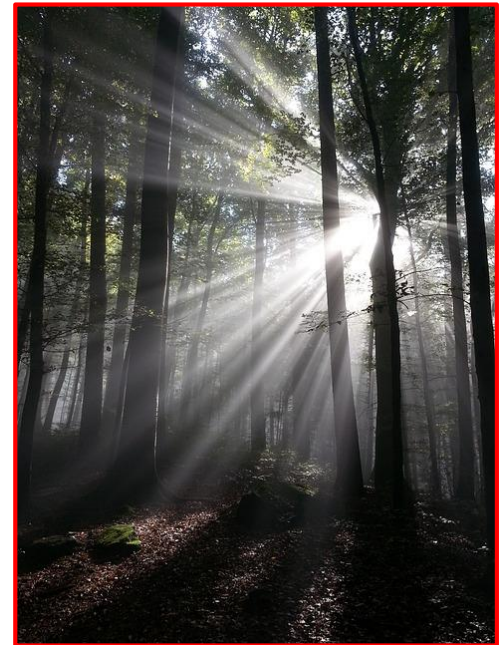
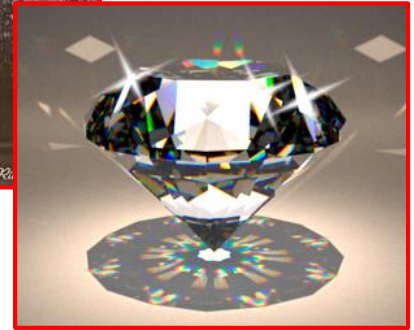


# What Is Light?

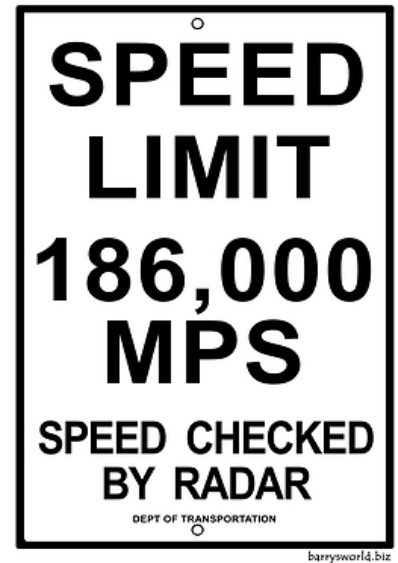


# Observed Properties of Light

- 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 substances (*transmission/absorption*)
  - Light slows down/changes direction in media (*refraction*)
  - Light can bend at an opening or edge (*diffraction*)
- ...and light is very fast!**

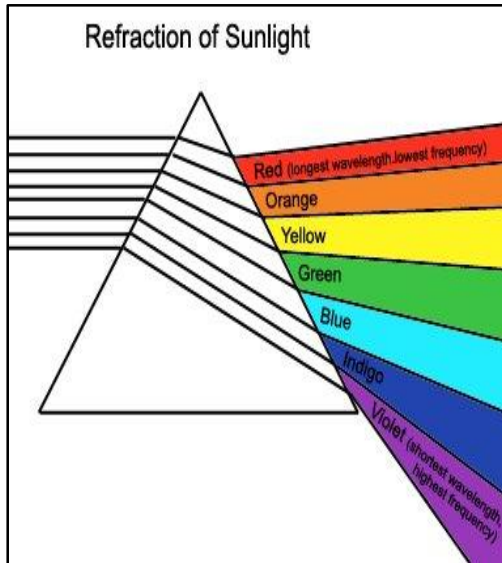
# Speed of Light

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



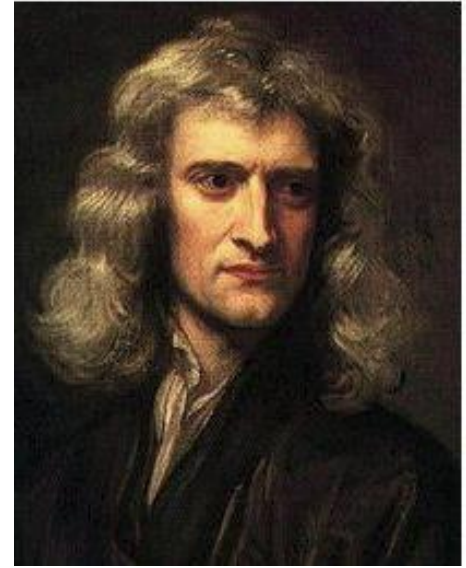
- **C** is the **maximum speed** at which all matter and information in the Universe can travel.
- **C = 299,792,458 meters/second** (~186,000 mps)
- Scale sense: it takes ~8 minutes for light to travel all the way from the Sun to the Earth.
- When light travels through matter, its speed can change (inside a *diamond*, light is *slowed down to less than 80,000 mps*), but can **never be larger than C**.





# Decomposition of Sunlight

Isaac Newton, 1665



**Common (Aristotle) wisdom:**  
*white light is the purest form - colored light must therefore have been altered somehow...*

- Newton **shined a beam of sunlight through a glass prism** and showed that it decomposed into a **spectrum** cast on the wall – therefore all the colors were together in the sunlight.
- He thought he then should be able to **combine the colors** of the spectrum and **make the light white again**: he placed another prism upside-down in front of the first prism. The band of colors combined again into white sunlight.
- Newton was the first to prove that **white light is made up of all the colors that we can see**.

# Infrared Light Discovery

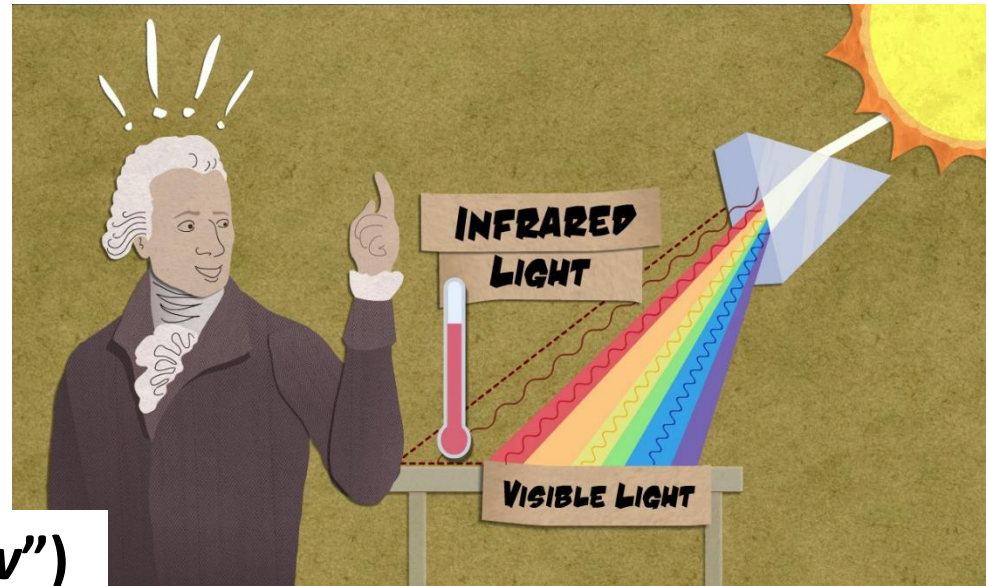
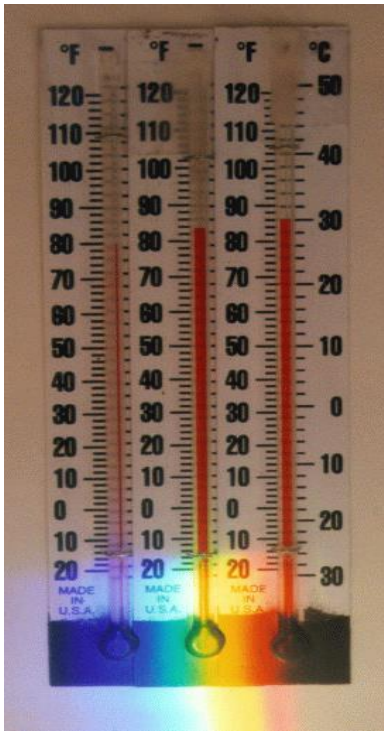
## Friedrich Herschel, 1800

Measured temperature of different colors of light.

- Observed the **increase in temperature** as he moved the thermometer from violet through blue, green, yellow, and orange to red where it reached its peak...
- ...and **moved the thermometer just outside** the red portion of the spectrum in an area that – to the human eye – contained no light at all.

- **“Invisible rays”** in this area had the **highest temperature of all**, and behaved just like visible light...
- First time anyone had demonstrated that there were forms of radiation that humans couldn't see.

**Infrared** (from Latin “*below*”)



# Ultraviolet Light Discovery

Johann Ritter, 1801



Measured the effect of different colors of light on a light-sensitive chemical, silver chloride.

- In the **red** portion of the spectrum darkening of the chemical was relatively **slow**.
- Progressing through orange, yellow, green, blue, and violet, he observed that each new batch of silver chloride grew darker faster...
- ...and placed the chemical **just outside the violet** portion of the spectrum in an area that – to the human eye – contained no light at all...
- “**Invisible rays**” in this area had the **greatest effect** (fastest darkening) **of all**.
- Same experiment can be done using a sheet of photographic paper.

**Ultraviolet**  
(from Latin “*beyond*”)

