

Si Photonics Integration for Middle school

(draft ---before class--)

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- Sajan Saini, PhD
- ec-discuss subgroup that replied to(my email
- Sanja Simonovic, Joseph Okoro (made me think it is cool)

History of knowledge about light and warm up

First part is bringing into context why this course. To do so, I am including in notes on human encounters with light and why light is so much essential to us that we take it for granted.

Starting with primitive light usage without understanding light to understanding something about light and making our own lights, then transmitting information using light, cutting things with light to bridge to the future of light at the end of the lecture.

1. Just sun(day/night)

Human probably saw light from sun and depended on it for their day and night. Light from the sun, made their day bright and made their plants grow and it still does to us.

This part, I am taking you from early encounter of light to current encounters of light in our daily lives. From unmanipulated forms to highly sophisticated systems of light

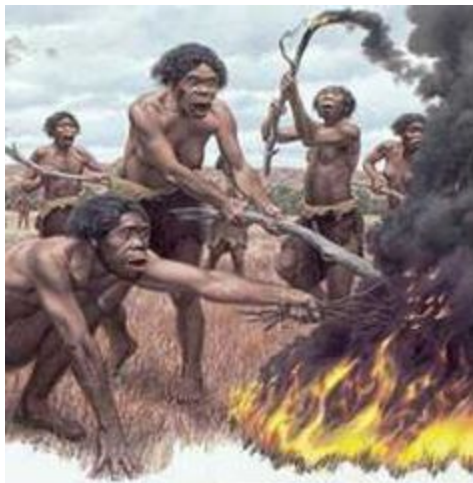
If there is any worst case imagination to humankind on earth is <sun not shining> without talking about things physicists say on what can happen. Take everything as normal, but Natural light is off. We can not make anything <just anything>

We still take for granted light as much as our primitive selves(Humans long ago?) did, but we have some minor things to do with light than them(that's what this class is mainly about)

2. Light(from burning) --fire

Have you taken Human history ? we ate fruits, burned things up< we still cook things up> even you some cookers today are not based on wood burning, but first fire encounter was also a light encounter. With Light of this kinds, it allow persons to have a longer day, but working during day time and having night ceremonies or gatherings around fire(at least in rwnda, I was told they gathered around fire)

[They were excited about this new life](#)



<https://s-media-cache-ak0.pinimg.com/236x/3b/6a/ba/3b6abaa25f010ef69badef19f20958c3.jpg>

3.Light bulbs

Light bulbs invention

...

4.Waveguiding(snell's law)

Light travel in medium at different speed

5.Science of light <EM wave, particle>

1. [Maxwell's equations](#) of Electromagnetic waves. Light is just an oscillating Electric and Magnetic waves.

I am not trying to teach you Maxwell's mathematical formulas, but what it meant to people doing things with lights.

2. Light as [photons](#)< particles of light>

Light energy quantized

- a. Certain light waves have enough energy to do something that others can't no matter how much light you have
- b. For example Blue light might be able to eject electrons from a surface of certain metal that red can't

6.Laser

LASER="light amplification by stimulated emission of radiation"

Pure light vs impure light

General Manufacturing and technological trends(electronics industry as focus)

- 1.Sizes that humans were working with<shrinking over time>

1. Do you have phones?

2. How large do you think first computers were ?

Current phones are cheaper, and more powerful than a computer that was as big as room in terms of what it can do.

How is that possible?

- 2.Cost vs number of units

- 3.Electronics case

1. Moore's law and fundamental limits

Light technologies at work

More to time work <Light>

Can you imagine life without artificial light? In our rooms. Some parts of the world still see light as the first two light source, sun and burning. They have less to be productive and using light is at night is not fun. With current technologies, it possible to have light 24 hours a day compared to sun that has average of about 12 hours.



<http://www.strengthleader.com/wp-content/uploads/2011/11/fire.jpg>

Extra Eye(Microscopes,and other imaging things)

1. [Light microscope](#)

Allowed people to see things their eyes could not see and helped learn more of about small things(this is an old tech)

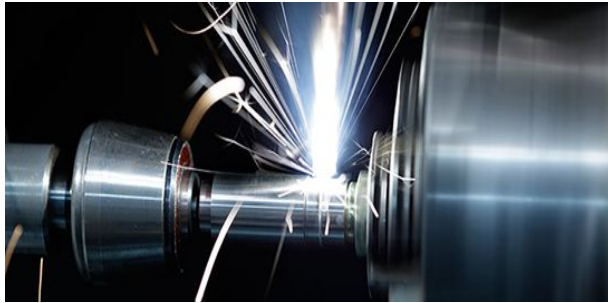
Extending definition of light to EM waves, you can not count all technologies using light



https://upload.wikimedia.org/wikipedia/commons/b/b1/Optical_microscope_nikon_alphaphot_%2B.jpg

2. Extra arm (Laser cutting and stuff)

With laser's short bandwidth < less spreading out >, Light energy can be concentrated on point to cut, weld or do whatever



https://www.rofin.com/fileadmin/_migrated/pics/laserschweissen_laserwelding545x217.png

3. In Communication (Replacement for electrical wires)

It is nothing more than switching light off and on and instead of lighting the space around, you guide the light in certain way. To move only in the optic fiber cable. It is light switching a light and letting pass through the path to a new place. In communication it is just switching light on and off <nothing else>



<http://www.cables-solutions.com/wp-content/uploads/2016/06/Fiber-Optic-Cable.jpg>

Integrating light technologies into electronics

1. Some of current challenges in electronics

2. Light in communication

1. Encoding and decoding
2. Transmitting

2. One of light proposed solutions (Will it work?)

What's up?

Why?

How we got here?

Need for High-way
What is traffic Jam?

3. Why light is still doing all this for us

a. Brainstorm what light can light for you? <Homework!, or class conclusion

b. Wait..... what's is actually light? <whatever>

Disclaimer:

This stuff are not 100% accurate, It to give you idea, but I assured as i can not lie

Reading lists after class:

1. **Photonic Networks-on-Chip: Opportunities and Challenges**(http://www.cs.columbia.edu/~luca/research/pnocs_ISCAS08.pdf)
2. **Light experiments simulations**
https://phet.colorado.edu/sims/html/bending-light/latest/bending-light_en.html
3. <https://www.technologyreview.com/s/601441/moores-law-is-dead-now-what/>