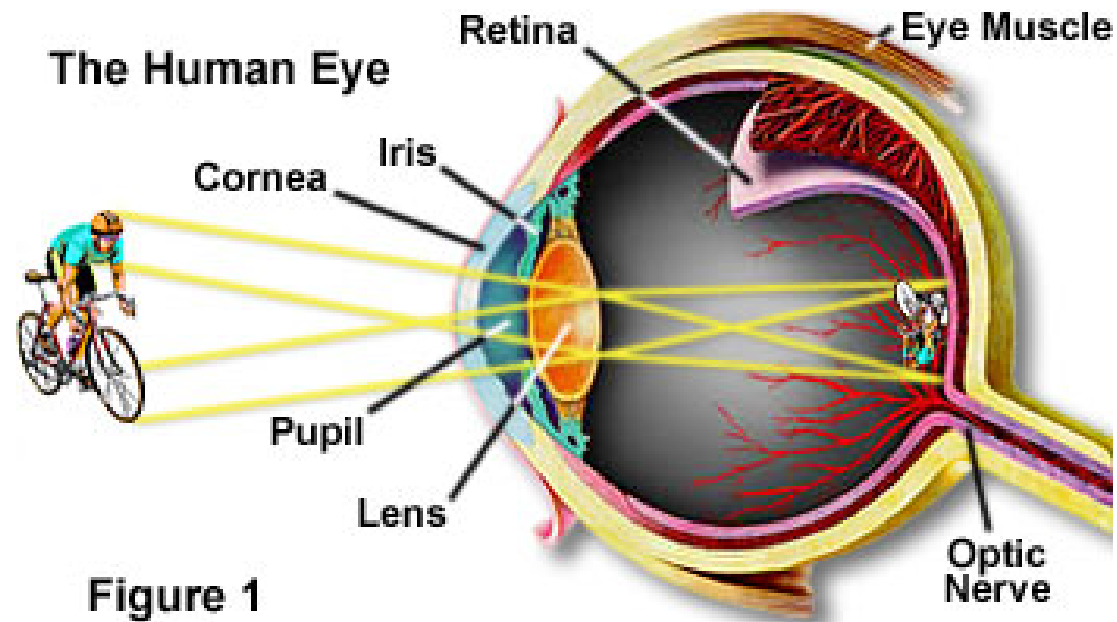
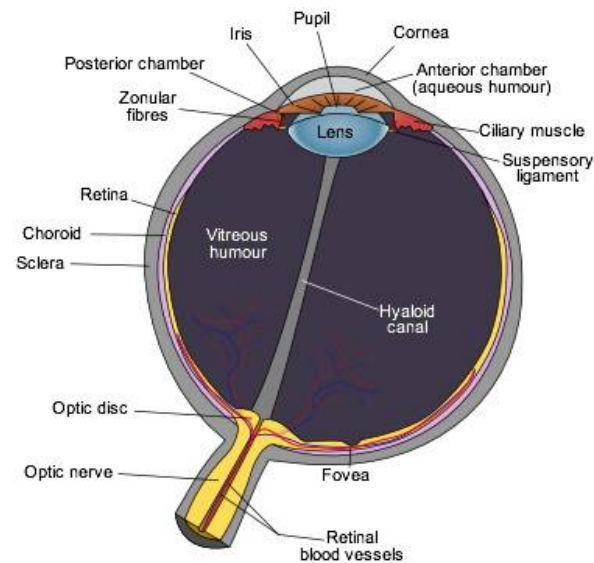
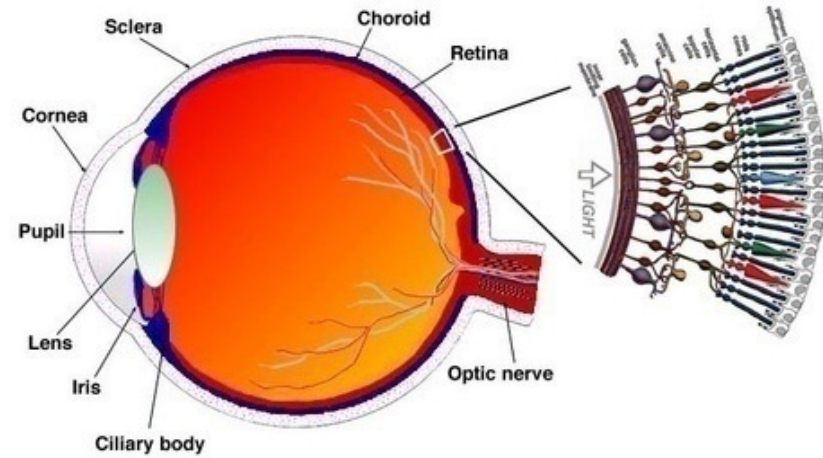
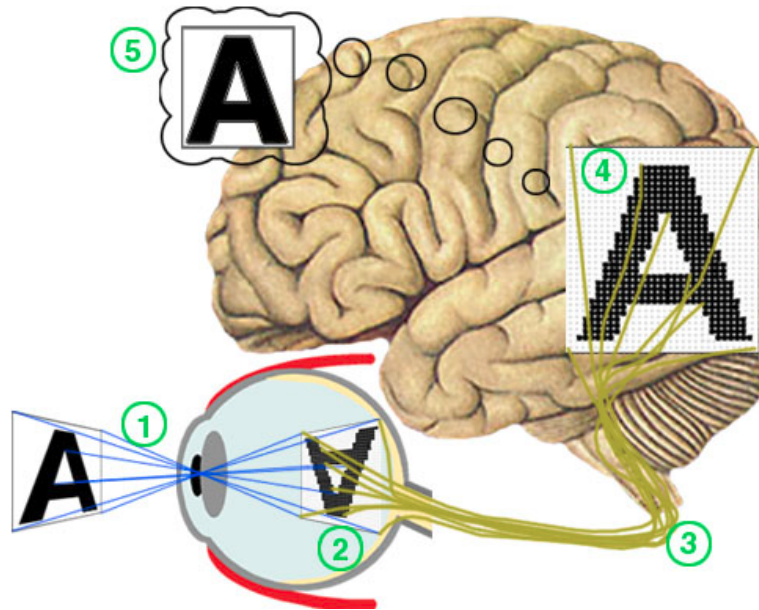


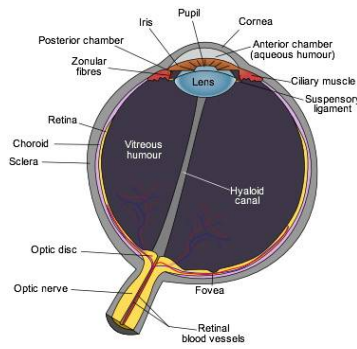
What is light?

You sense it with your eyes



It's even more complicated than that





scotoma

- [https://en.wikipedia.org/wiki/Blind_spot_\(vision\)](https://en.wikipedia.org/wiki/Blind_spot_(vision))

Blind spot test [edit]

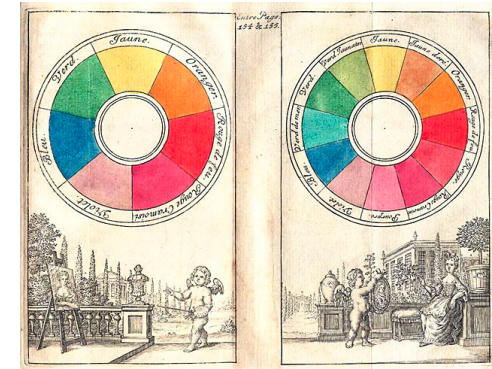
Demonstration of the blind spot

R

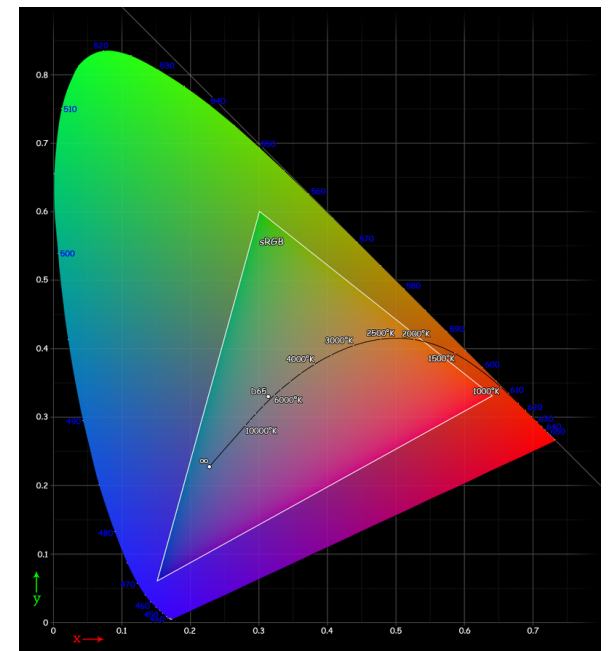
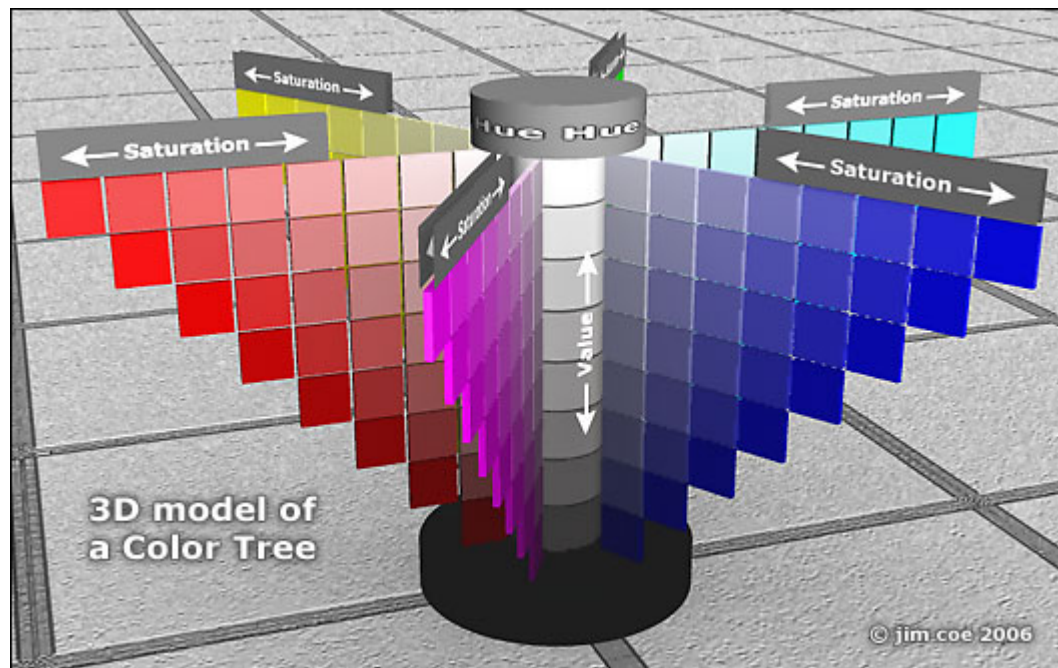
L

Instructions: Close one eye and focus the other on the appropriate letter (**R** for right or **L** for left). Place your eye a distance from the screen approximately equal to 3× the distance between the **R** and the **L**. Move your eye towards or away from the screen until you notice the other letter disappear. For example, close your right eye, look at the "L" with your left eye, and the "R" will disappear.

We sense 'brightness' and 'color'

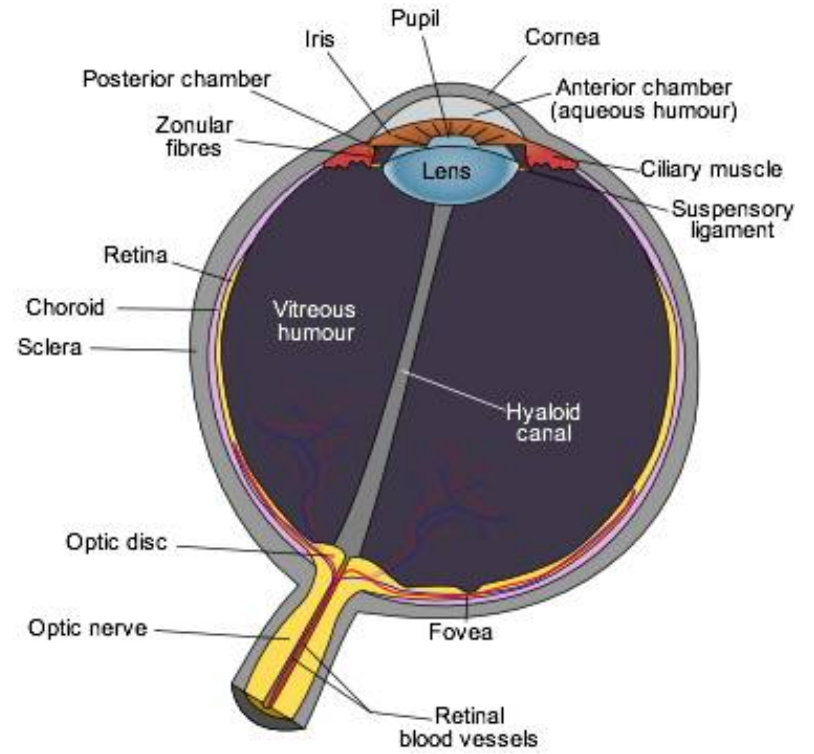
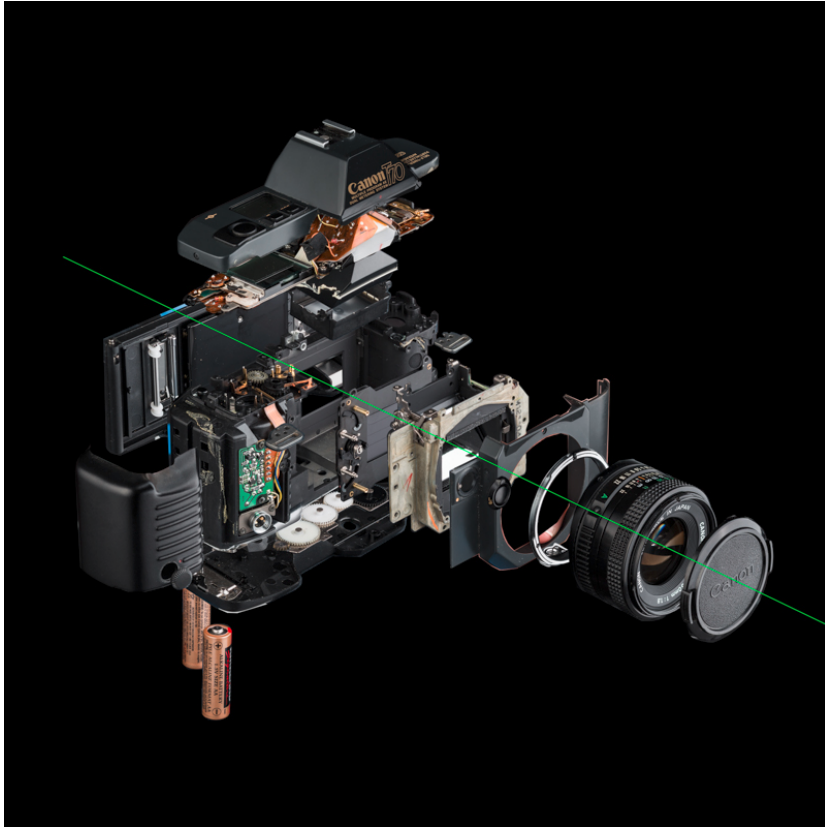


Boutet's 7-color and 12-color color circles from 1708

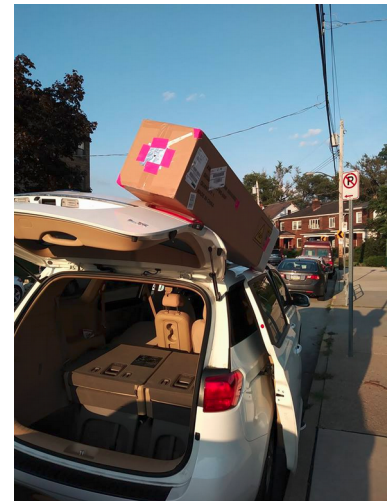
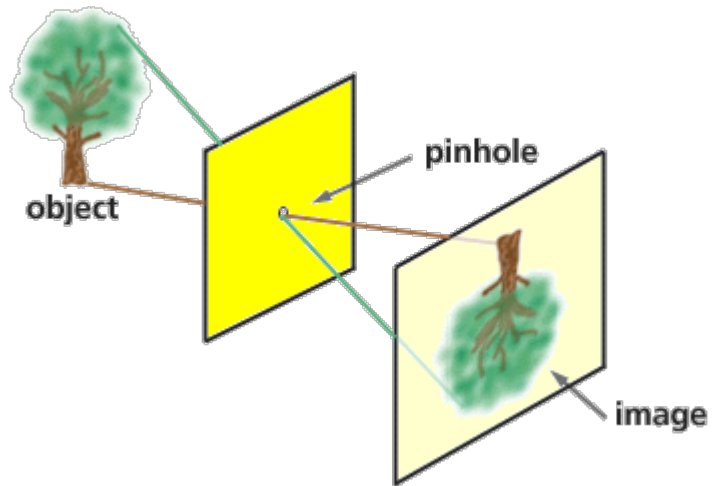


CIE 1931 xy chromaticity diagram

Cameras



Pinhole can make a lens

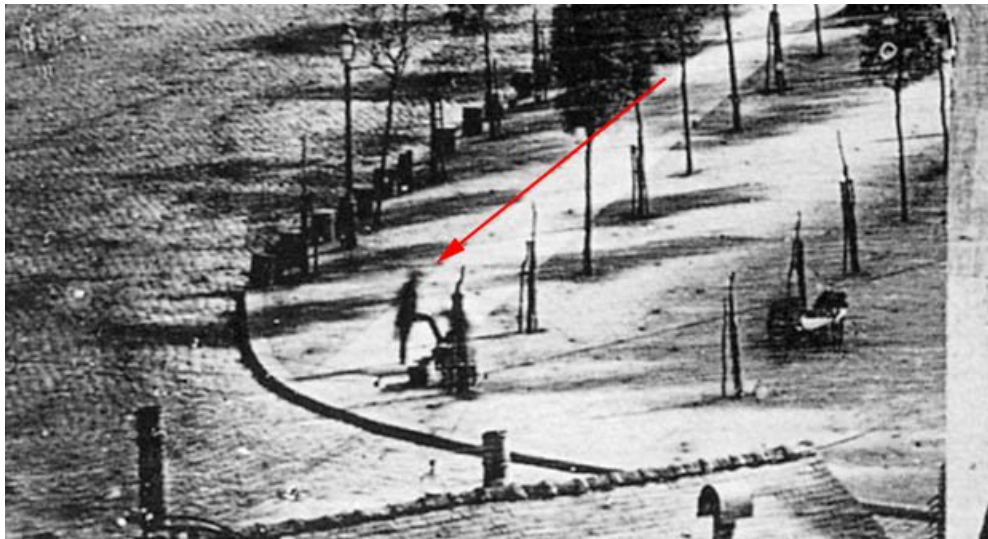
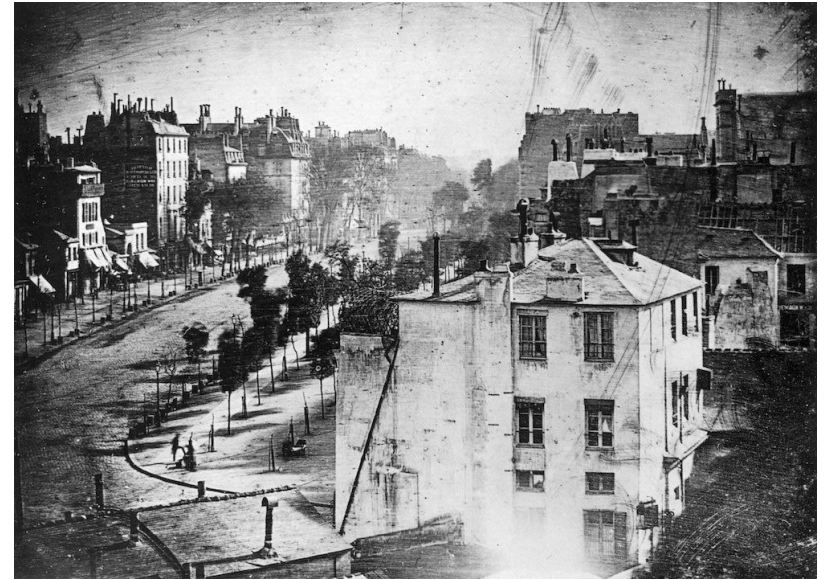


Camera Obscura

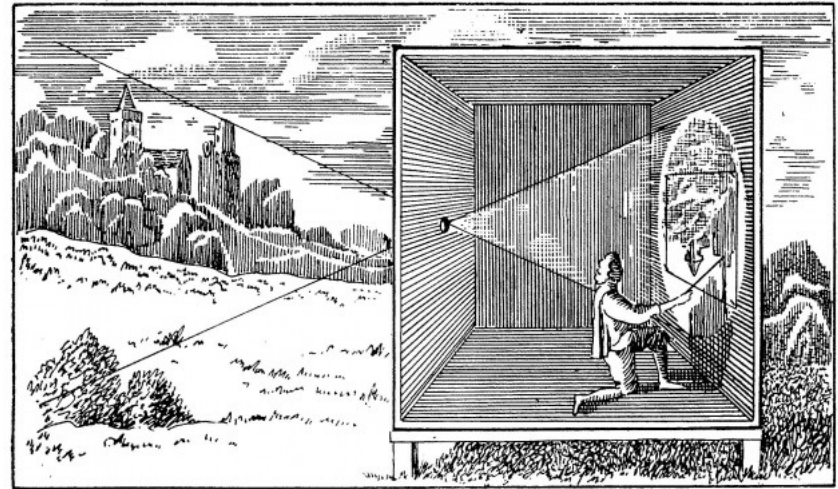


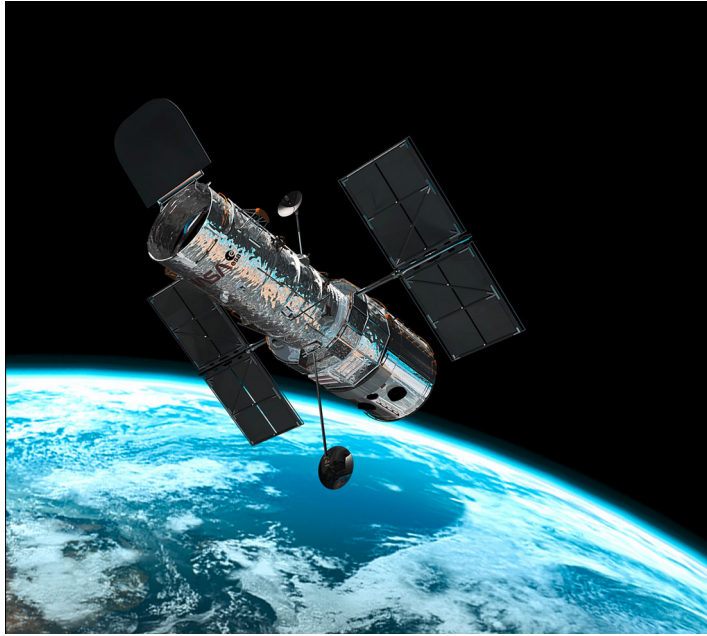
Officer and Laughing Girl
Johannes Vermeer
c. 1655–1660
Oil on canvas, 50.5 x 46 cm.
Frick Collection, New York

First Photographed Human 1838

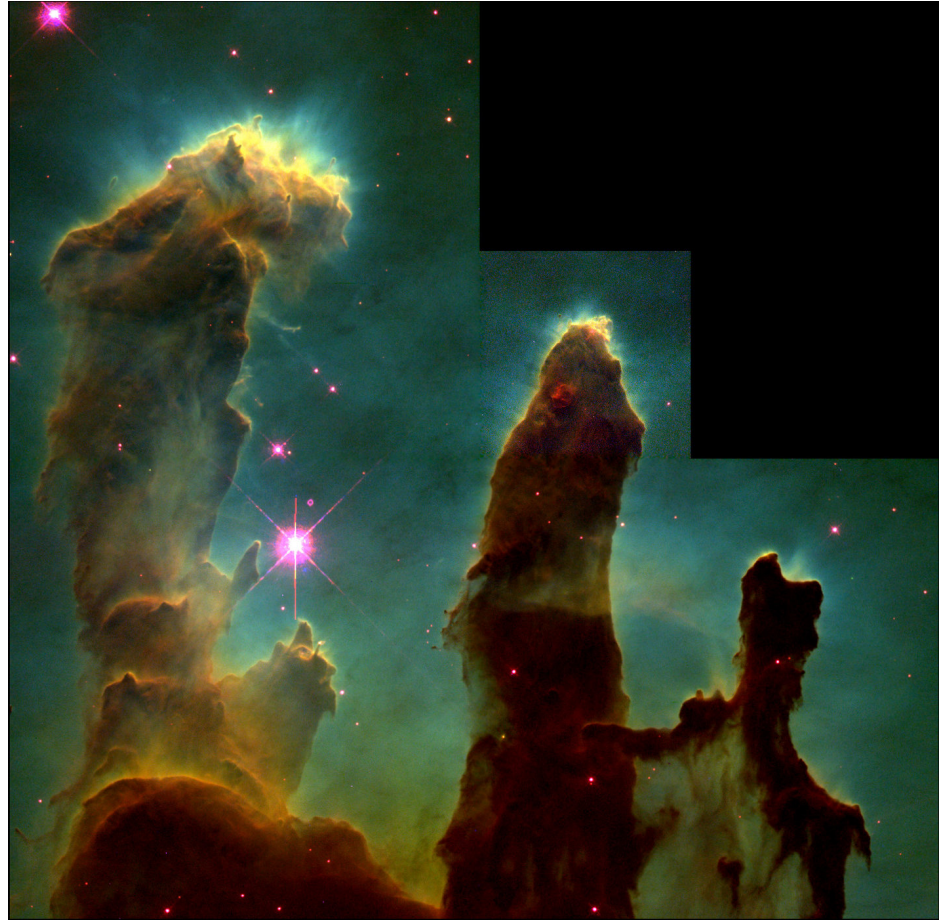


Central Park from an apartment



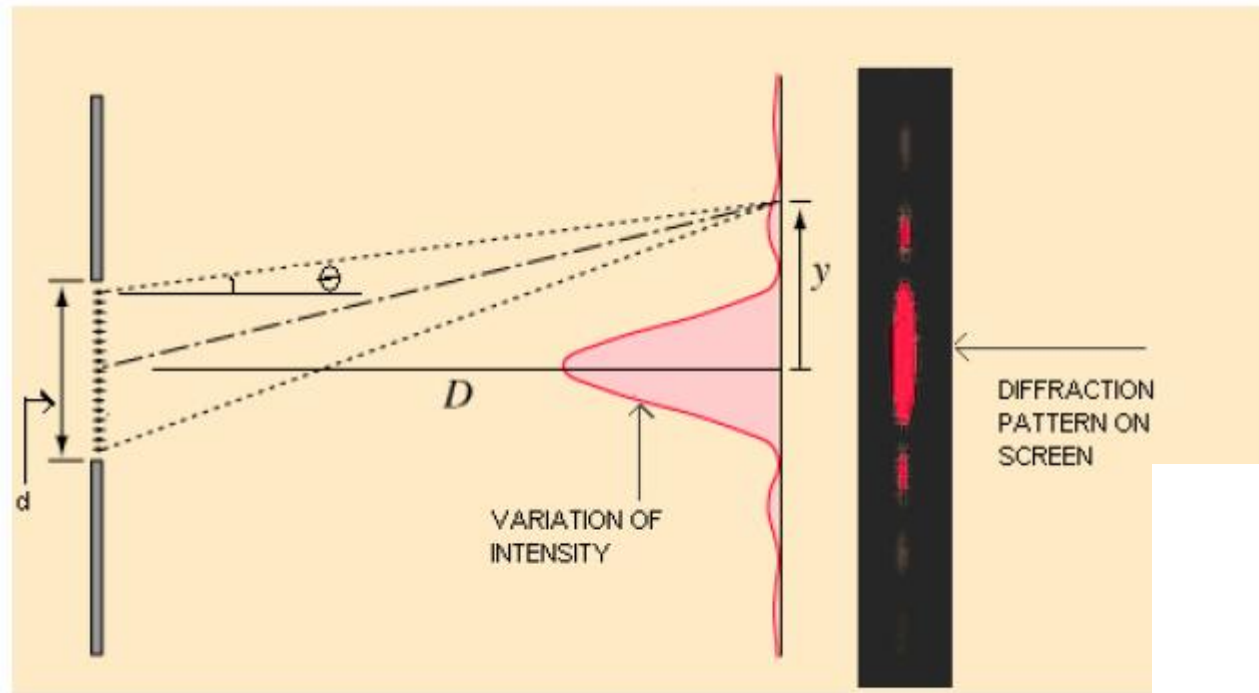


<--9.5 light-years (90 trillion kilometers) -->

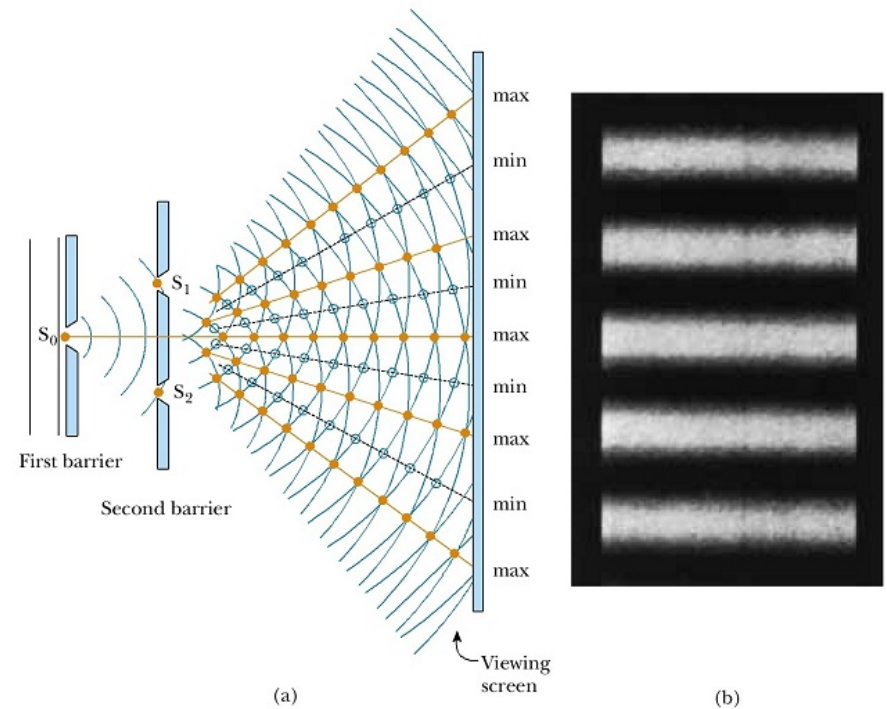


"Pillars of Creation"
1995 Hubble Space Telescope
visible light, SII/H-alpha and OIII filters
Eagle Nebula NGC 6611
7000 light-years distant

Light gets Weirder



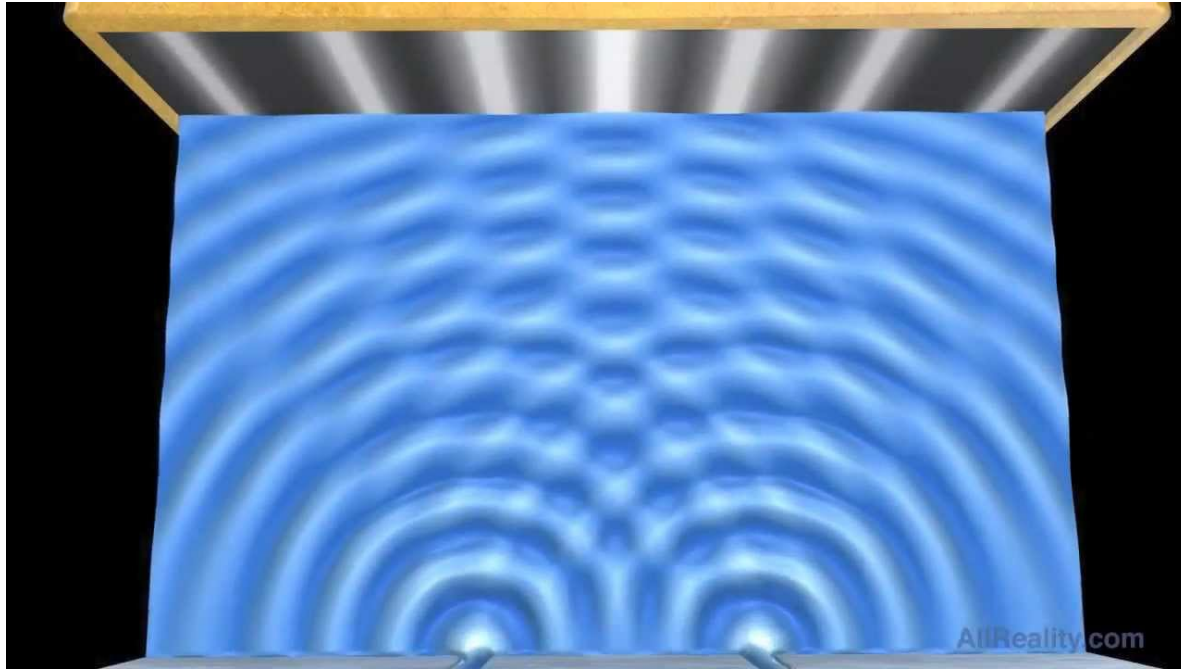
SINGLE SLIT FRAUNHOFER DIFFRACTION PATTERN.



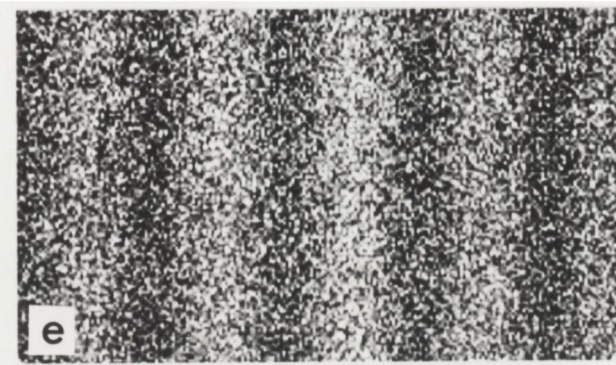
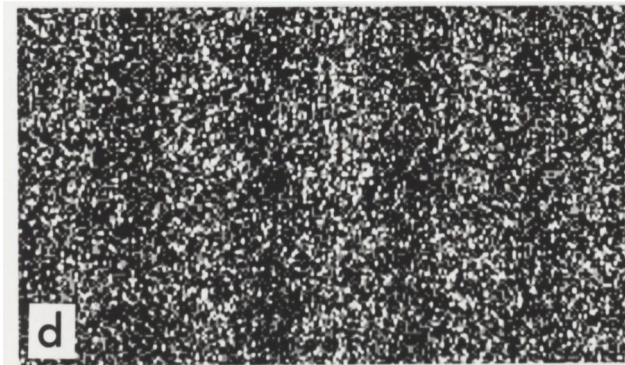
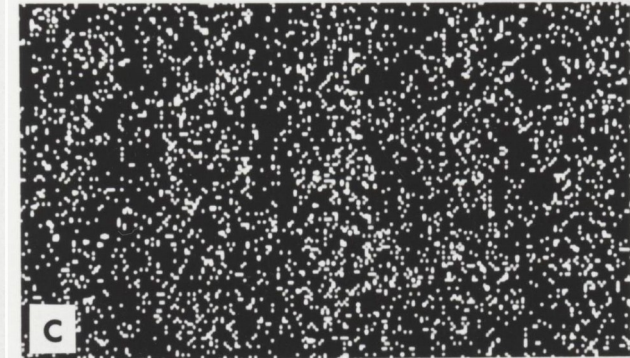
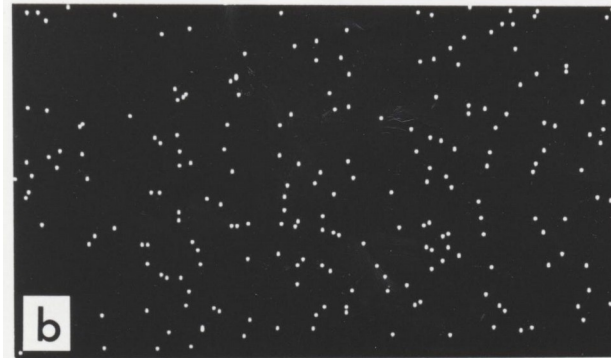
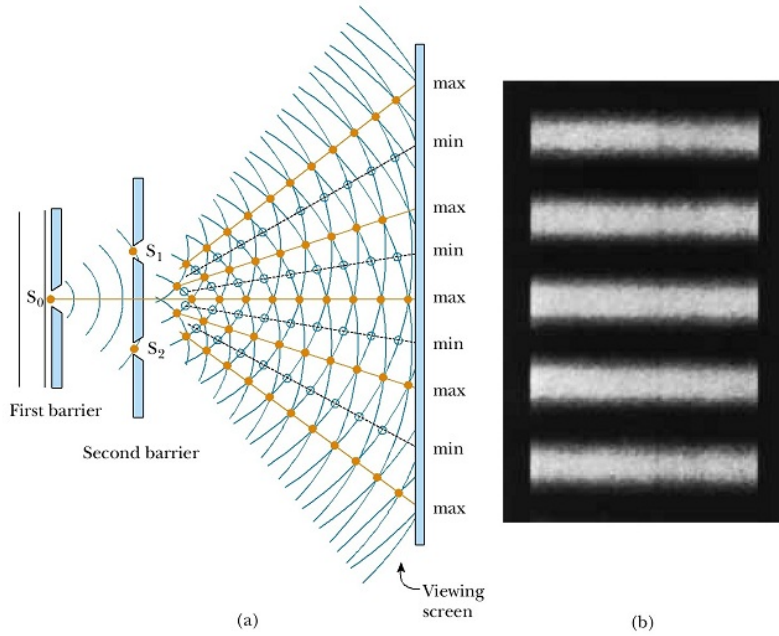
(a)

(b)

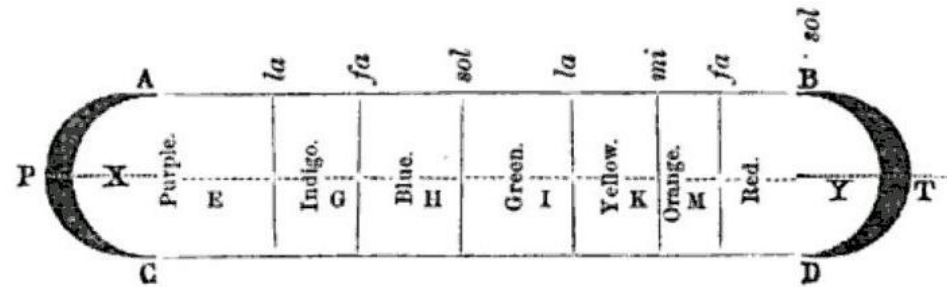
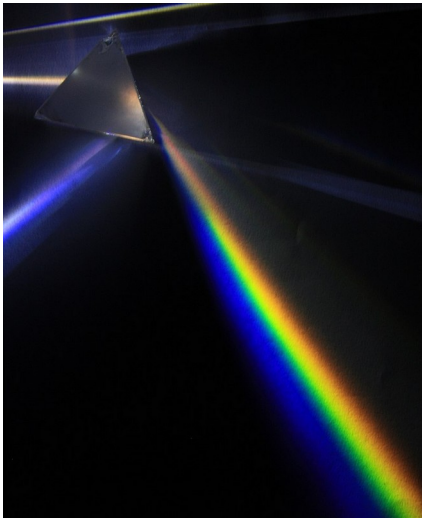
Same pattern observed with waves



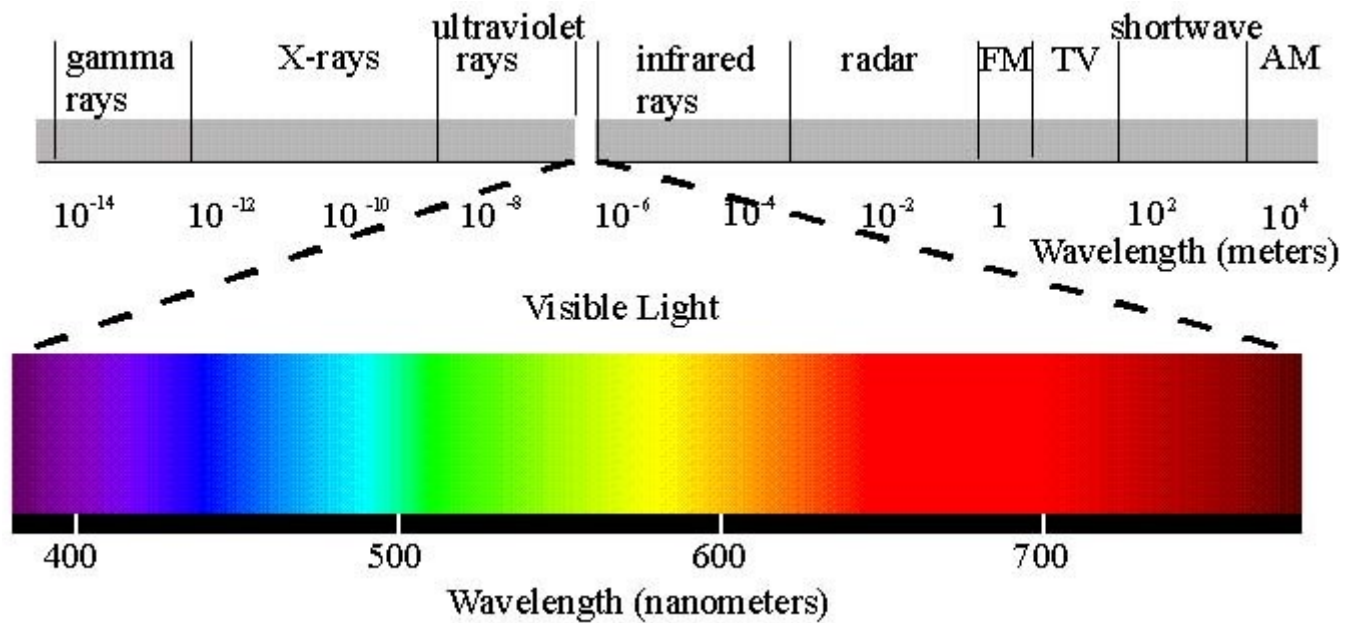
...and Even Stranger



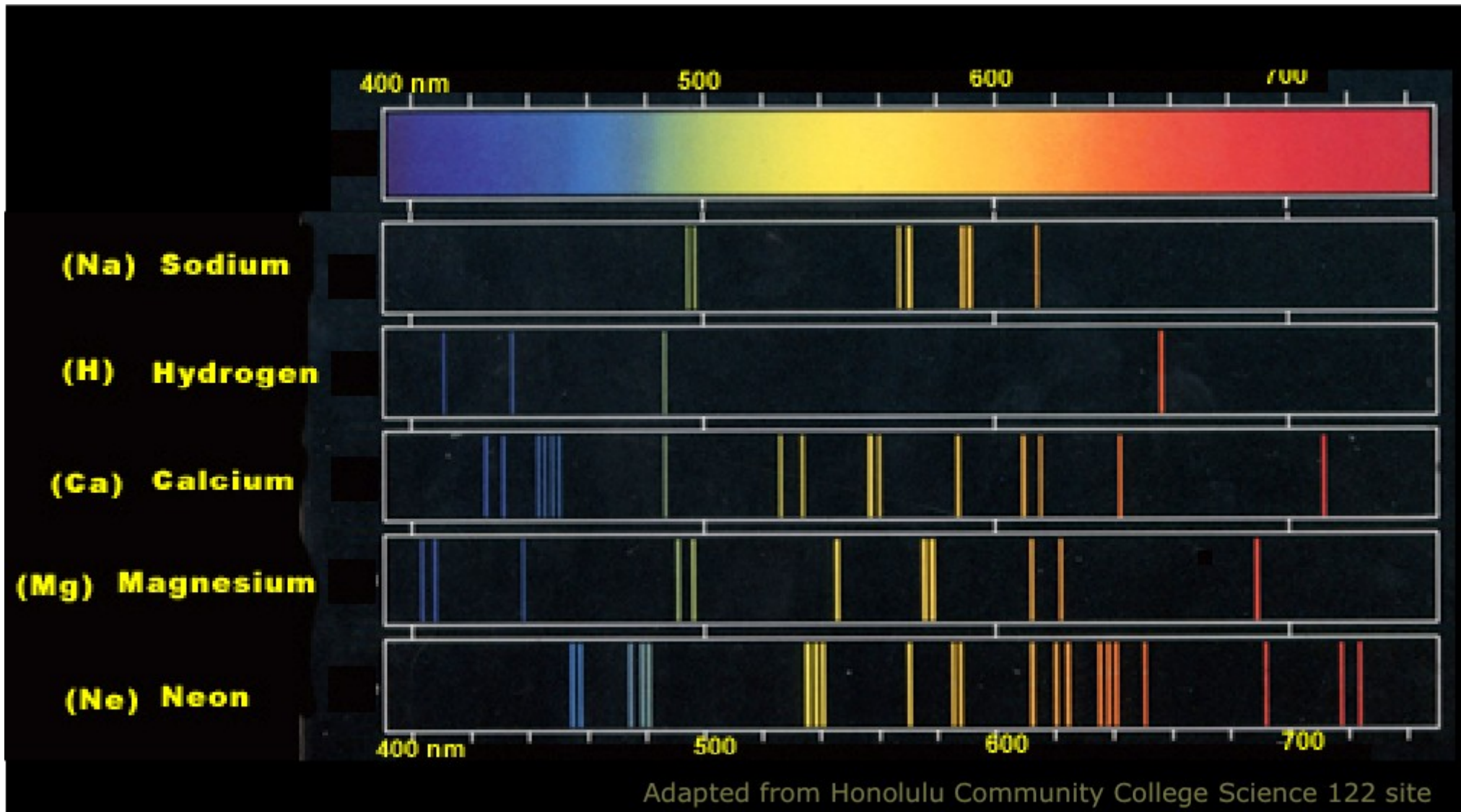
Wavelength Associated with our color perception



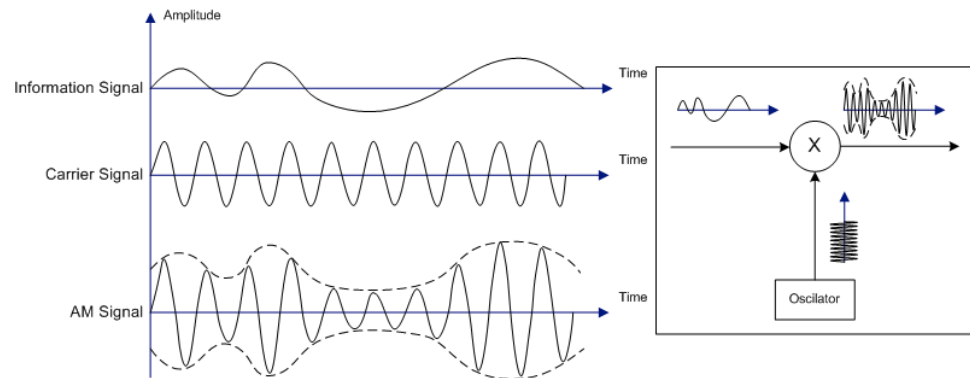
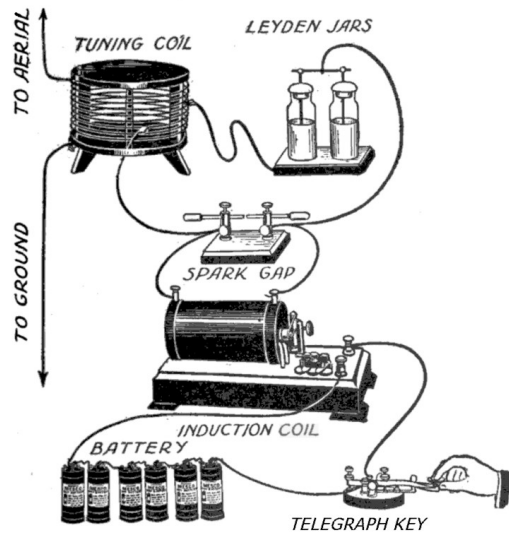
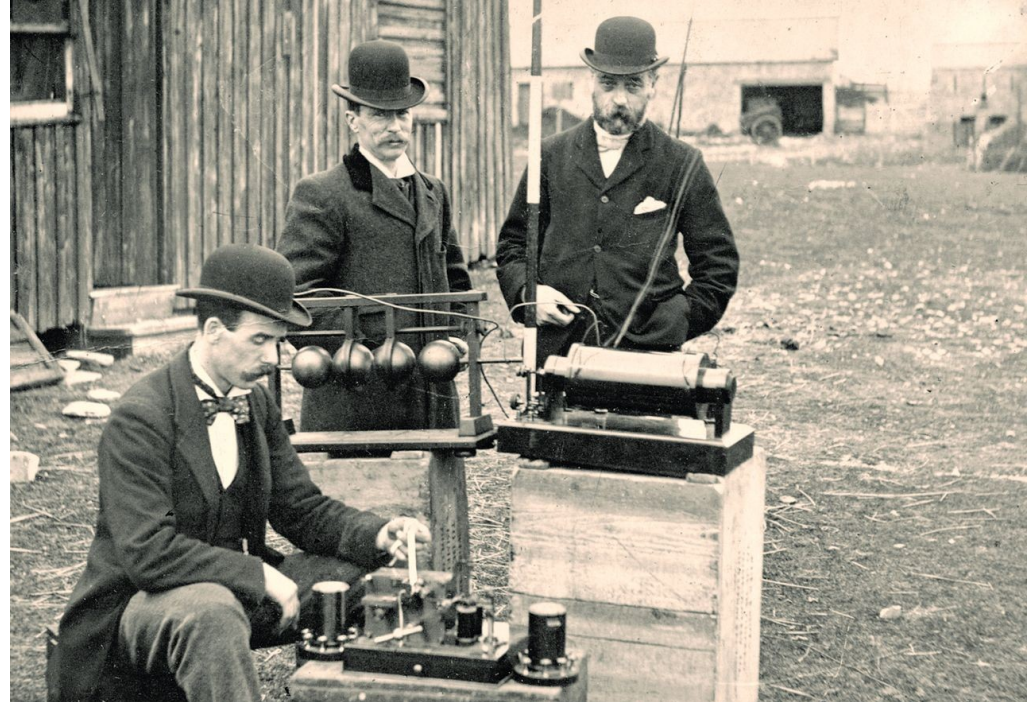
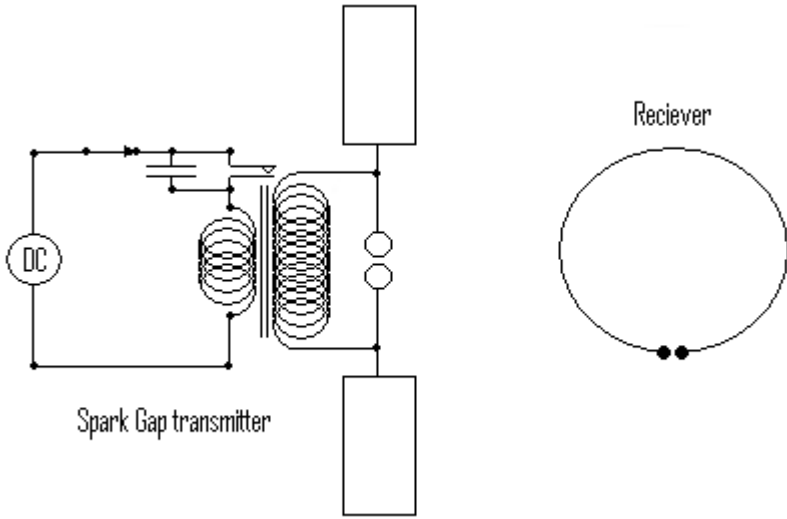
Isaac Newton, circa 1750



Visible light from atomic vibration



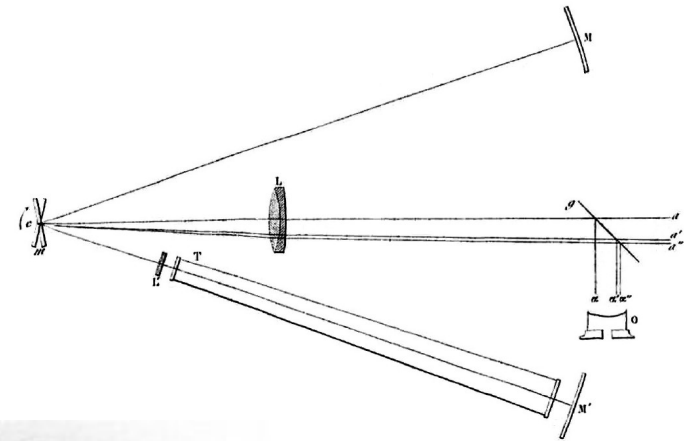
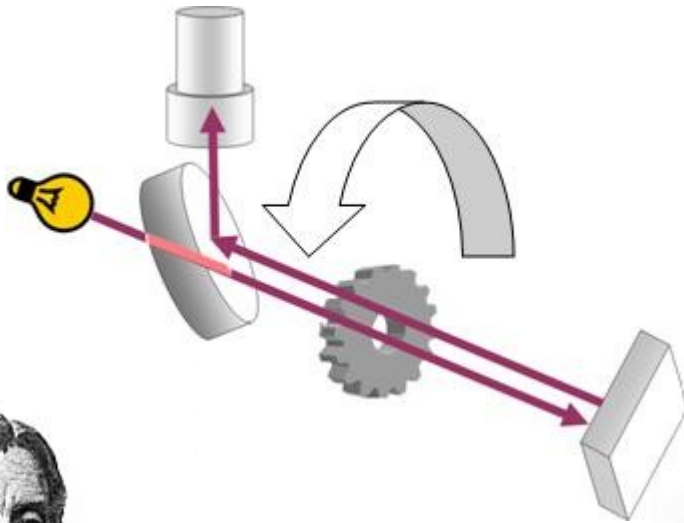
Radio Waves



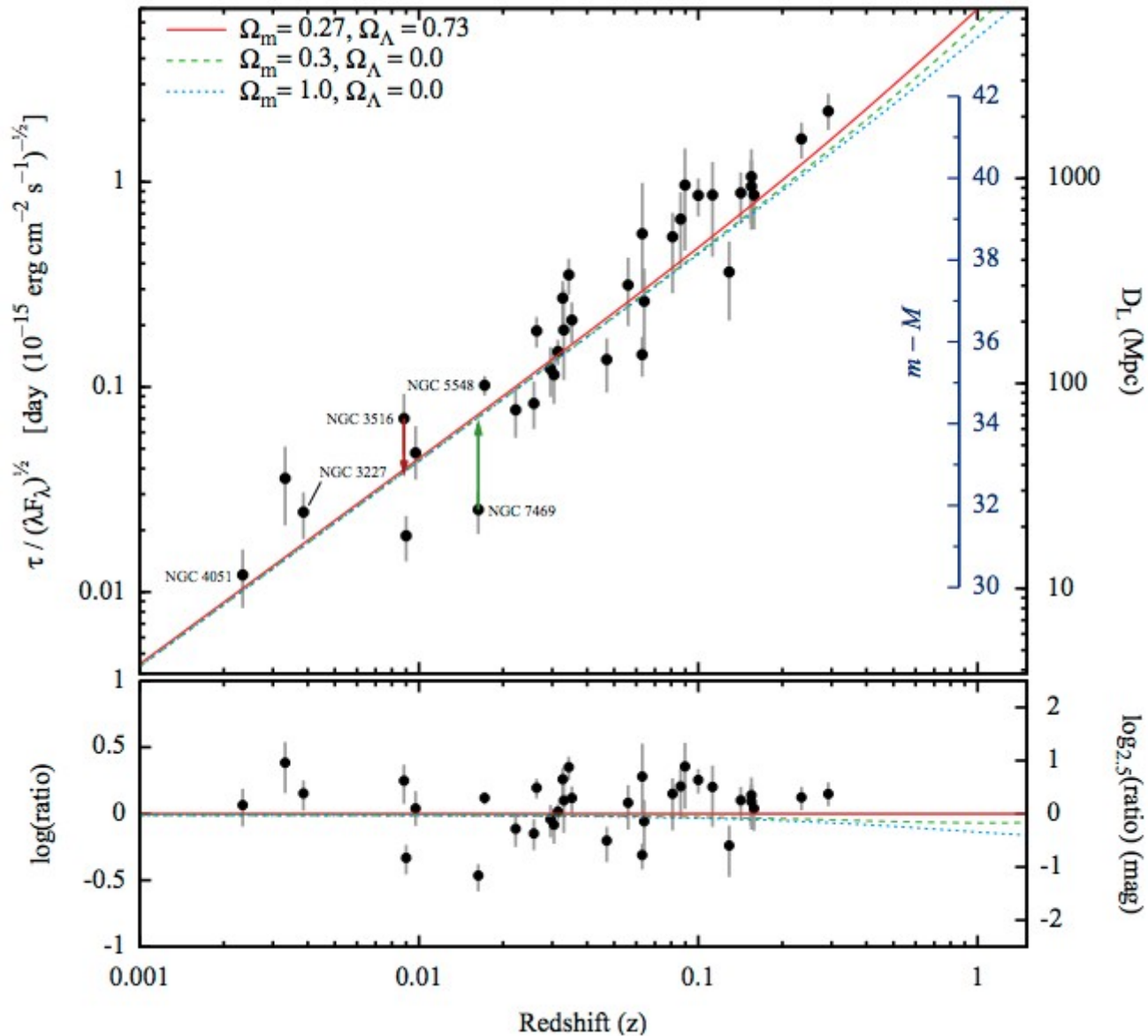
Radar Old and New



Measuring the speed of light - 1850

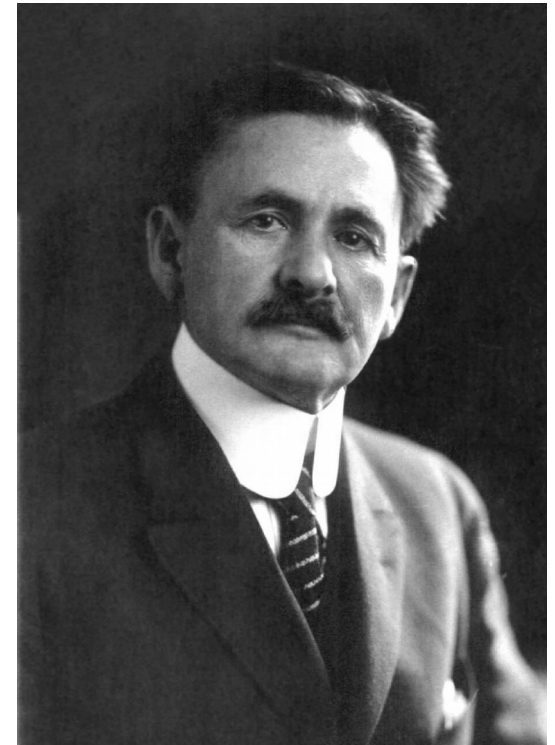
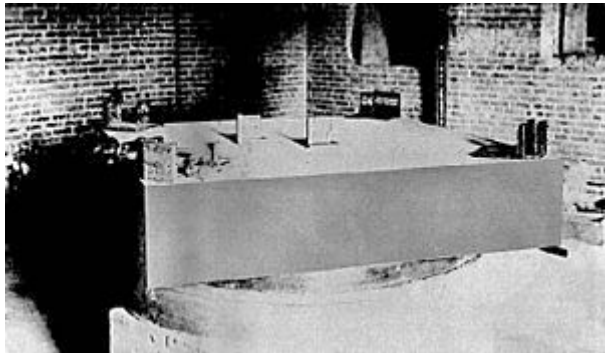
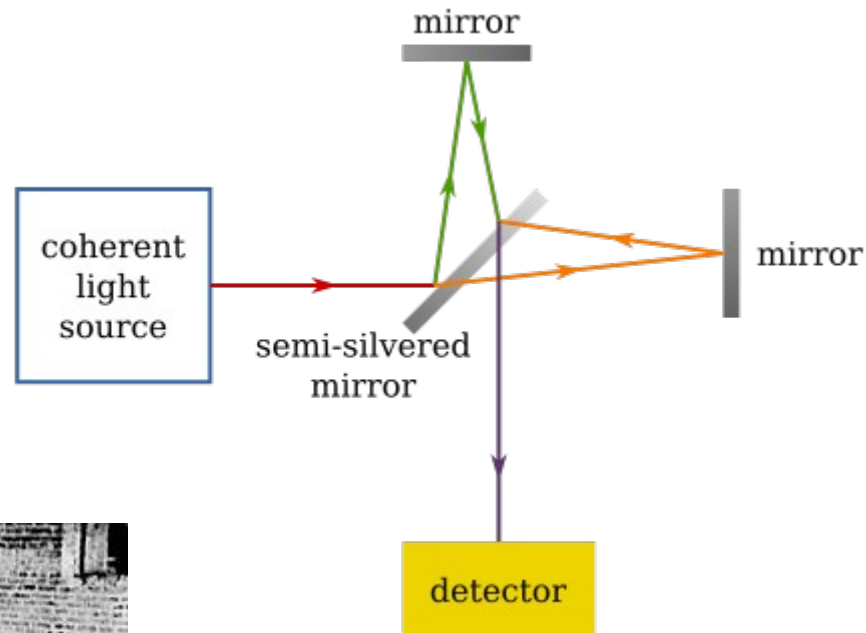


Observed expansion of the universe

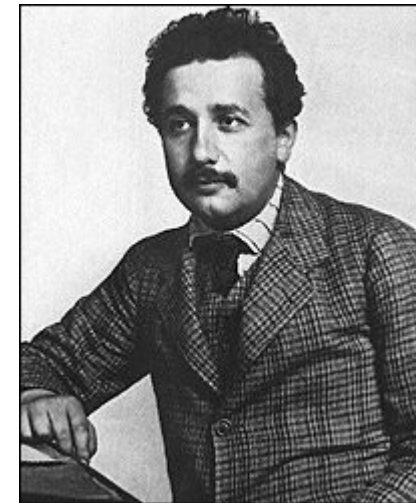
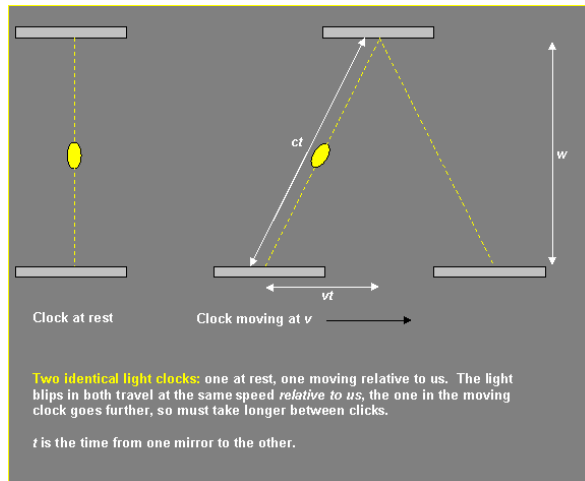


...another shocking revelation 1887

- Speed of light is the same everywhere



Special Relativity 1905



Lorentz boost (x direction)

$$t' = \gamma \left(t - \frac{vx}{c^2} \right)$$

$$x' = \gamma (x - vt)$$

$$y' = y$$

$$z' = z$$

where v is the relative velocity between frames in the x -direction, c is the **speed of light**, and

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$