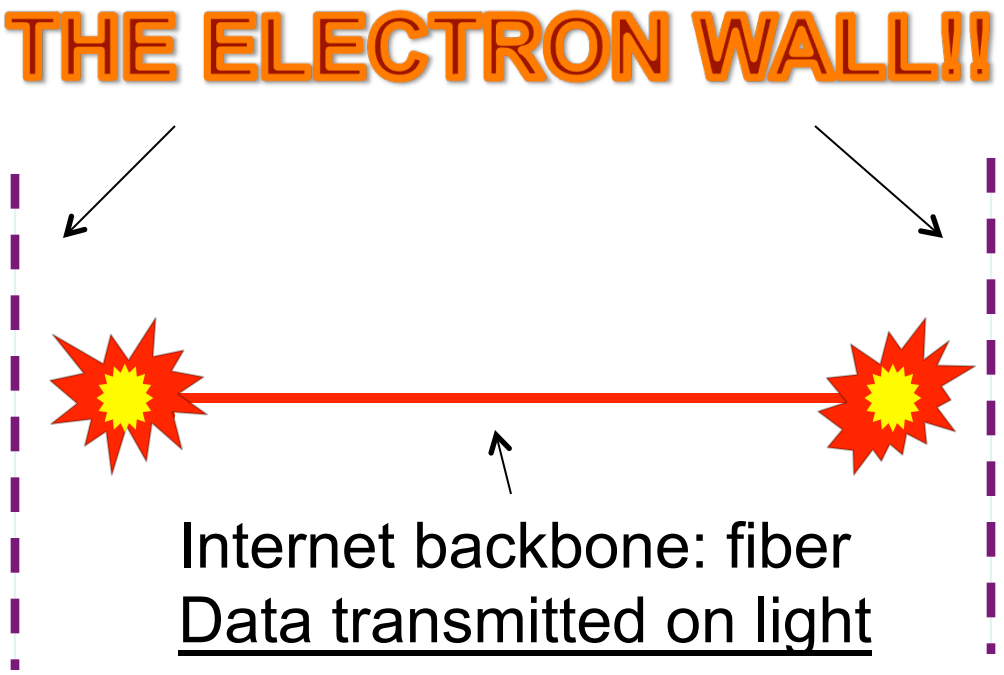

You:

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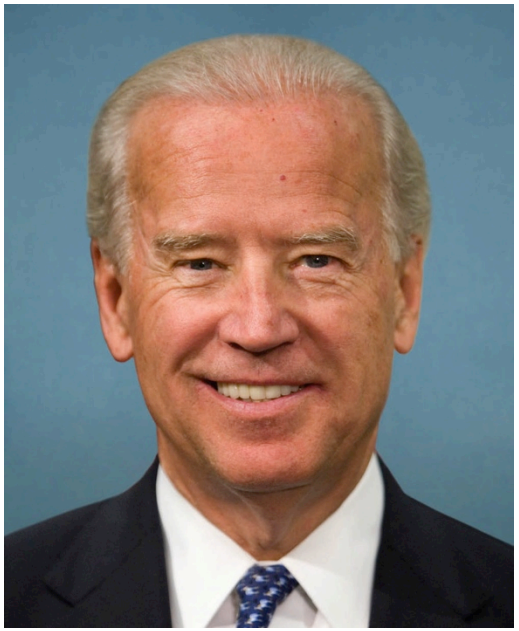
Bullish on Optics & Photonics



Bullish on Rochester's Optics and Photonics Future

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Bullish on Optics & Photonics

Optics & photonics!

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