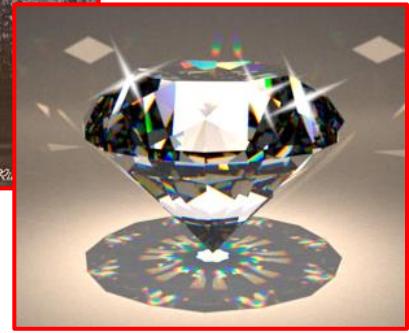


What Is Light?



Observed Properties of Light

- Light travels in straight lines (*shadows*)
- Light can be bright or dim (*intensity*)
- Light can be different colors (*dispersion*)
- Light can bounce off surfaces (*reflection*)
- Light can, or cannot go through objects/ substances (*transmission/absorption*)
- Light changes its speed/direction when entering different materials (*refraction*)
- Light can bend at an opening or edge (*diffraction*)

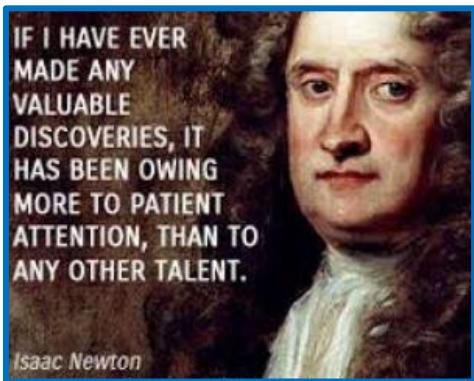
... WHAT IS LIGHT ?

Nature of Light Debate

Isaac Newton, 1675:

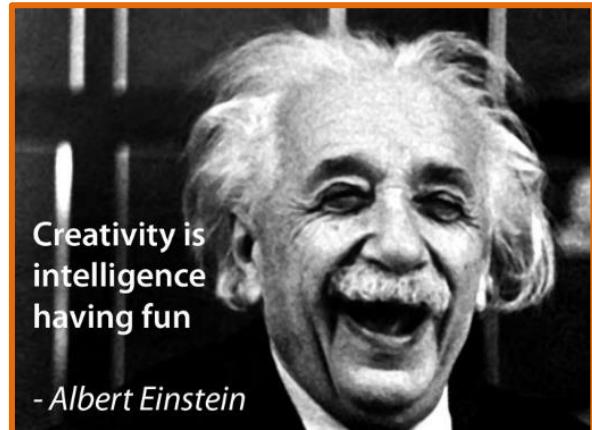
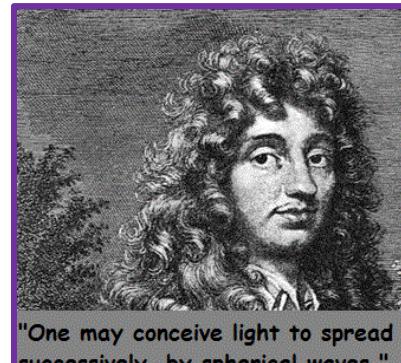
light is made of
particles of energy
(corpuscles).

Explained reflection,
shadows, traveling
in straight lines.



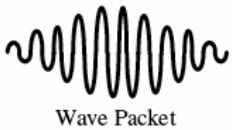
Christiaan Huygens, 1678:

light is made of
waves in ether.
Explained
diffraction,
interference.



Albert Einstein, 1905:

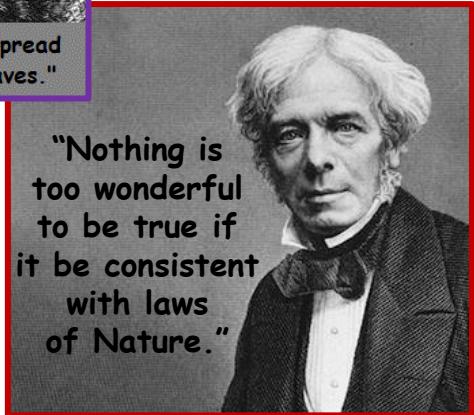
a beam of light is not a continuous wave propagating through space, but rather a **collection of discrete wave packets, photons.**



Michael Faraday, 1847:

light is a **high-frequency electromagnetic vibration**, which could propagate even in the *absence of a medium*.

"Nothing is too wonderful to be true if it be consistent with laws of Nature."



"Mathematicians may flatter themselves that they possess new ideas which mere human language is as yet unable to express."

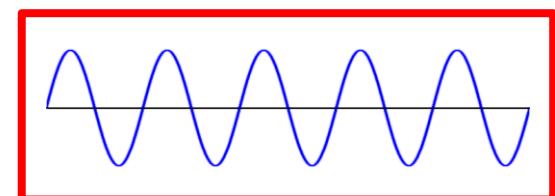
James Maxwell, 1864:
light is an **electromagnetic wave**.



Can we compare light to... ...the waves in the ocean?



***“High-low”
pattern behind
the obstacle***

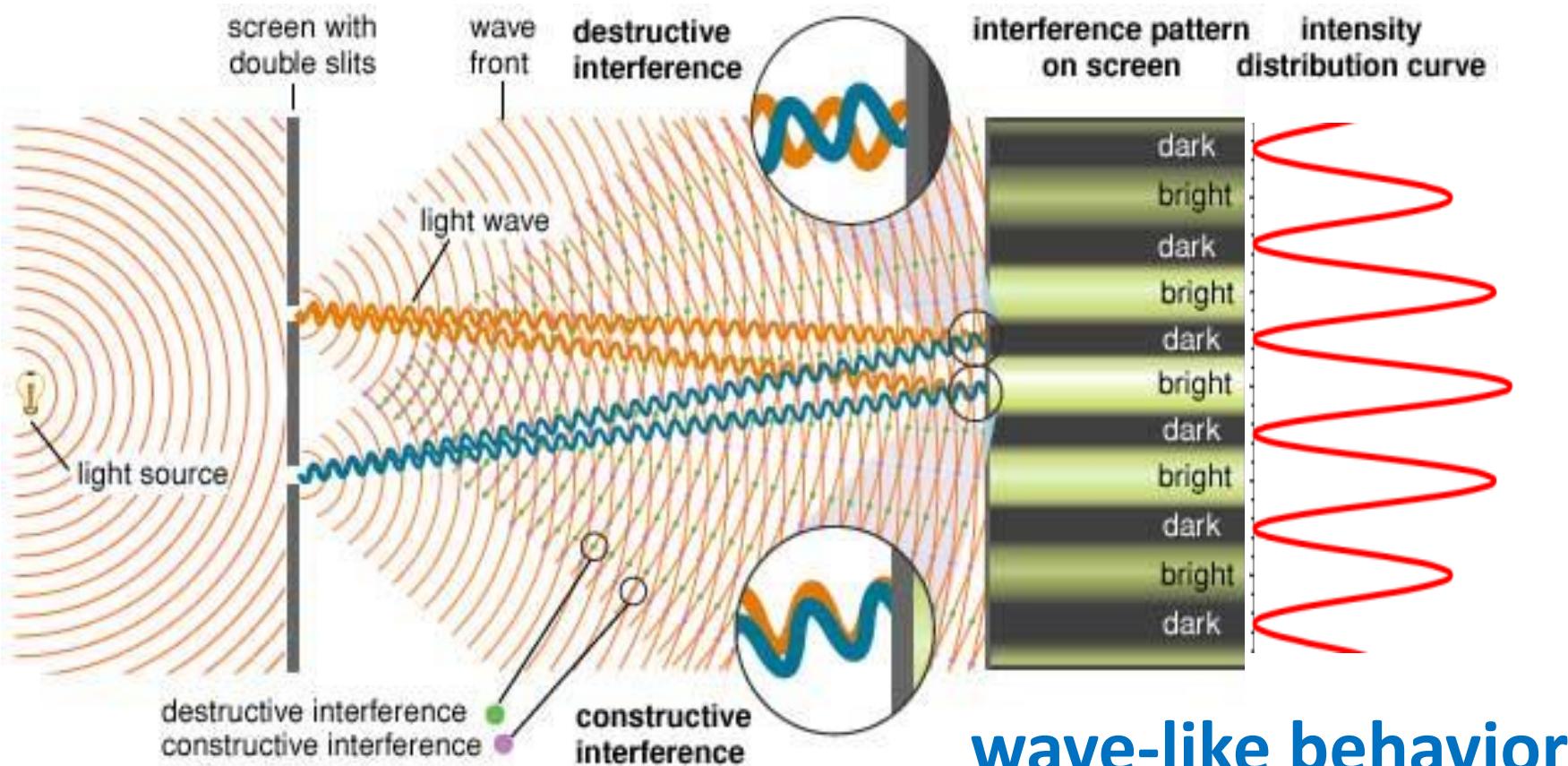


Double-Slit Experiment

Thomas Young, 1803



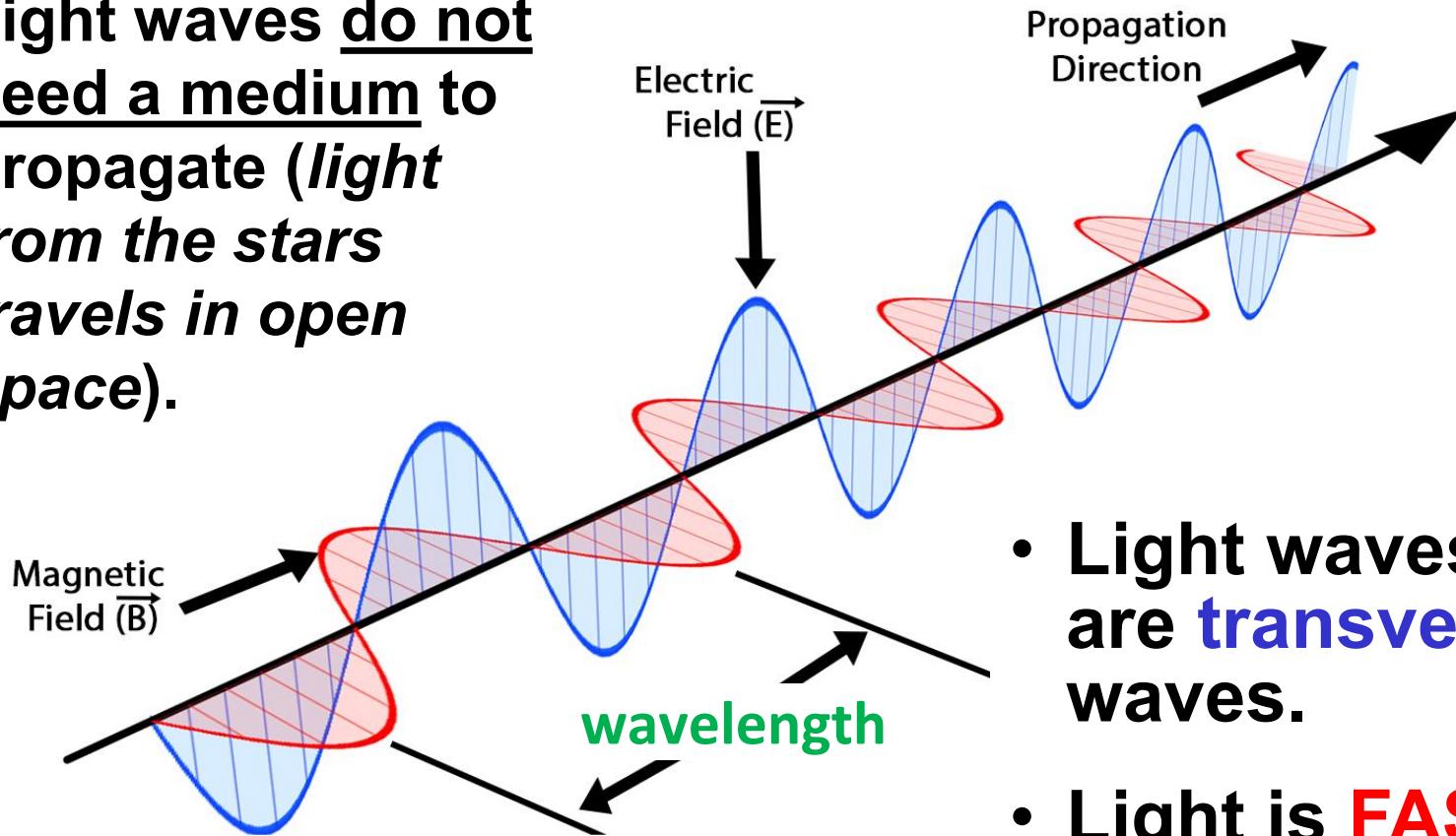
Light passing through two parallel slits will interfere, producing a *pattern of bright and dark fringes*.



Light Waves

Light is an **electromagnetic wave** made of oscillations of *electric and magnetic field*.

- Light waves do not need a medium to propagate (*light from the stars travels in open space*).

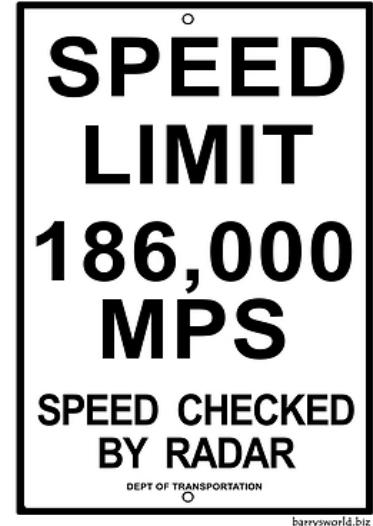


- Light waves are **transverse** waves.
- Light is **FAST!**

Speed of Light

<https://www.youtube.com/watch?v=kZZ4B8UiEGM&t>

The speed of light in a vacuum, denoted ***C***, is **constant** throughout the Universe.



- ***C*** is the **maximum speed** at which all matter and information in the Universe can travel.
- ***C* = 299,792,458 meters/second** (approximate value of ~300,000,000 m/s is commonly used for simple calculations)
- When light travels through matter, its speed can change (inside a *diamond*, light is *slowed down to less than 80,000 mps*), but can **never be larger than *C***.

Speed of Light – How Fast?

- It takes ~8 minutes for light to travel all the way from the Sun to the Earth.
- It takes ~ 4.4 years for light from the nearest star, Alpha Centauri, to reach the Earth.



- It takes ~2.5 million years for light from the nearest large galaxy, Andromeda, to reach our own galaxy, the Milky Way.