

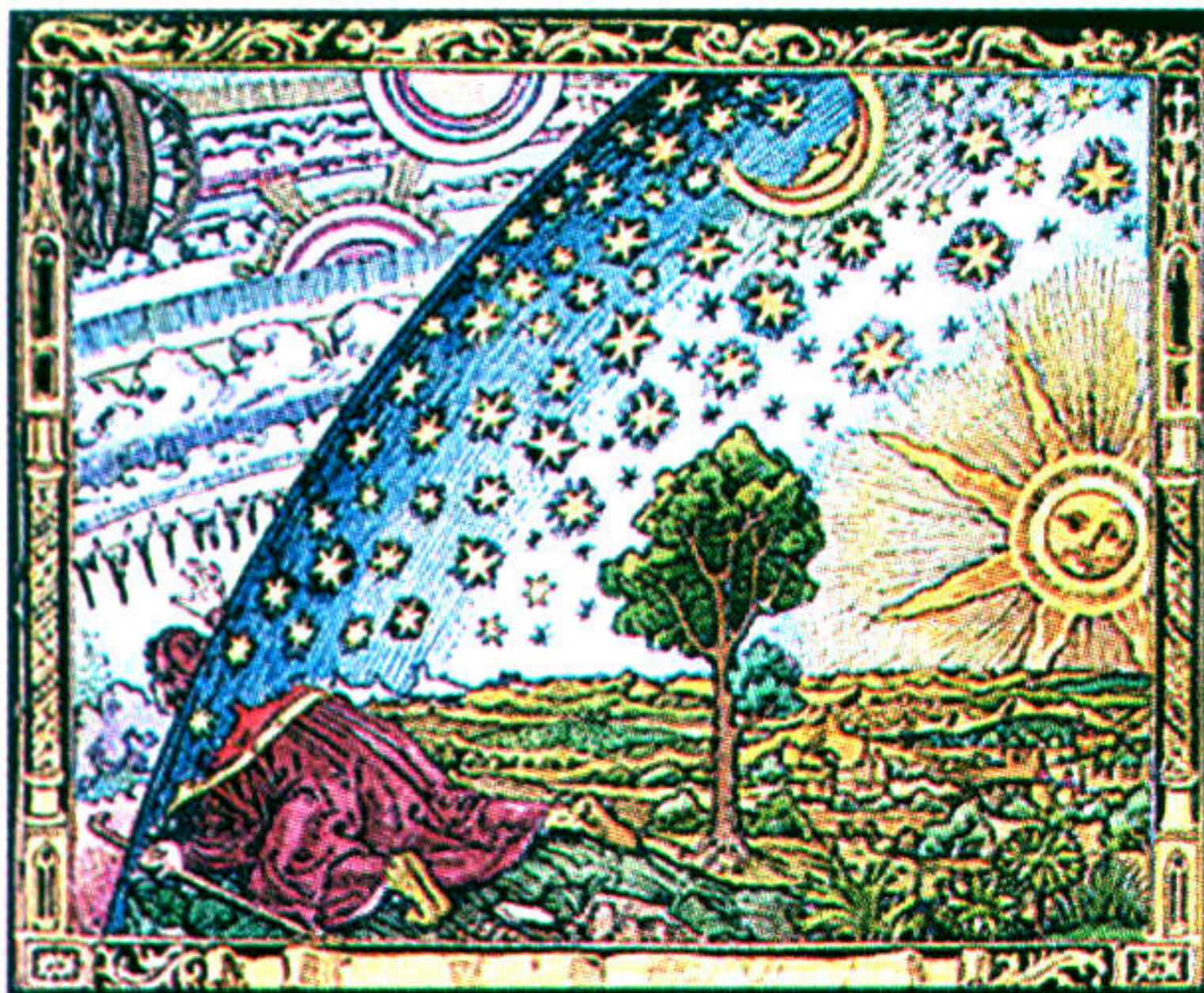


OPTRICKS & OptoBotics®

Donn Silberman

2007-2008 President & Fellow; Optical Society of Southern California
Founding Director; Optics Institute of Southern California
Advisory Committee Chair, UC Irvine Optical Engineering
Sr. Applications & Sales Engineer, PI-USA
Sr. Member; SPIE
Sr. Member, OSA

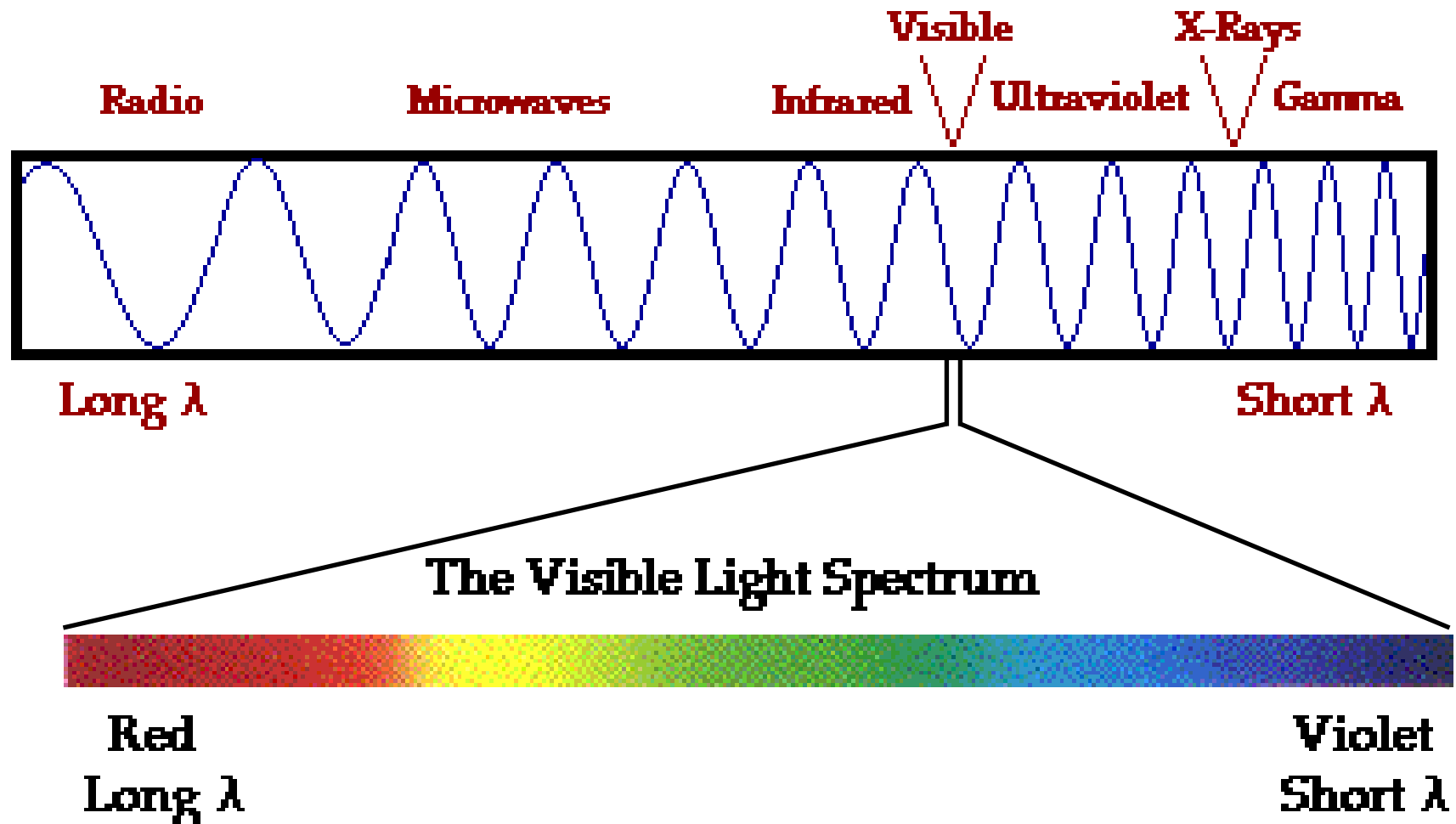




OPTRICKS

What is Light?

Light is radiation we can see



Optics is the Science of Light

Where are optics in everyday life?

Eyes

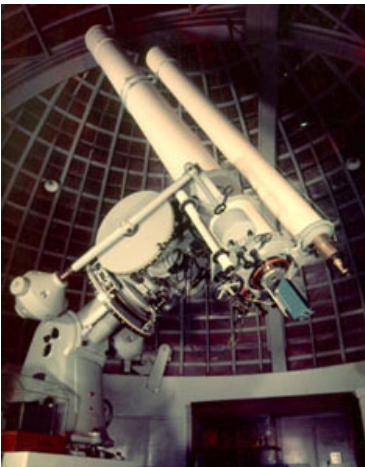


Glasses

Cameras



Lasers

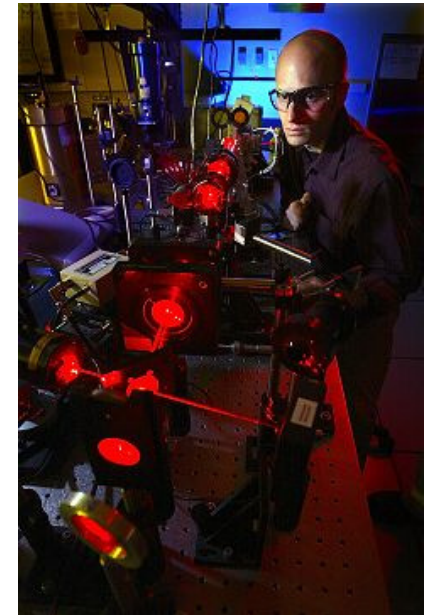


Telescopes

Displays



Fiber Optics

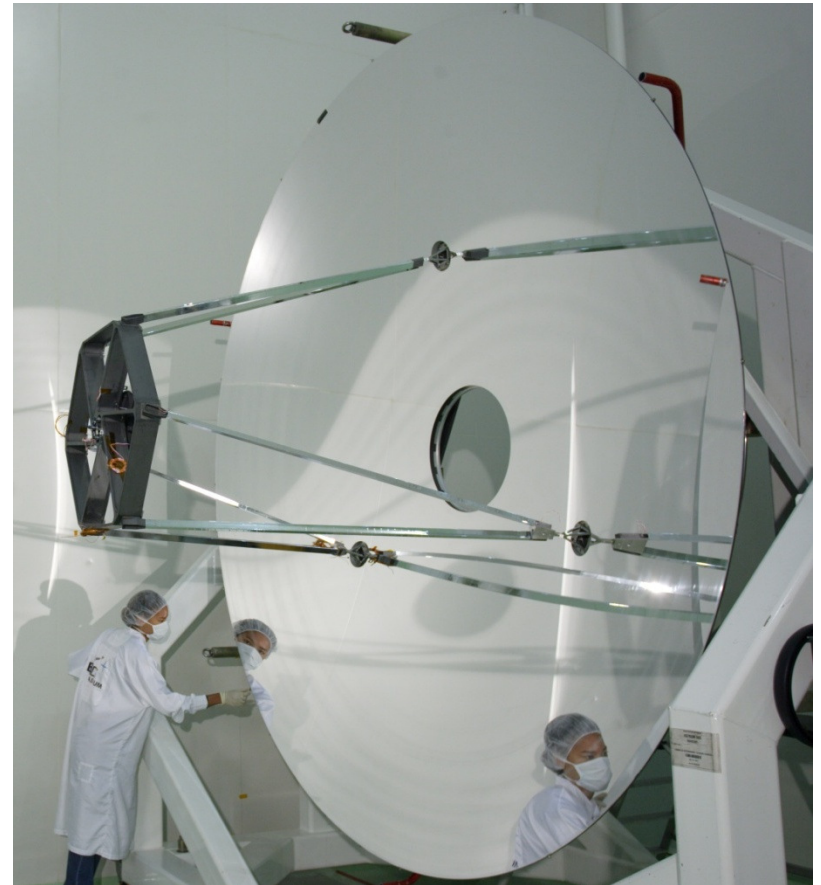


Optics is the Science of Light

Basic Optics



Lens



Mirror

PERIODIC TABLE ELEMENTS

First, a little chemistry...

PERIODIC TABLE ELEMENTS

Dmitri Mendeleev 1869-1907

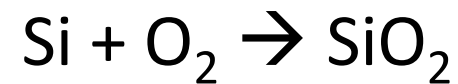
Si
Silicon 14
28.09

H	He																						
Li	Be	B	C	N	O	F	Ne																
Na	Mg	Al	Si	P	S	Cl	Ar																
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr						
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe						
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn						
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
									Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Silicon Makes Mirrors and Lenses



Silicon plus Oxygen is
Silicon Dioxide

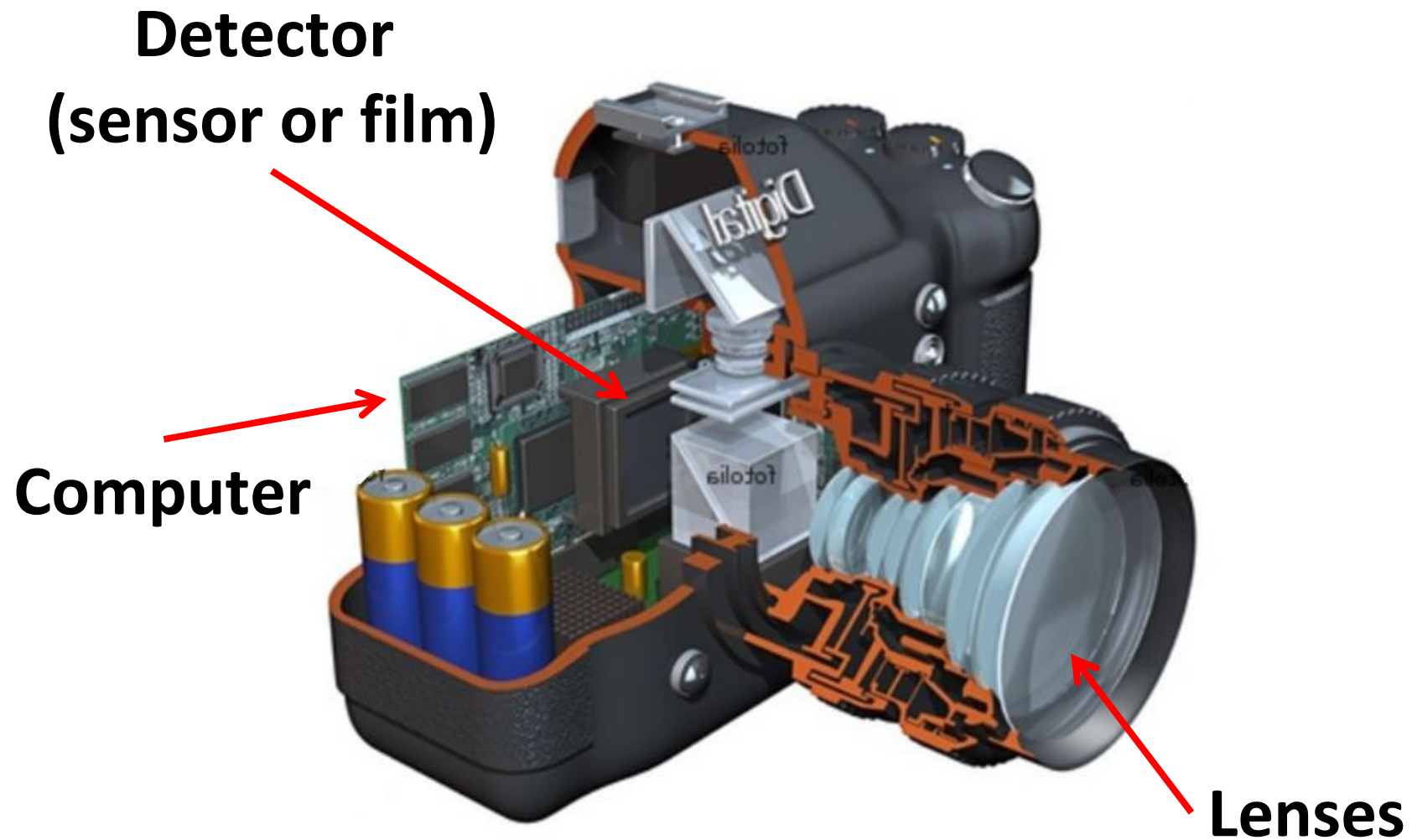


Sand is amorphous SiO_2
It has no shape

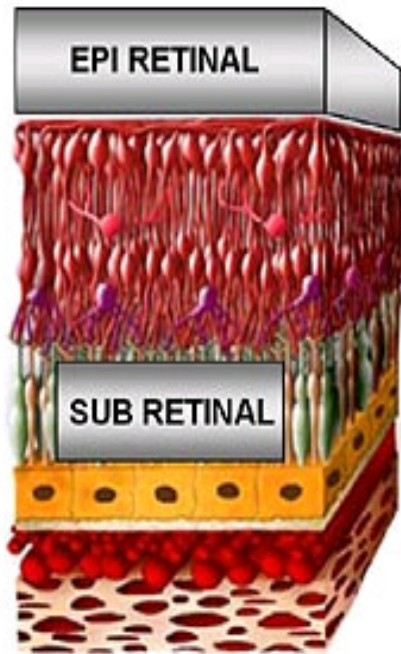


Glass is crystalline SiO_2

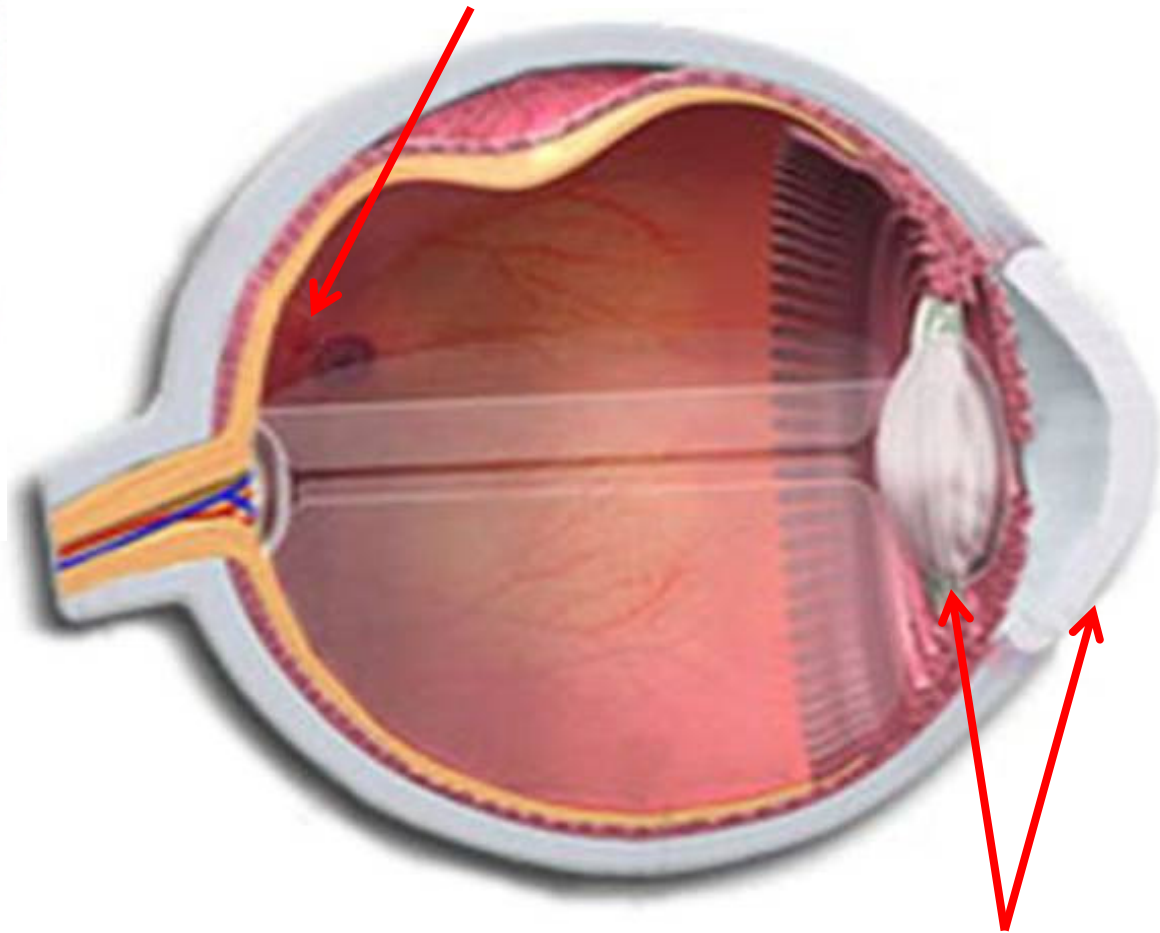
Camera Optics



Eyeball Optics



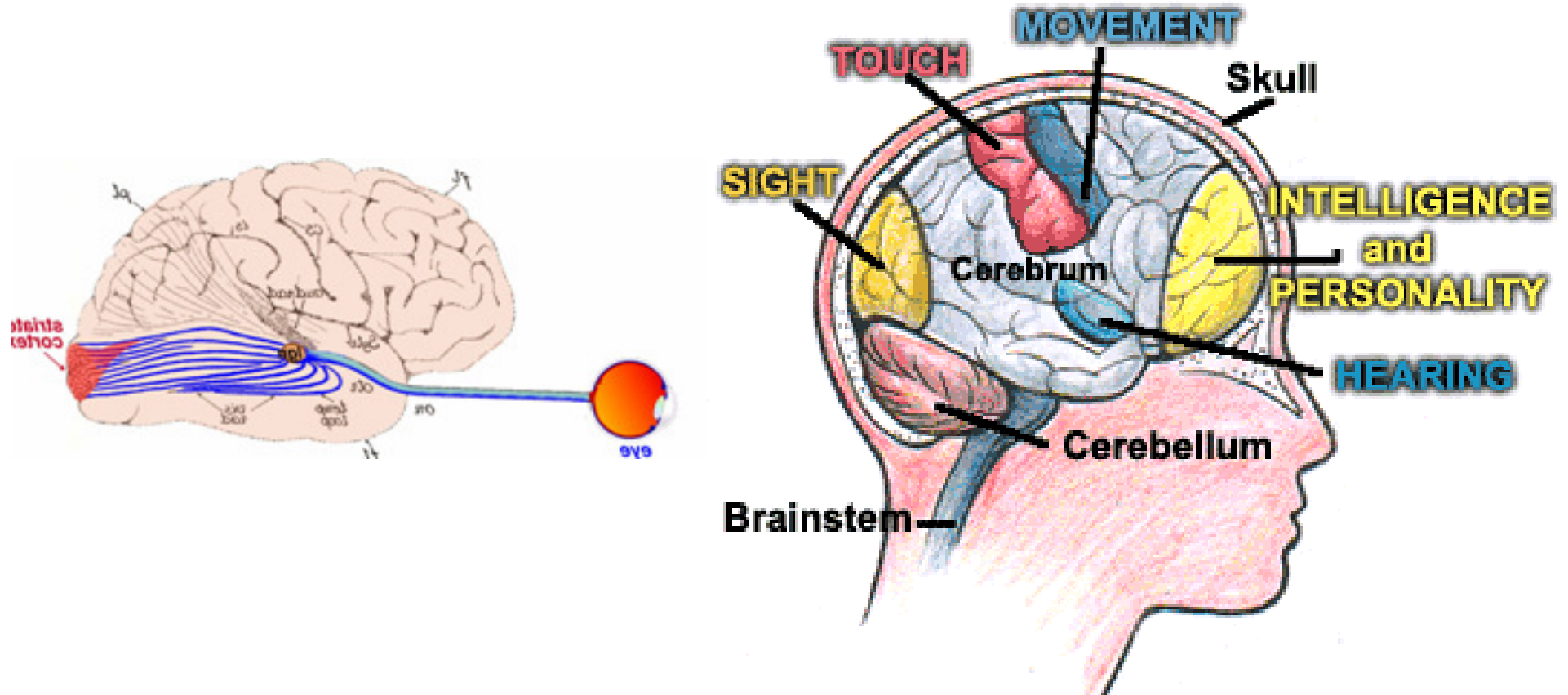
Detector = Retina



Computer?

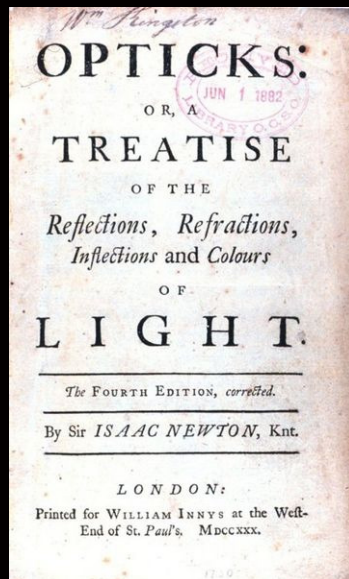
Lenses = Lens + Cornea

Your Brain is Your Computer!



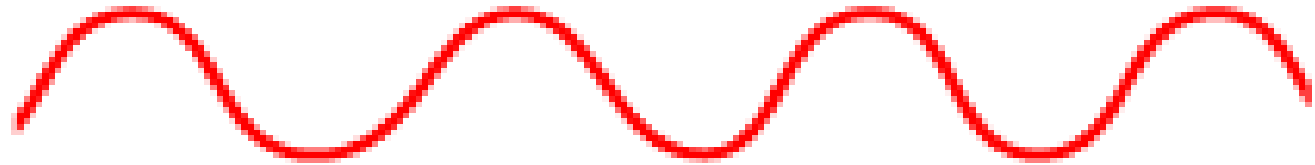
The *striate cortex* in the back of your brain interprets images from your eye.

Wavelength is Color

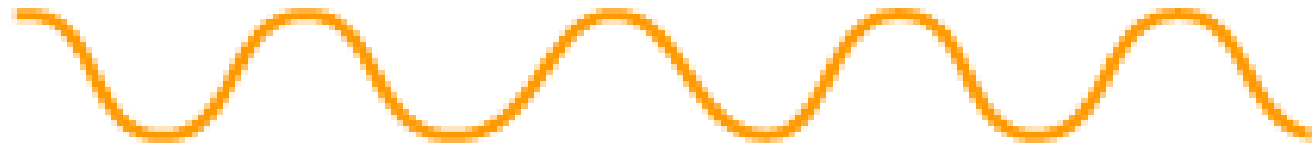


Wavelength is Color

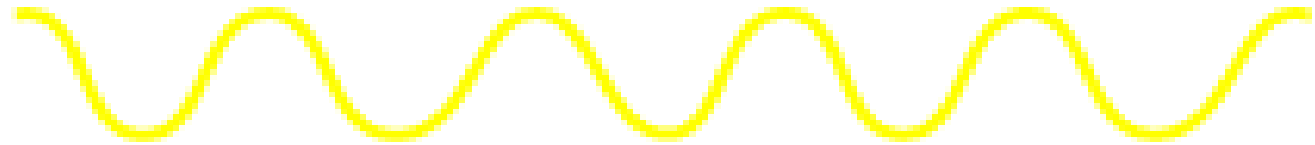
RED



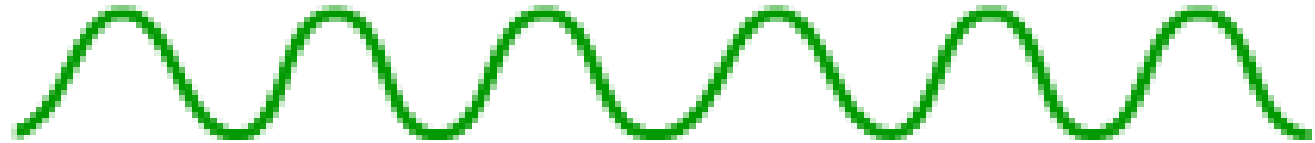
ORANGE



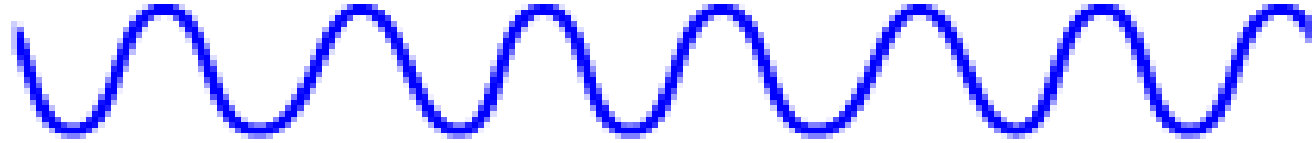
YELLOW



GREEN



BLUE

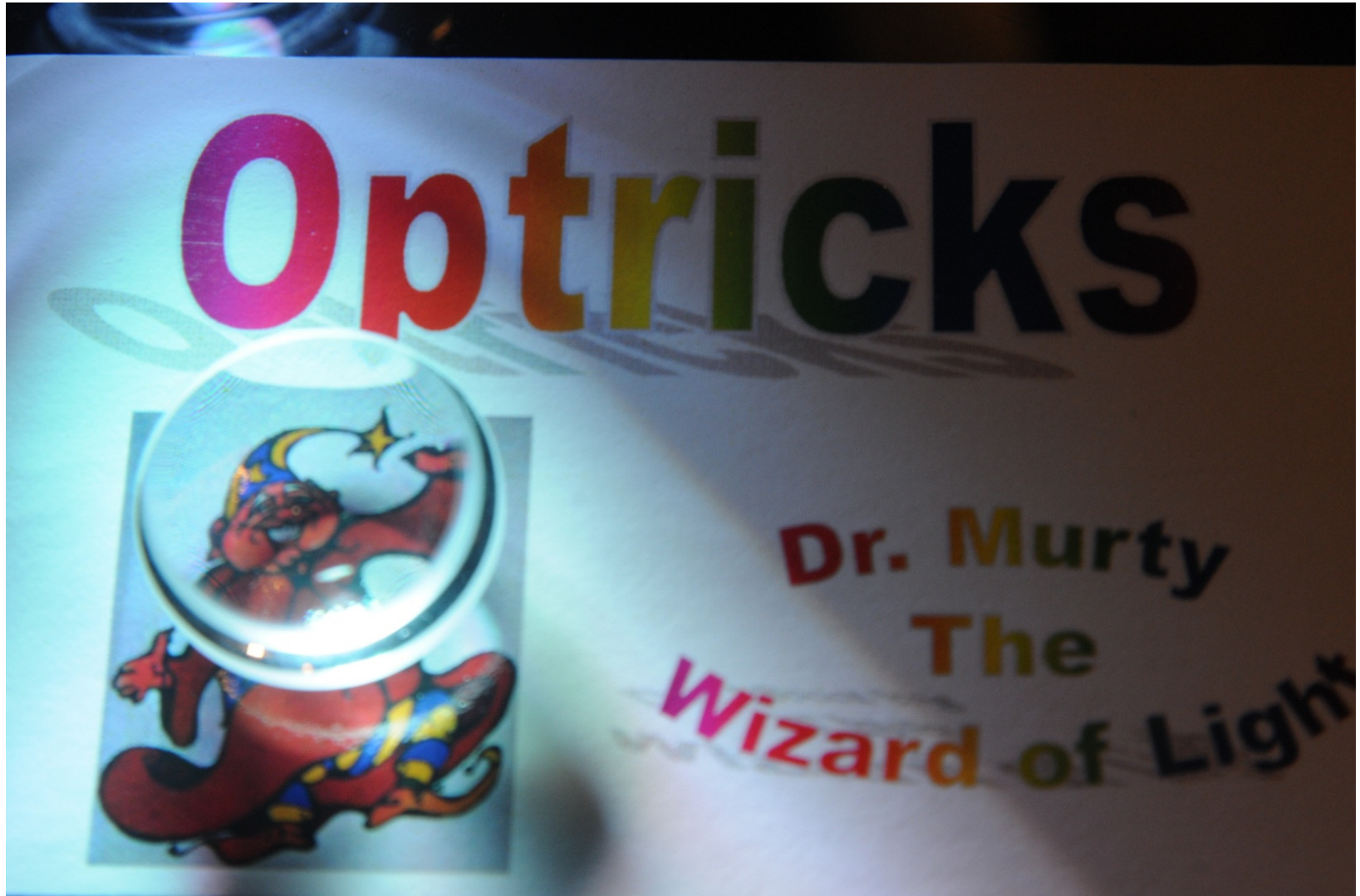


VIOLET



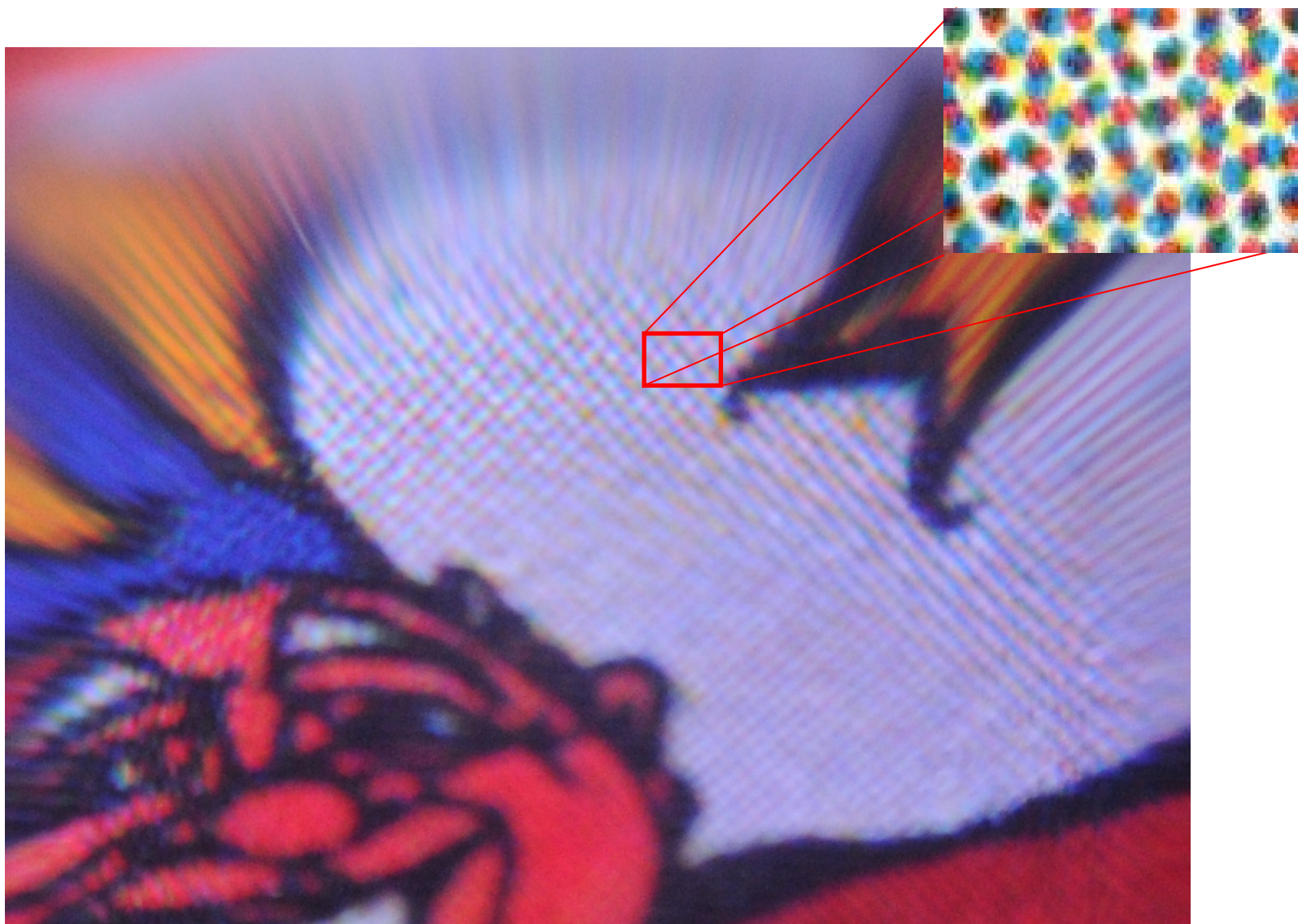
Magnify Your Optricks Card

At a distance...

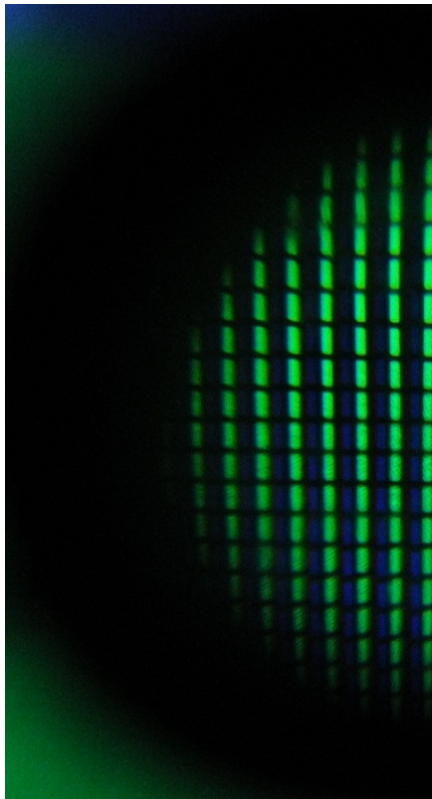


Magnify Your Optricks Card

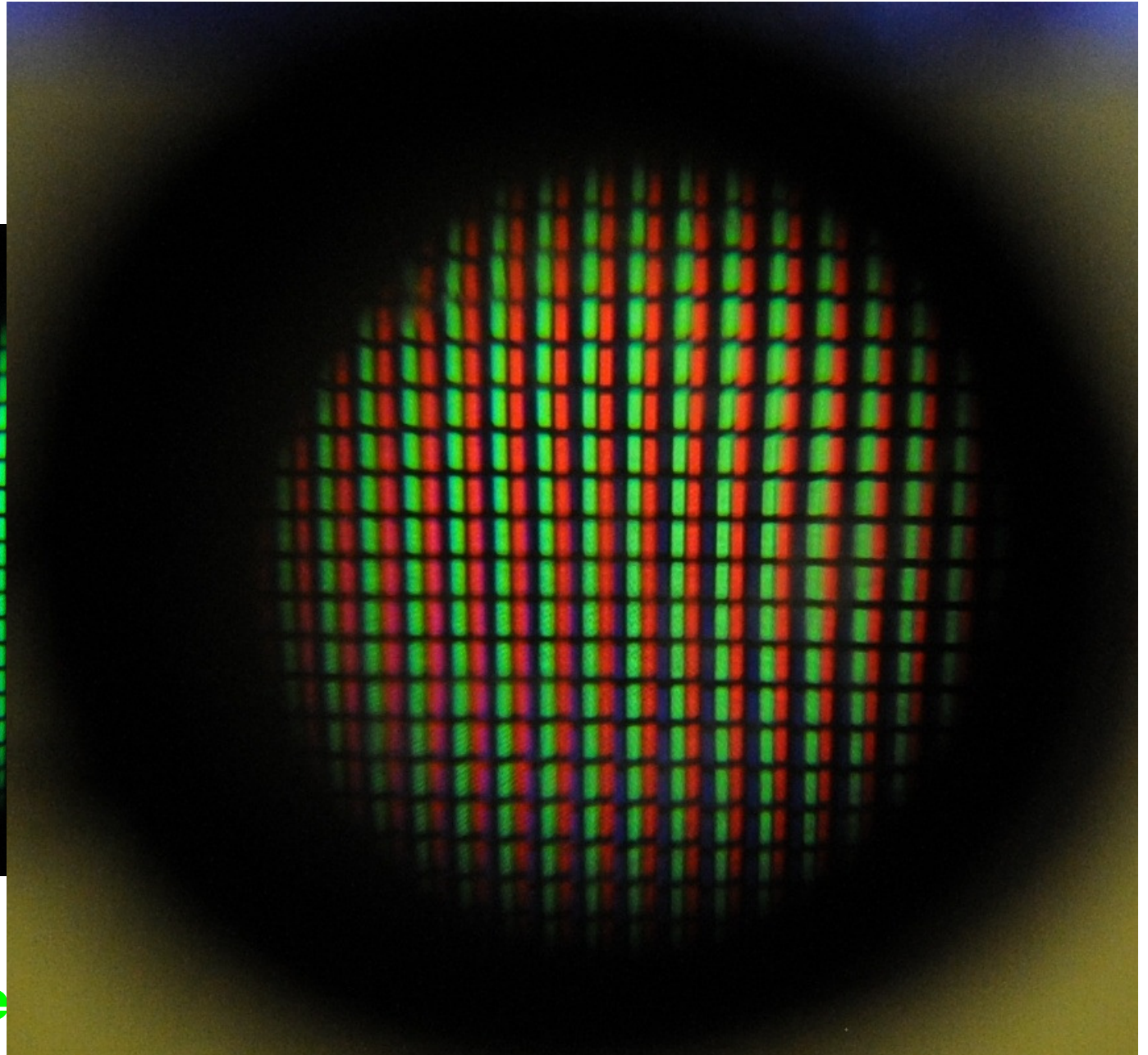
Tiny Dots of Color Appear!



Magnify a Cell Phone Display



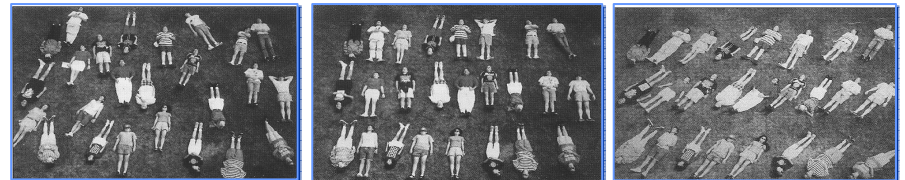
gre



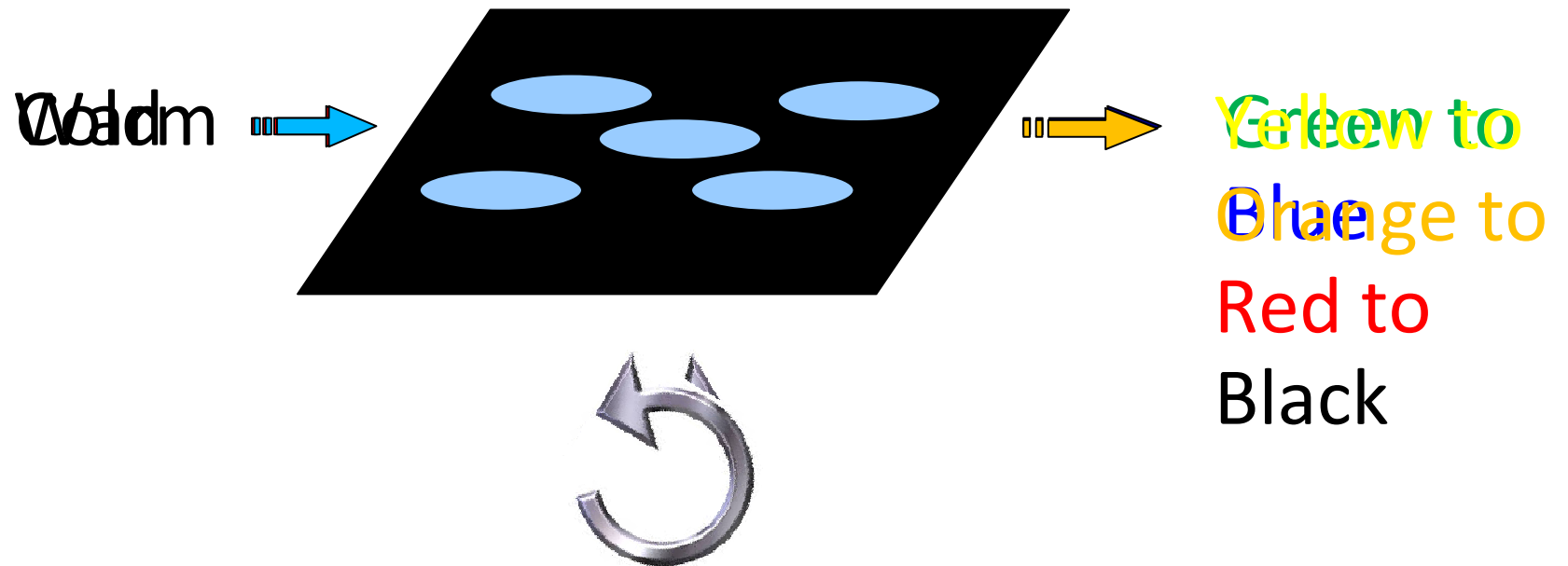
Magic Patch

Liquid Crystal

- “*Magic Patches*” change color with heat
- These are liquid crystals (LCs) that *selectively reflect* different colors at different temperatures
- Temperature changes the ordered structure of the LCs, like the students in the images below
- Engineers cut LCs into tiny pieces known as pixels (picture elements)
- Tiny LC pixels are arranged in a grid and individually heated to make LC displays (LCDs) for computers, watches, cell phones, etc.

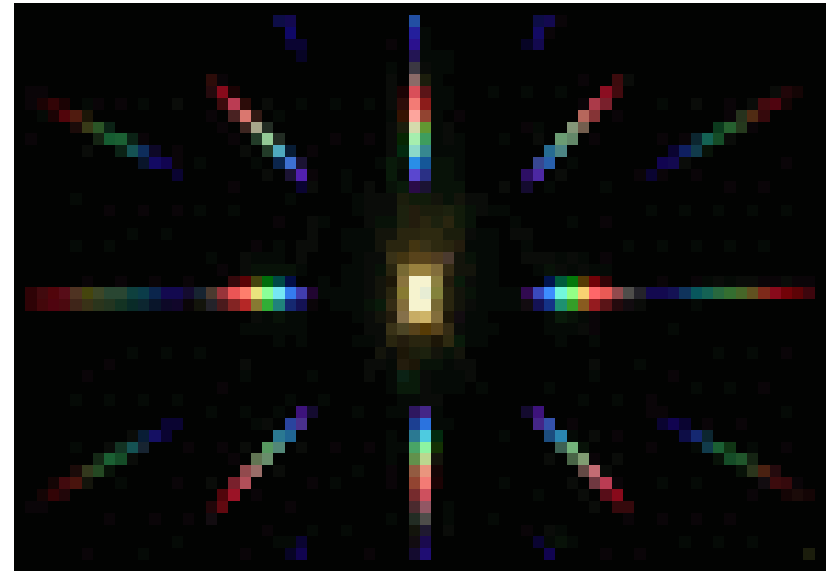


Cholesteric Liquid Crystals



Rainbow Peepholes®

Diffraction Gratings



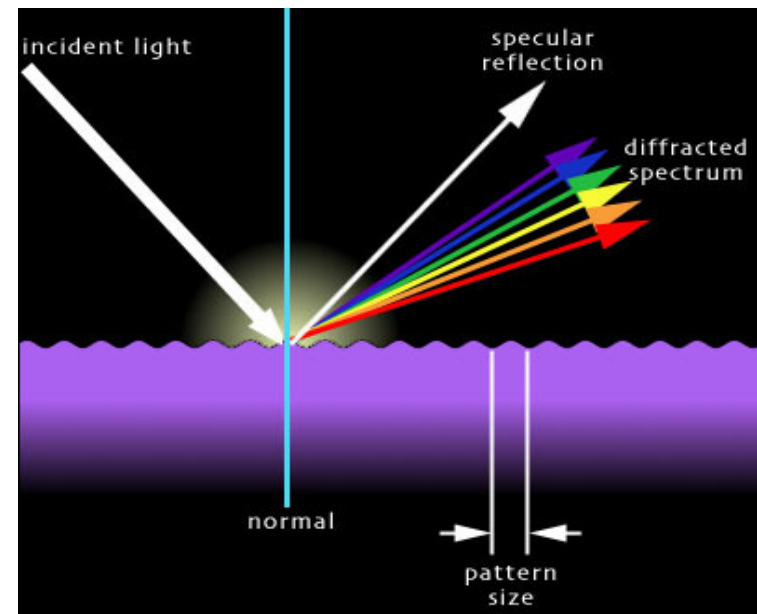
The grid of bumps in the plastic **diffract** the colors of the white light into the **visible spectrum**.

Rainbow Peepholes®

Diffraction Gratings

Colors are **mixed together** to make many types of lights.

Lights are separated into its constituent **colors** by **diffraction**



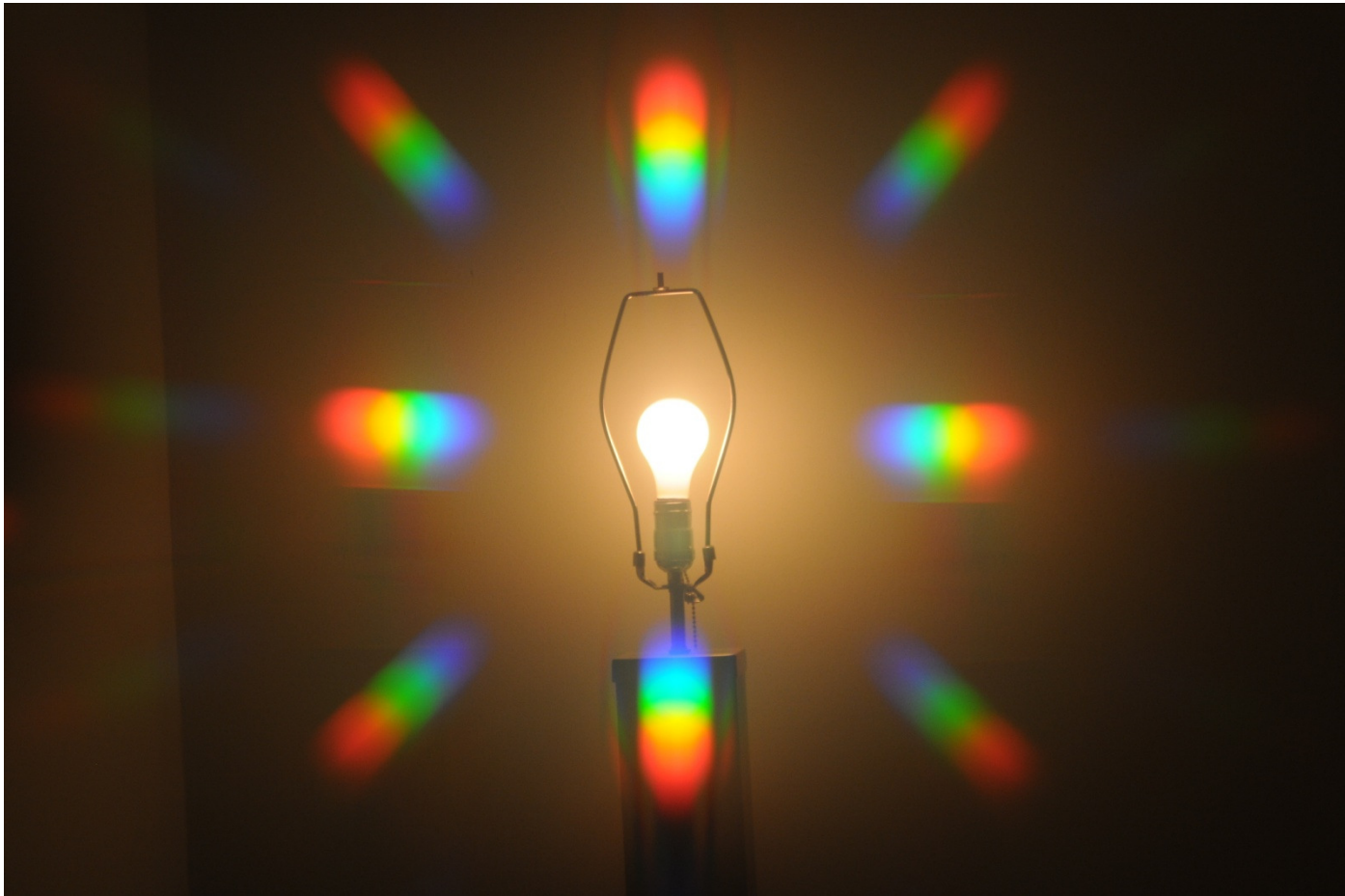
Diffraction

Incandescent (tungsten halogen) Light



Diffraction

Incandescent (tungsten halogen) Light



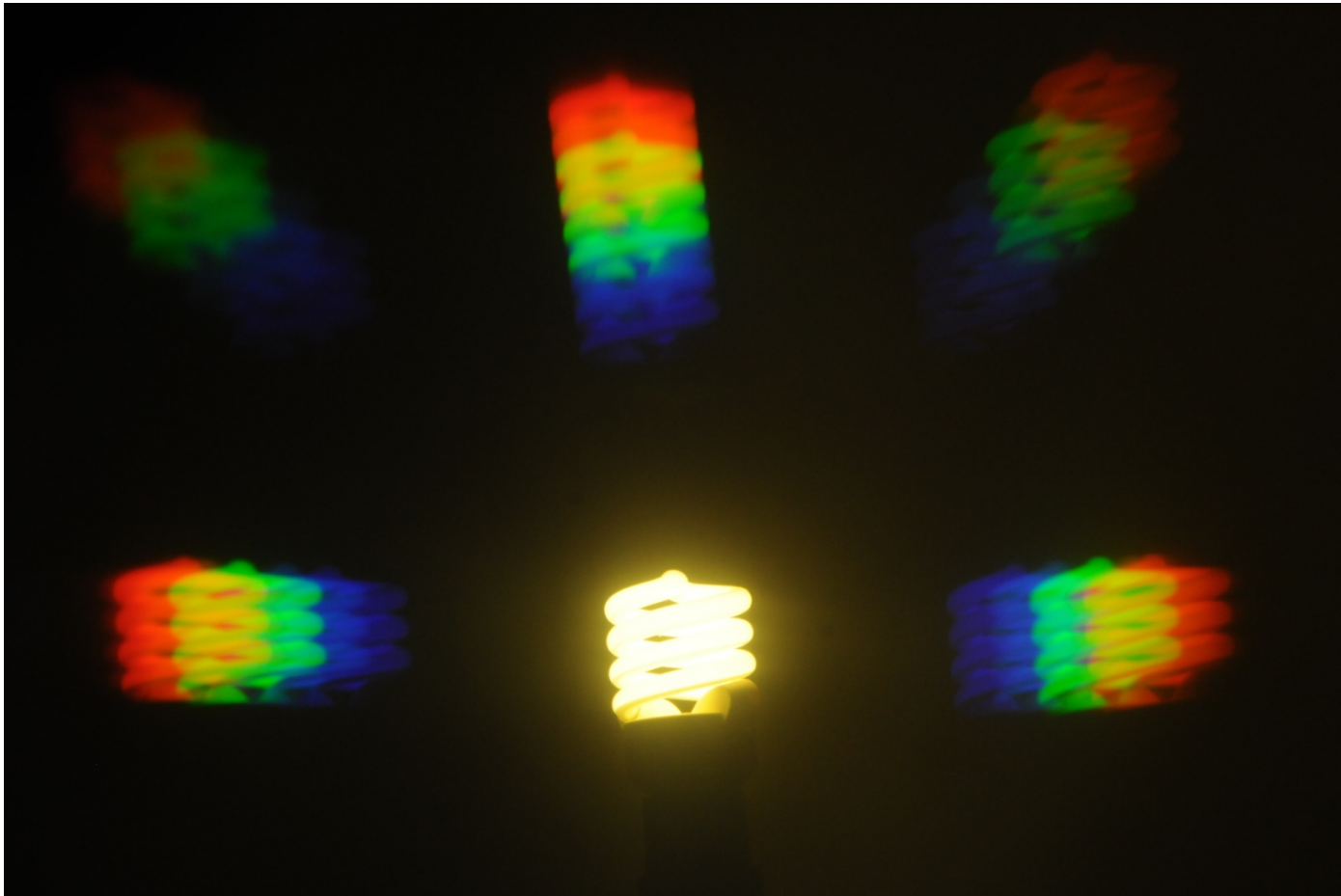
Diffraction

Compact Fluorescent Light (CFL)



Diffraction

Compact Fluorescent Light (CFL)



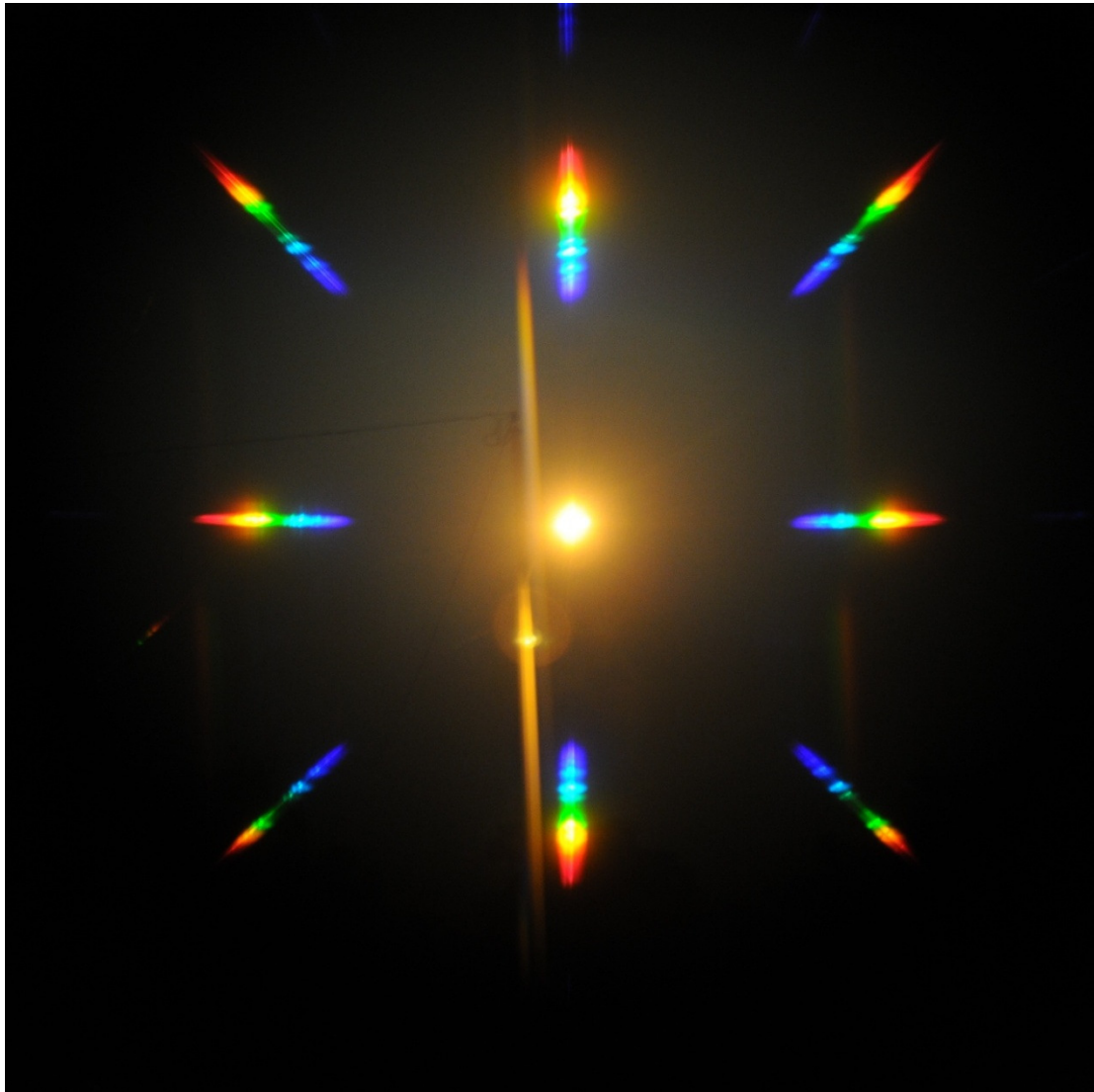
Diffraction

Sodium Vapor Street Light



Diffraction

Sodium Vapor Street Light



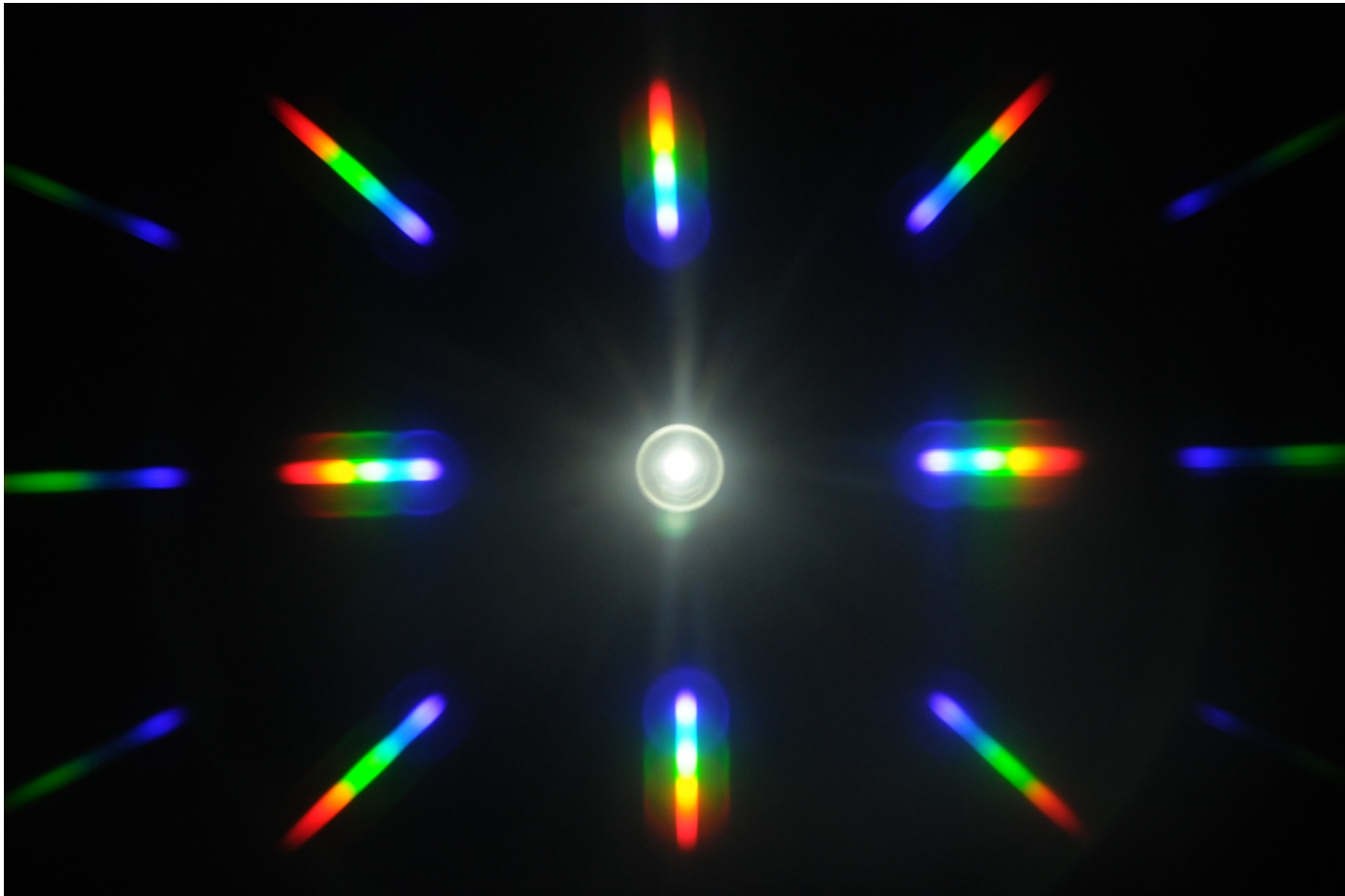
Diffraction

LED Flashlight



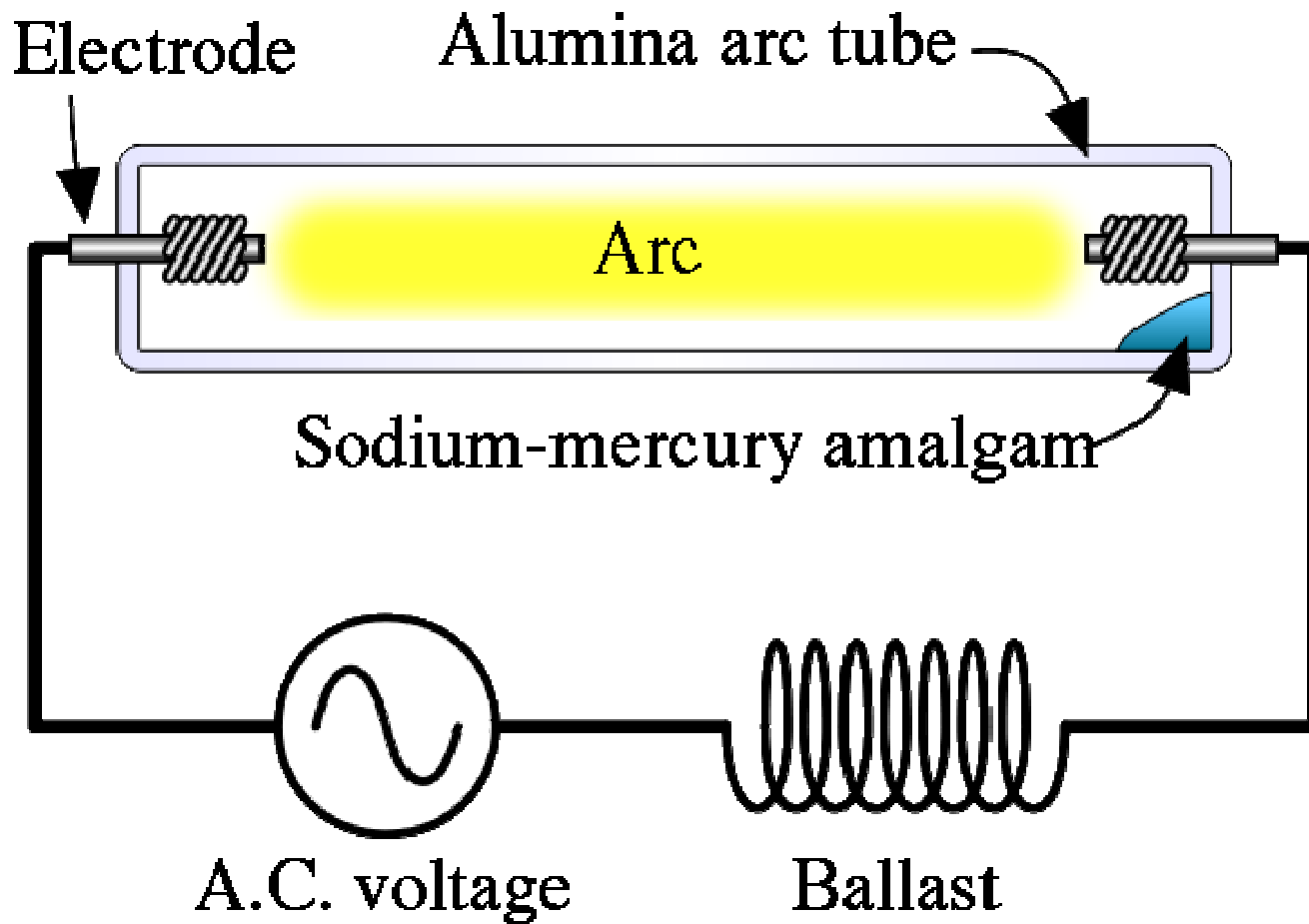
Diffraction

LED Flashlight



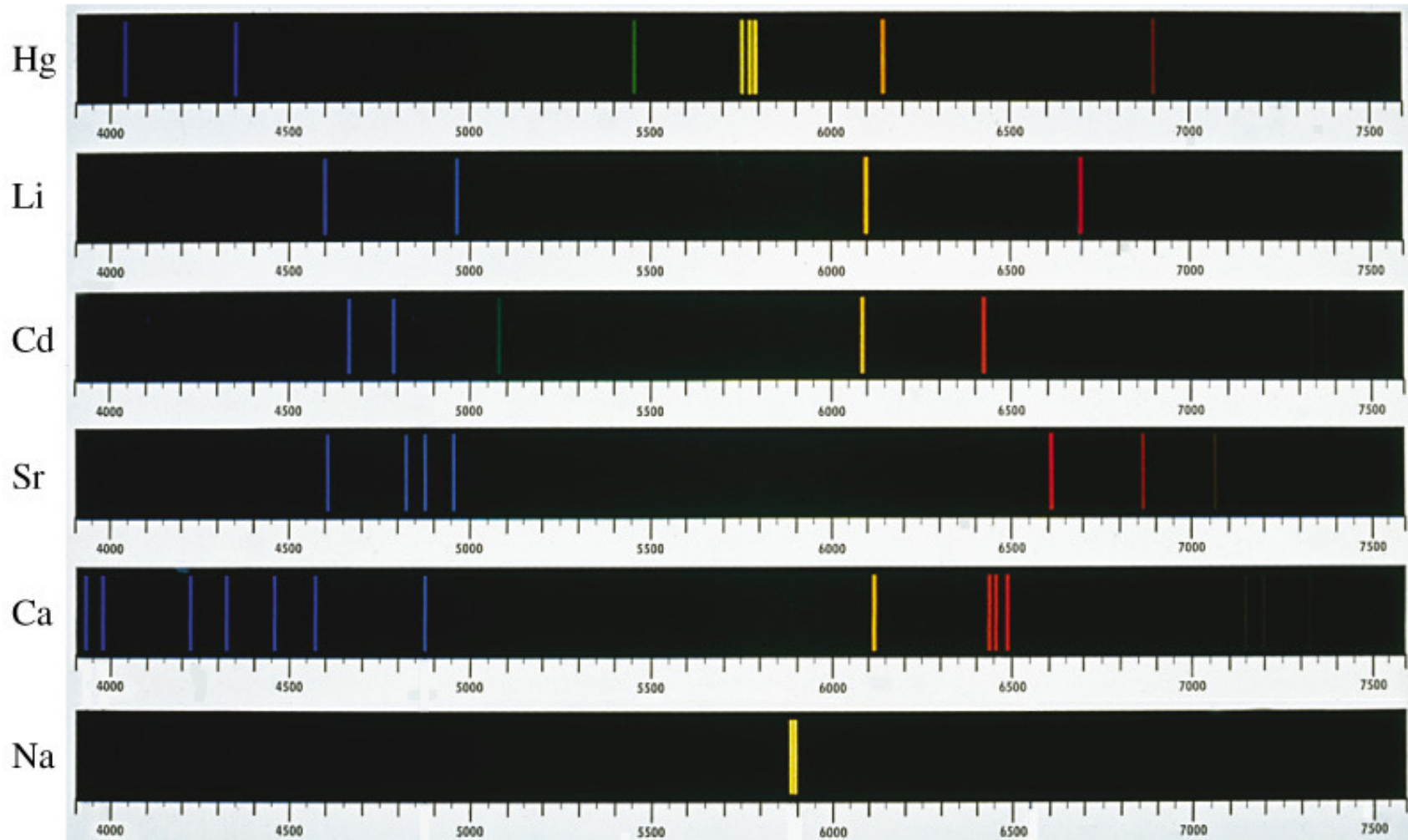
Diffraction

Gas-Discharge Lamps (“Neon” Lights)



Diffraction

Atomic Emission Spectra



OptoBotics® teaching about Optics + Robotics

Why give your robot eyes?

- So it can see where it is going?
- So you can see where it is going?

What kind of eyes can you give a robot?

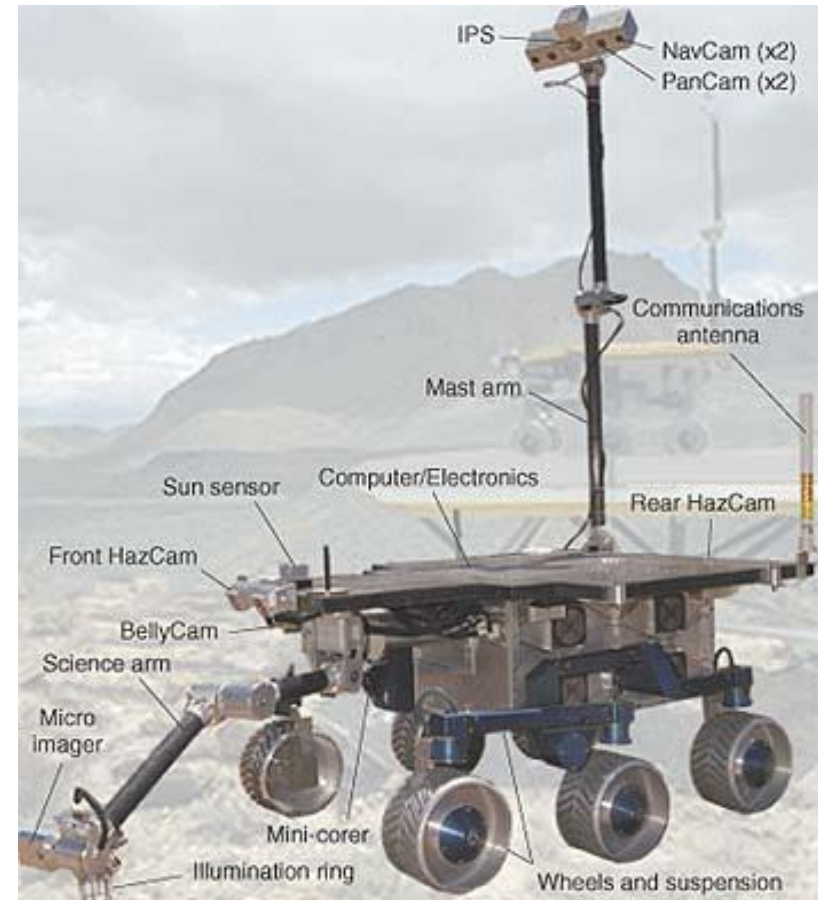
- Video cameras?
- Laser Sensors?
- Radar?
- IR (night vision)?

What to do with the information?



OptoBotics and the Mars Rover

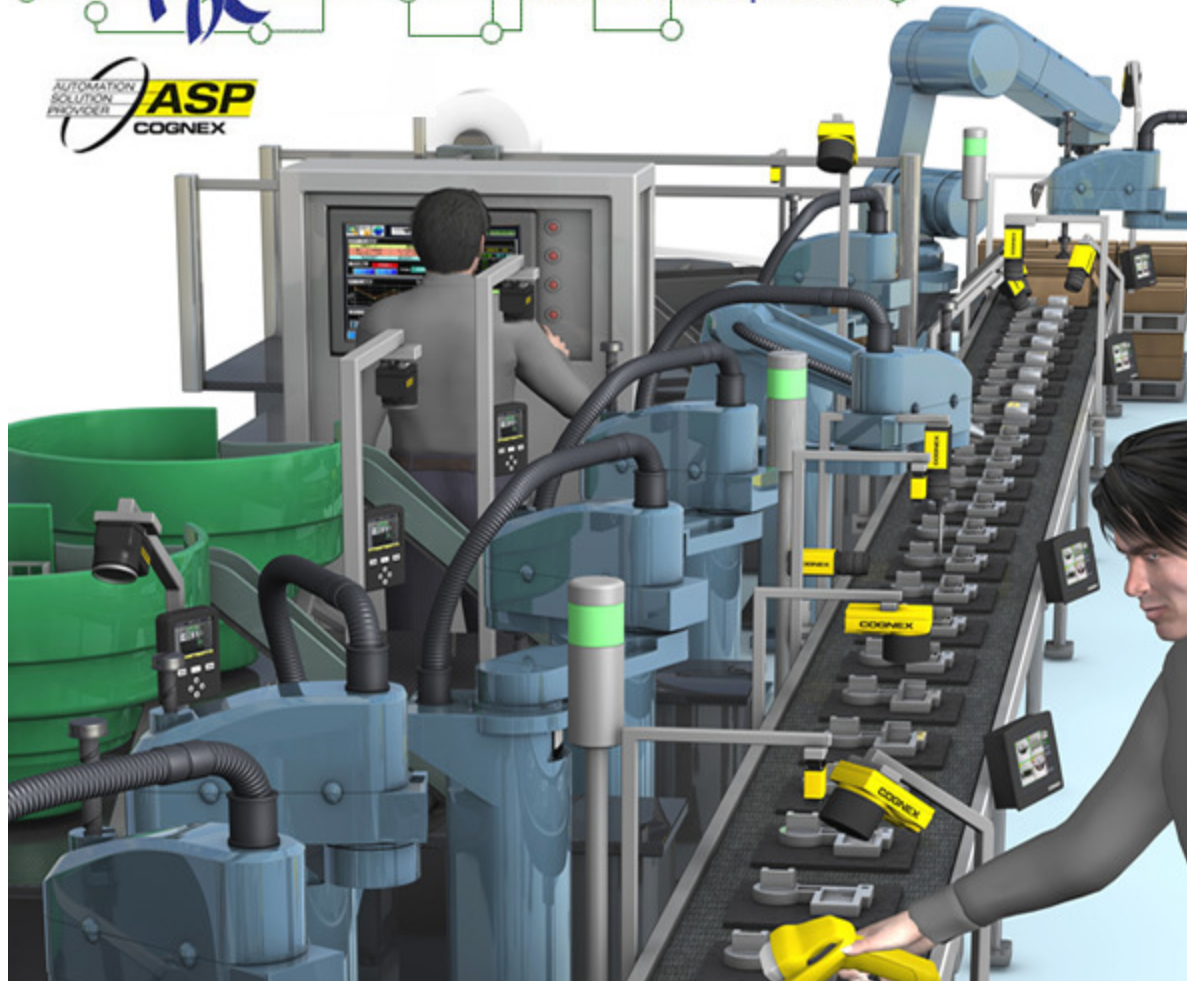
- NavCam (x2)
- PanCam (x2)
- Rear HazCam
- Front HazCam
- Sun Sensor
- Belly Cam
- Micro Imager
- Illumination Ring



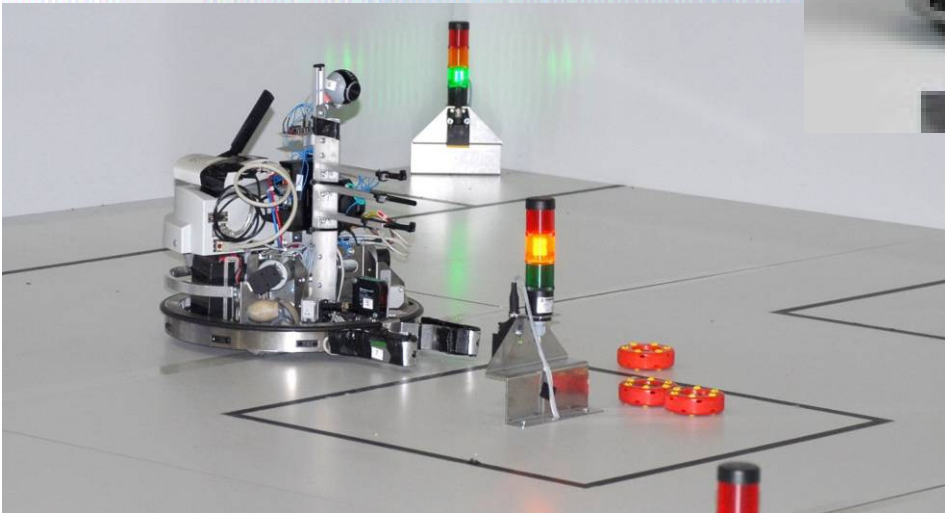
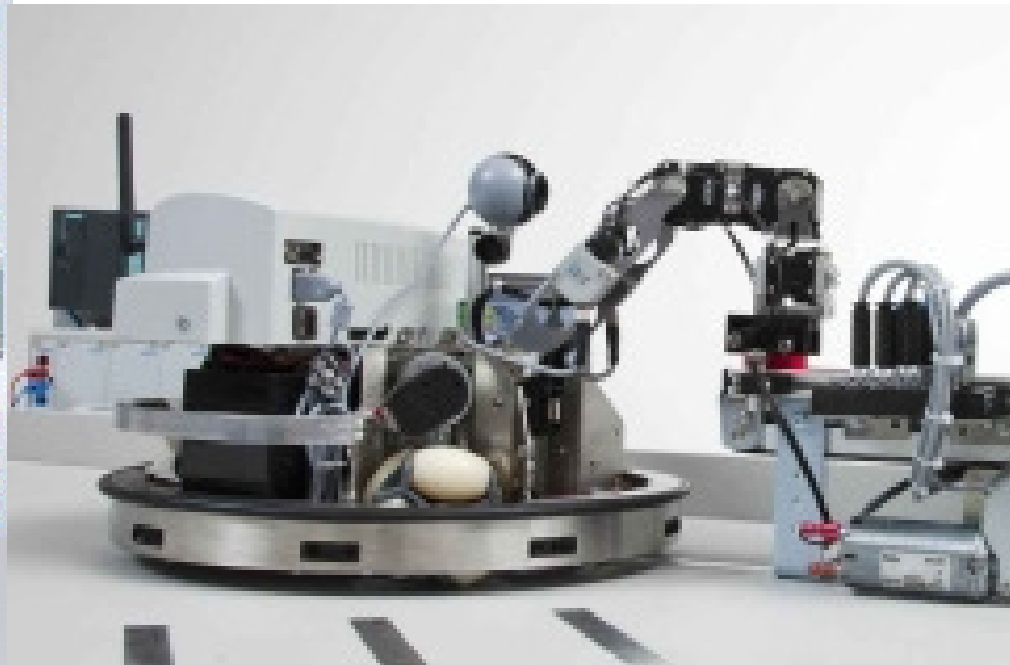
Bio-Laboratory Optobots



Factory Vision Systems



Factory Automation use of Optobots



Soldiers use IR Night Vision

Human Optobots!!

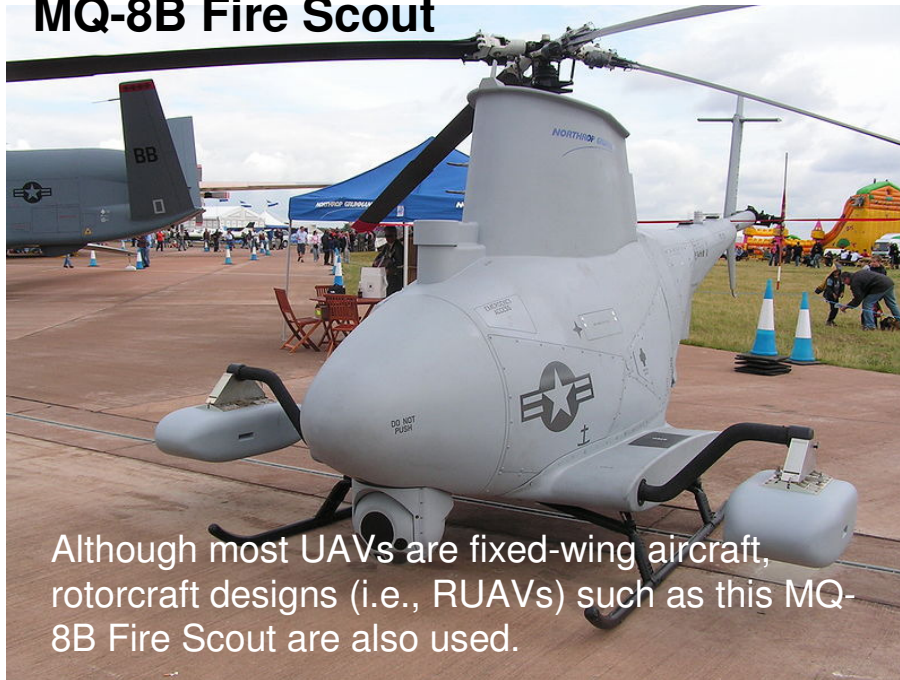


Group photo of aerial demonstrators at the 2005 Naval Unmanned Aerial Vehicle Air Demo



Helicopter Mounted Optobots

MQ-8B Fire Scout

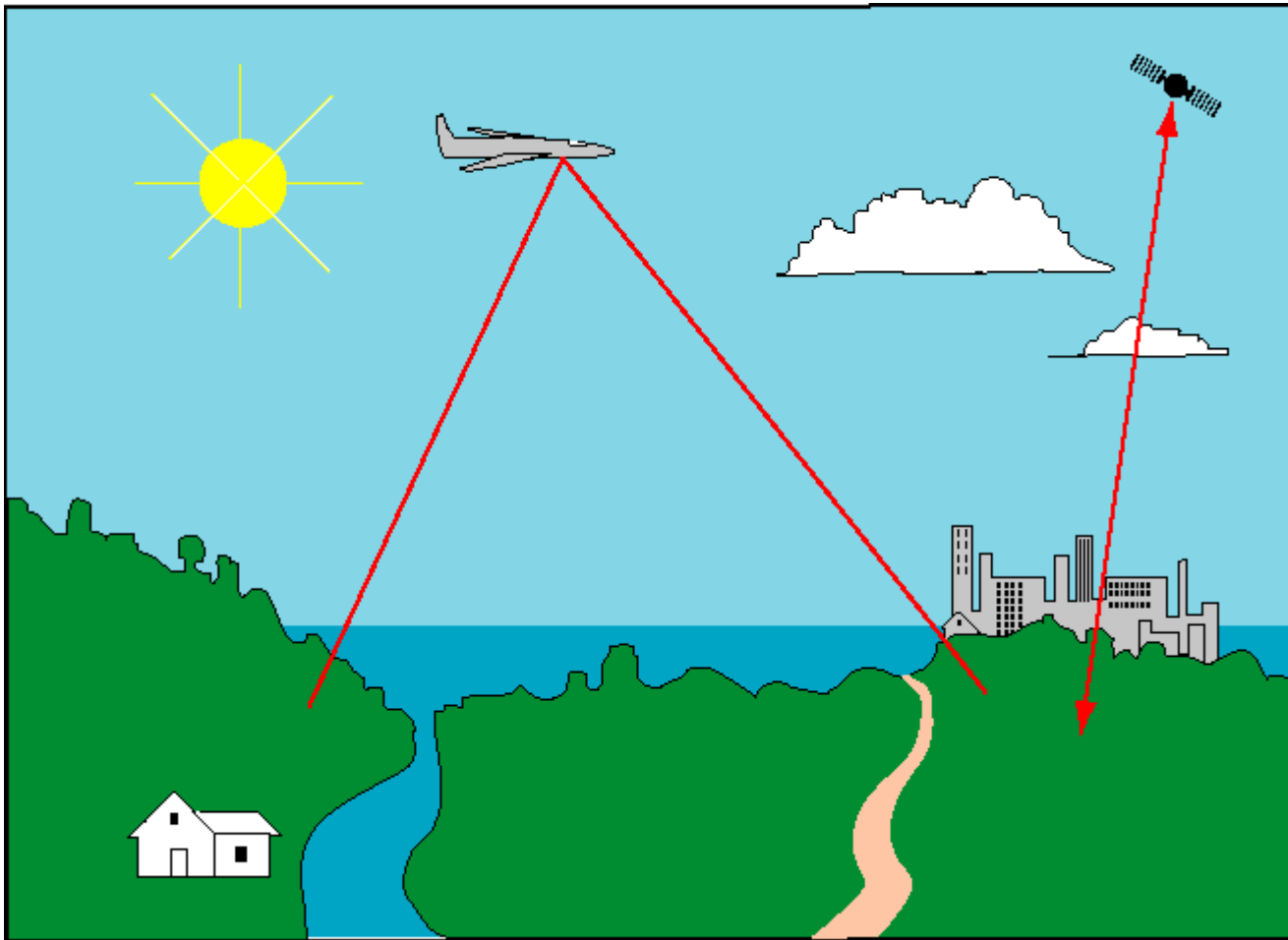


Although most UAVs are fixed-wing aircraft, rotorcraft designs (i.e., RUAVs) such as this MQ-8B Fire Scout are also used.

Helicopter-mounted infrared camera (FLIR).

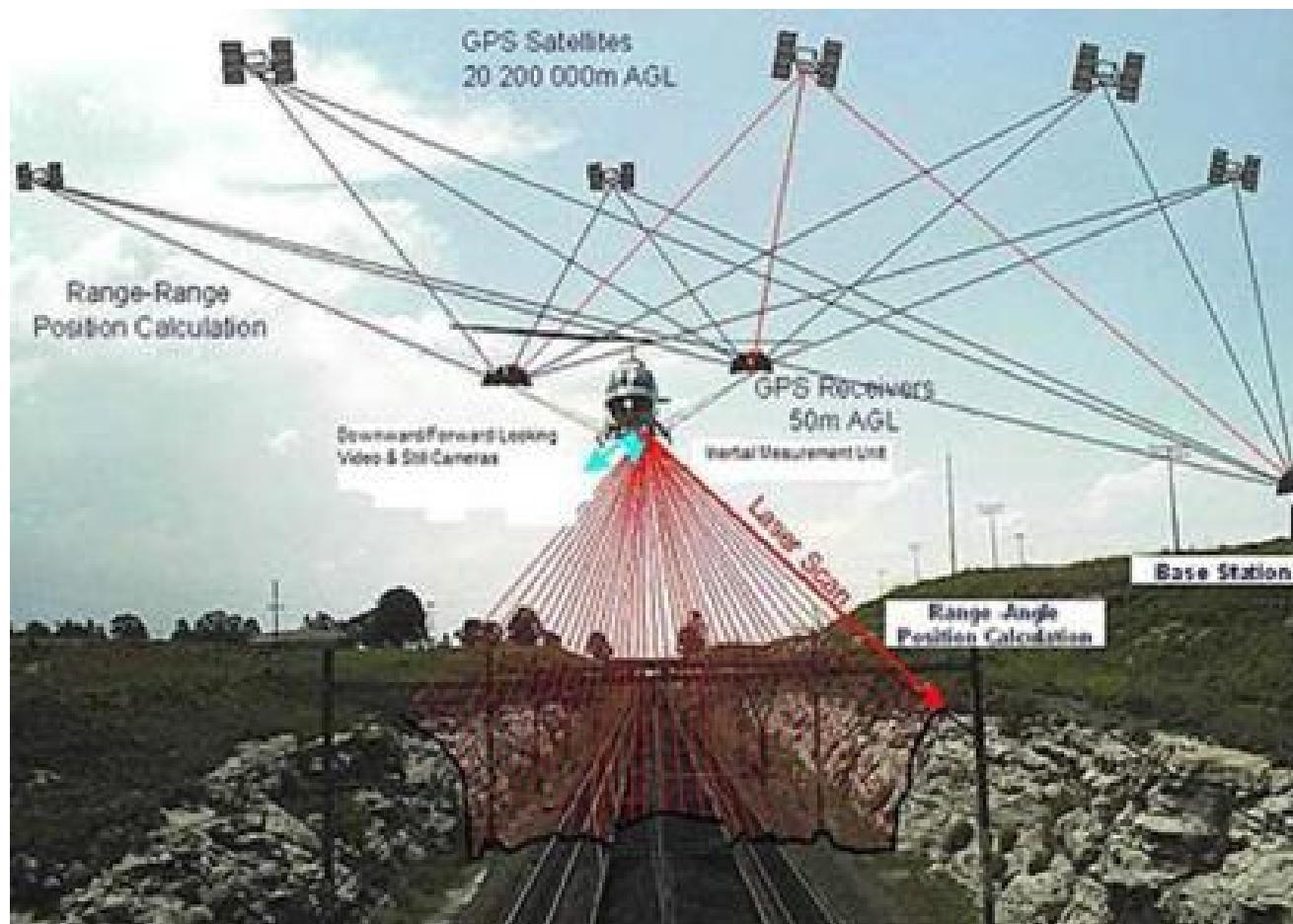


Remote Sensing – Watching the Earth

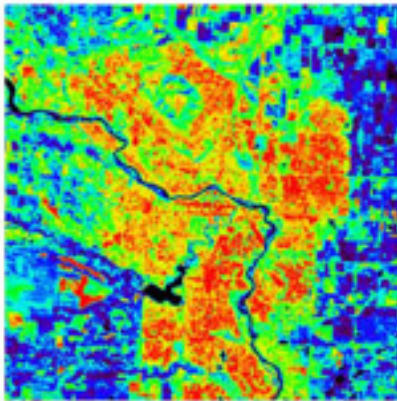


Remote sensing is any technique for measuring, observing or monitoring a process or object without physically touching the object under observation. Optical and radio telescopes, cameras, even eyesight, are types of remote sensing with which you are probably familiar.

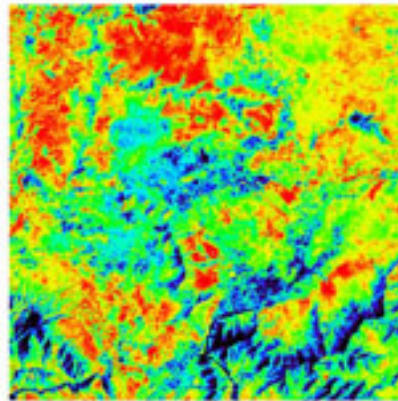
Remote Sensing – Watching the Earth



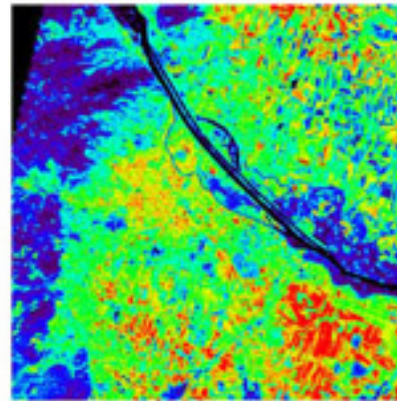
Global Analyses of Urban Reflectance



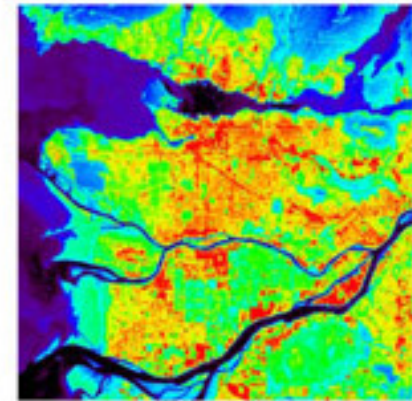
Calgary



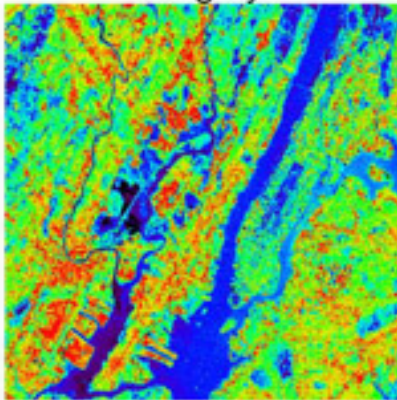
Kabul



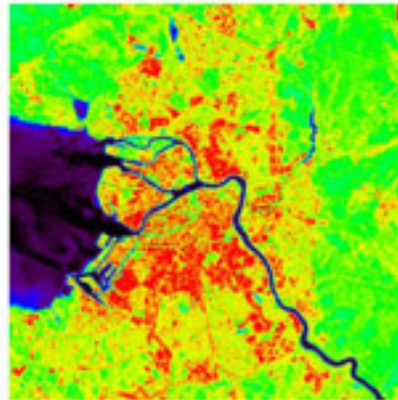
Vienna



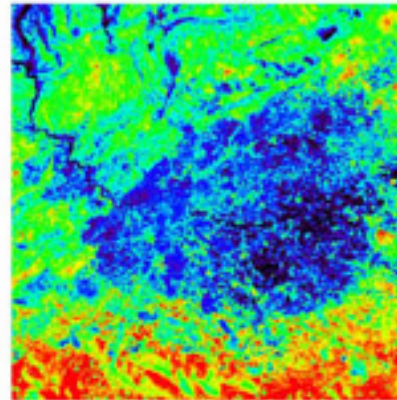
Vancouver



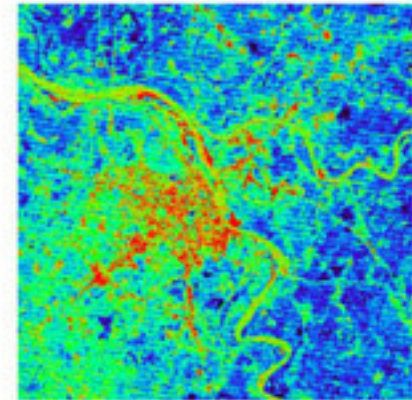
New York



St. Petersburg



Damascus



Hanoi

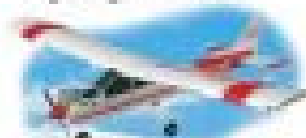
What about your OptoBotics?

2.4 GHz Long Distance Micro Wireless COLOR Video Camera

The World's Smallest Full-Color Wireless Video Camera!
complete kit



projects ...



AIRPLANE



HELICOPTER



CAR



NOW ENROLLING



Mathobotix

OptoBotics™

Giving your Robots Eyes - A Fun Filled Learning Experience about Light, Lasers, Optics & Robots

Grade level:

5th to 8th grade

Prerequisite:

Curiosity

Duration:

12 weeks, 2 hours/week (24 hours total)

Session Timeline:

September – November 2014

Weekly Schedule (enroll in one session only):

- Session 1: Day Monday Time 5:30 – 7:30 pm
- Session 2: Day Friday Time 5:30 – 7:30 pm

Offered in Irvine Lab



Course Description: OptoBotics™

The Optics Institute of Southern California (OISC) joins with Mathobotix to present an exciting new course: OptoBotics™ (optics, lasers & robotics) based STEAM Open Learning Projects in this fun filled 3 month program in a special format for curious students. In this course, junior high level students will learn how to apply grade level math and science in simulated real world projects. Each project utilizes a sample set of applications of Science, Technology, Engineering, Art and Math (STEAM) concepts. Project based learning methods are used in a lab environment. Students demonstrate their finished projects to an audience at the monthly open house.

Class Objectives:

- To have fun playing with light, lenses, lasers, optics, video cameras and friendly computerized systems.
- To learn the basics of using light, laser and optics to give your robots eyes (optical sensors)
- To understand the basics of light by using the Photonics Explorer Kits & Optics Benches
- To introduce basic problem solving techniques using light, lasers, optics and robots
- To help build soft skills to work in a team environment

Sample Projects:

Make a product or create a service using their OptoBotics™ based STEAM knowledge and skills. For example:

- Add a wireless remotely controlled optical video system to a robotic roving vehicle that lets the owner operate & navigate the unit from a different room. Include a small pointing laser to hit a designated target.
- Create a spectroscopic optical / video / robotic system to analyze material composition at a distance

An extreme version of these are on the famous Mars Rover Curiosity.

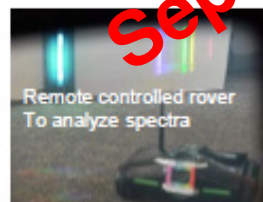
Language & Communication: Students write Project Reports and present their project to audience and explain how their program works and how they solved their problems.

Soft Skills: 5Cs: Critical thinking, Creative problem-solving, Communication, Collaboration, and Cross-cultural relationship building.

Learning Activities: Hands-on Optics & Laser Lab, Short Presentations, Writing, Team Review, and Research

Course Fee: \$480

Lab Fee: \$40



Mathobotix Lab. || 1000 Roosevelt, Suite 200, Irvine, CA 92620 | Tel (949) 857 1419 || Fax (949) 743 1618

Email: info@openprojectsandapps.org | web: www.openprojectsandapps.org

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The Optics Institute of Southern California is Proud to be a Project of Community Partners, a 501(c)(3) nonprofit in California.
Mathobotix™ offers Science, Technology, Engineering, and Mathematics (STEM) curriculum based after-school educational robotics classes, day camps, workshop to K - 12 students, and corporate team building activities.

Next Formal OptoBotics Program
Sept – Nov 2014 @ Mathobotix



Our sponsors and supporting organizations:





Thank You for Paying Attention

Always Ask Questions!

**Download other Fun and Educational
Optical Presentations from**

www.oisc.net