How to describe light?

Bright/Dim

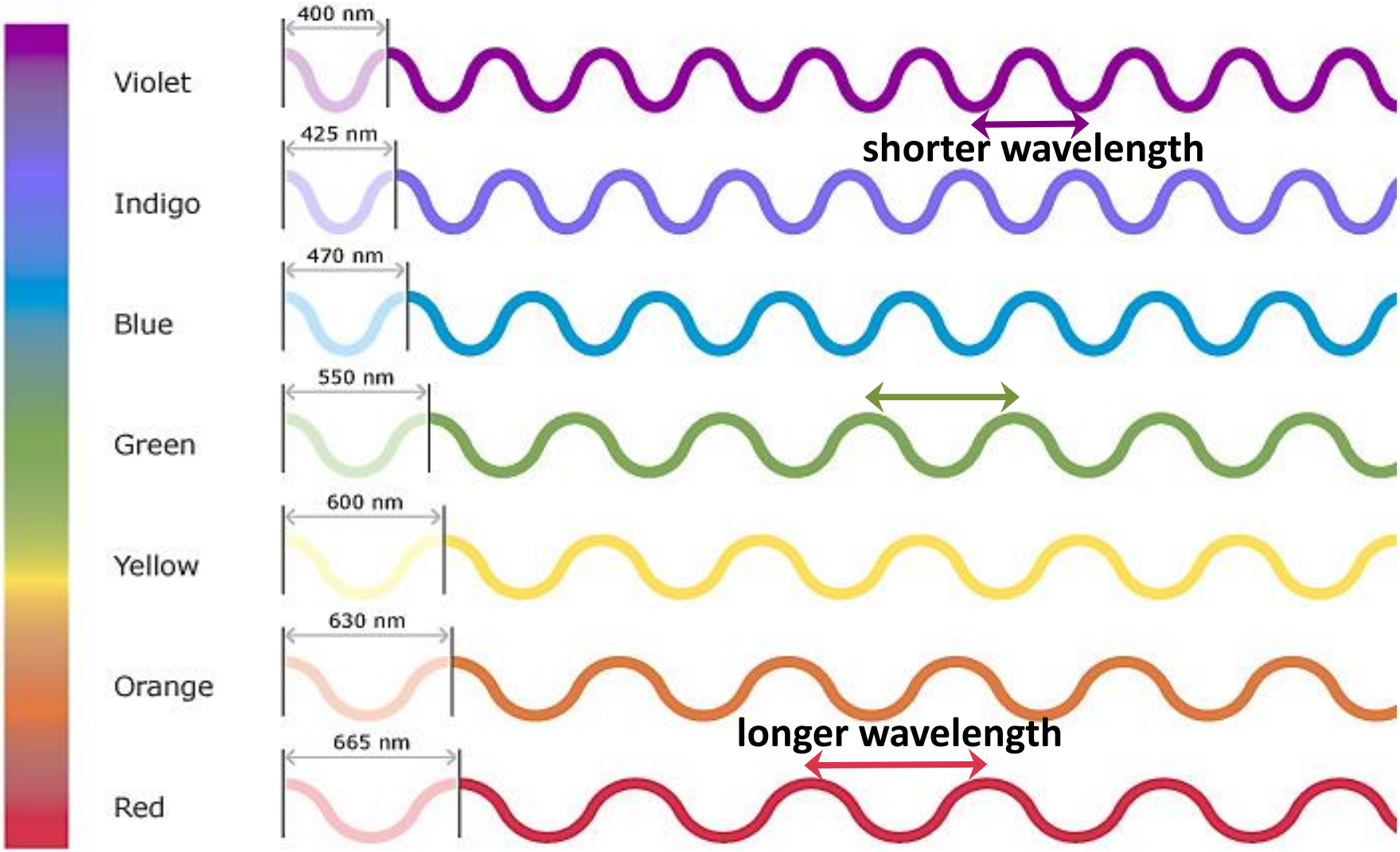
Color

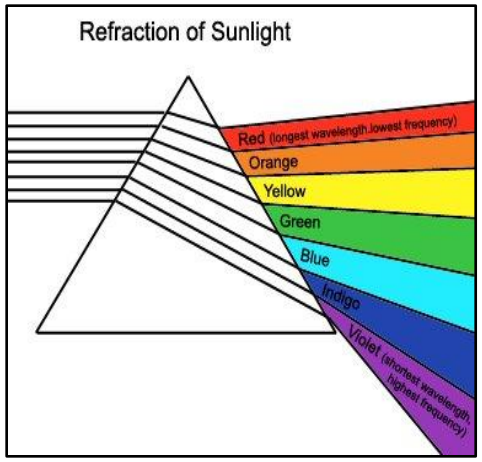
Amplitude

Frequency/Wavelength

Light Waves: Color

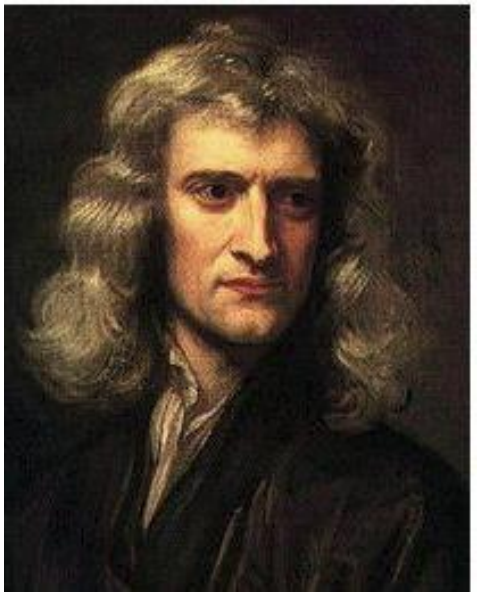
determined by the wavelength(s) of light waves





Decomposition of Sunlight

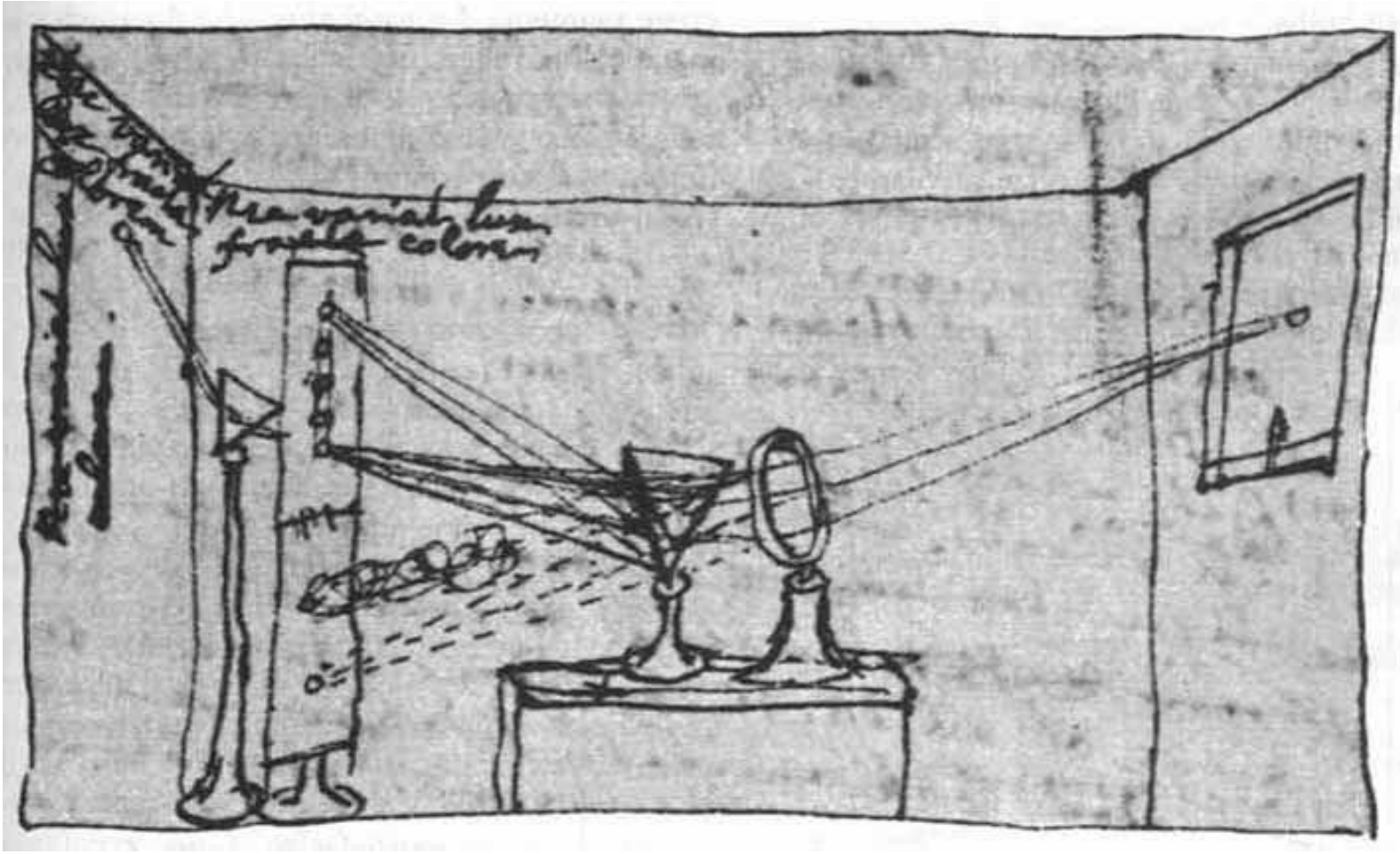
Isaac Newton, 1665



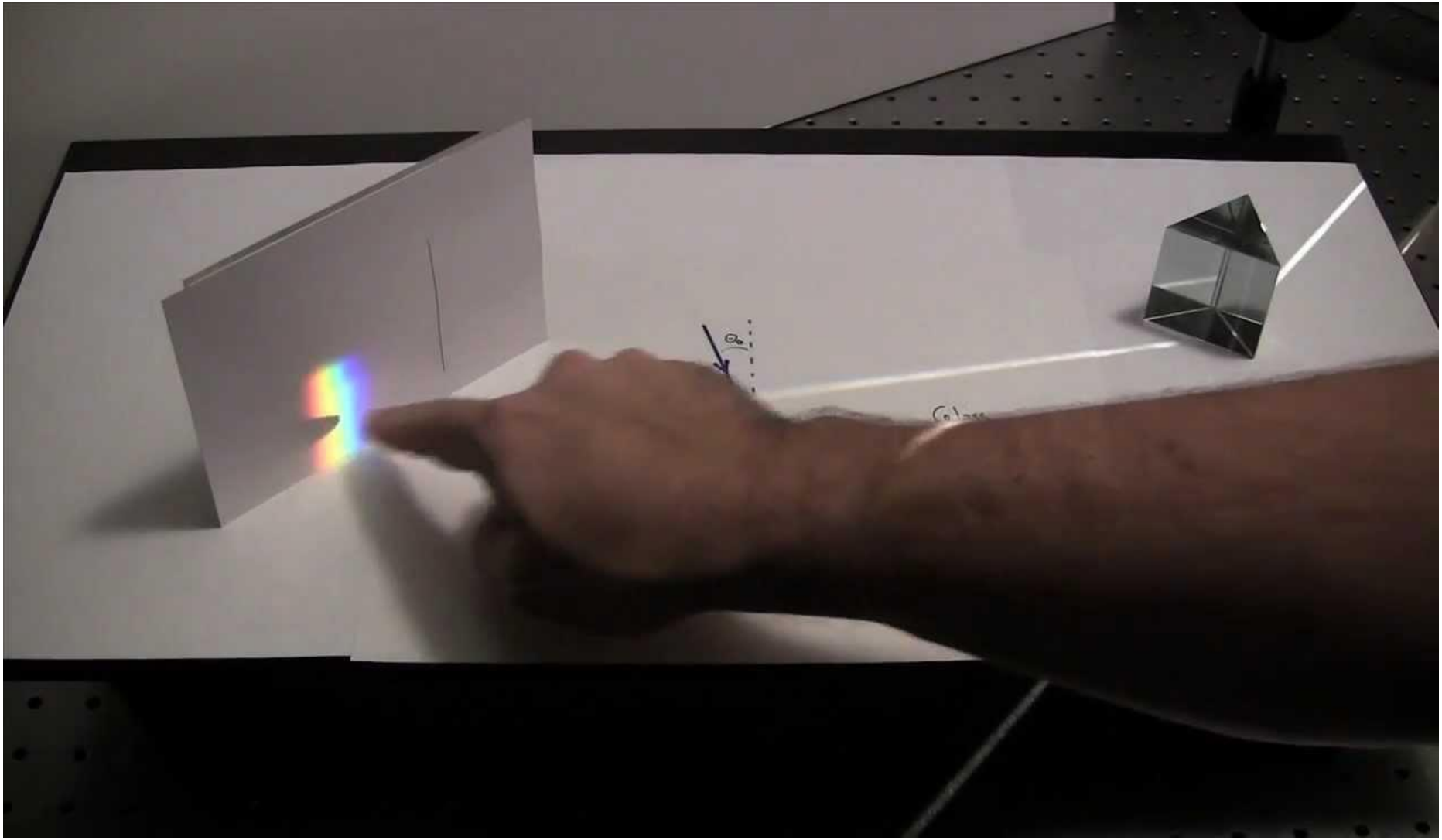
Common (Aristotle) wisdom:
white light is the purest form - colored light must therefore have been altered somehow…

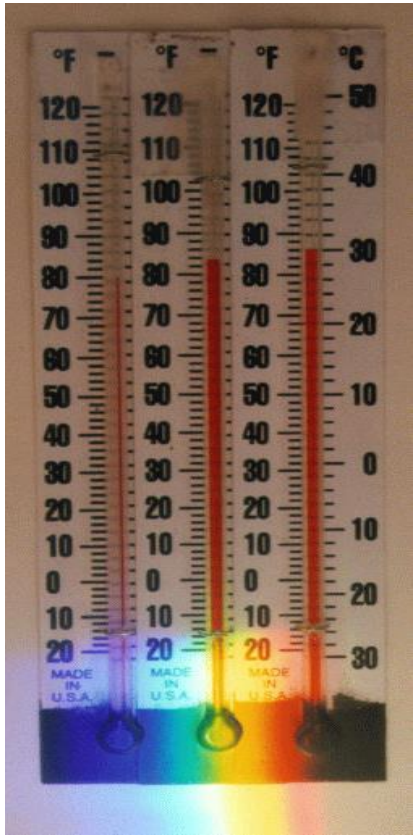
- Newton **shined a beam of sunlight through a glass prism** and showed that it decomposed into a **spectrum** cast on the wall – therefore all the colors were together in the sunlight.
- He thought he then should be able to combine the colors of the spectrum and make the light white again: he placed 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**.

A drawing 23 years old Isaac Newton made of the prism experiment he conducted in his dorm room in Cambridge.



The Prism Experiment



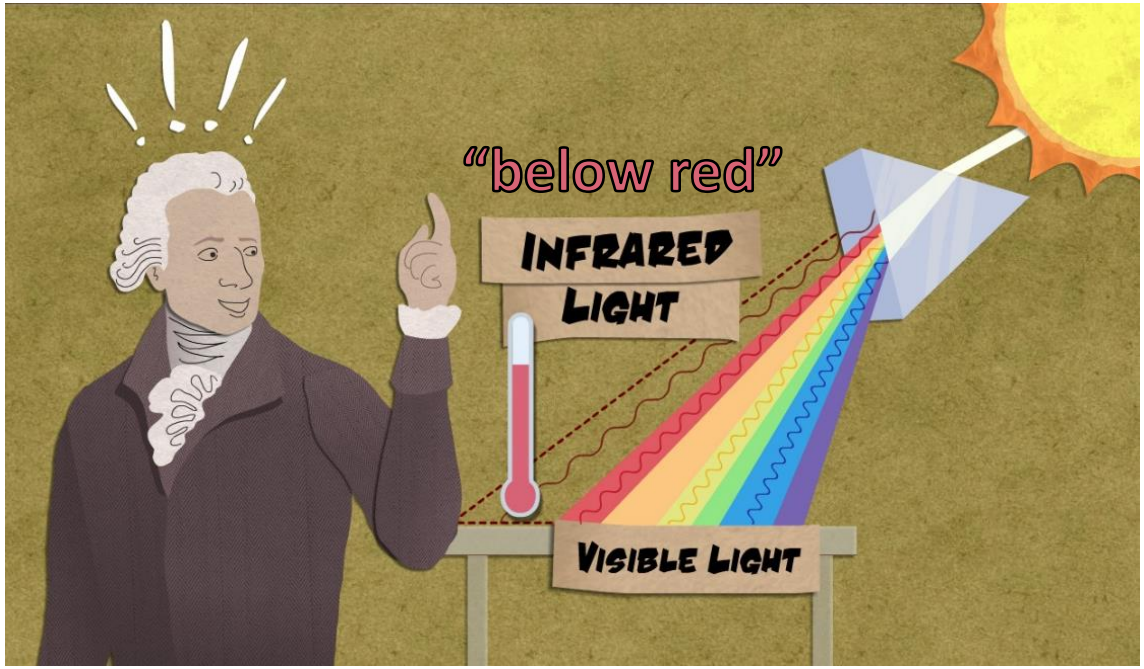


Infrared Light Discovery

Friedrich Herschel, 1800

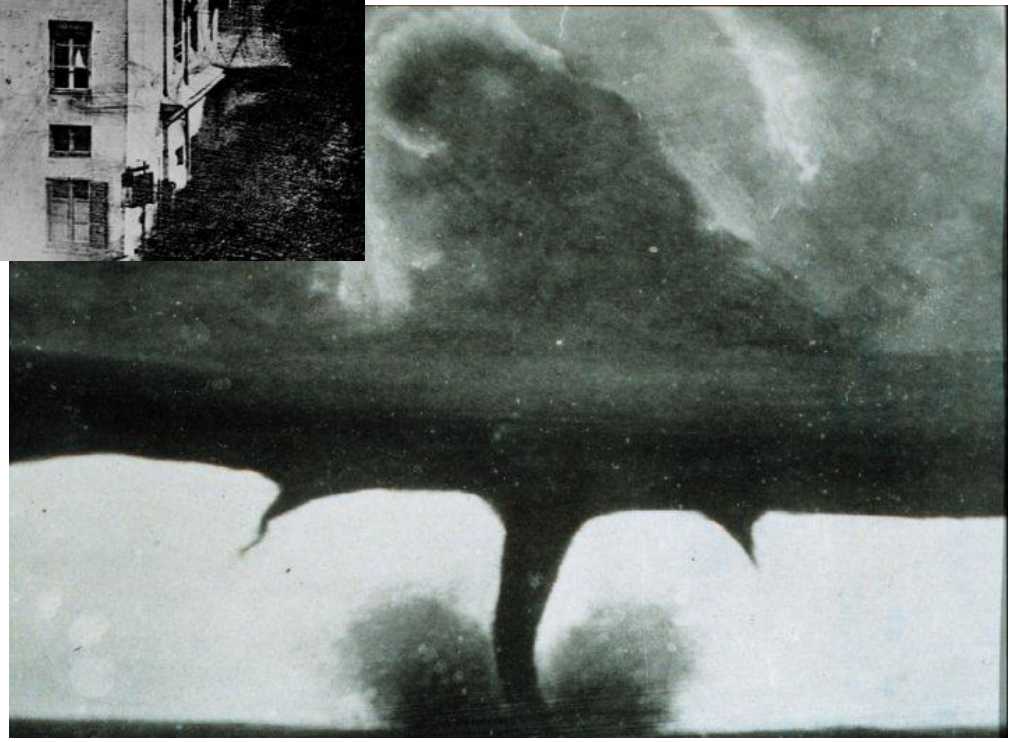
Measured <u>temperature</u> of different colors of sunlight.

Temperature increased as he moved the thermometer <u>from violet</u> through blue, green, yellow, and orange <u>to red</u> …and further increased just outside the red portion of the spectrum in an area that – to the human eye – contained no light at all!



- **First time anyone had demonstrated that there were "invisible rays", forms of radiation that humans could not see.**

First ever photograph of a *person*, 1838



First ever photograph of a *tornado*, 1884

Ultraviolet Light Discovery

Johann Ritter, 1801

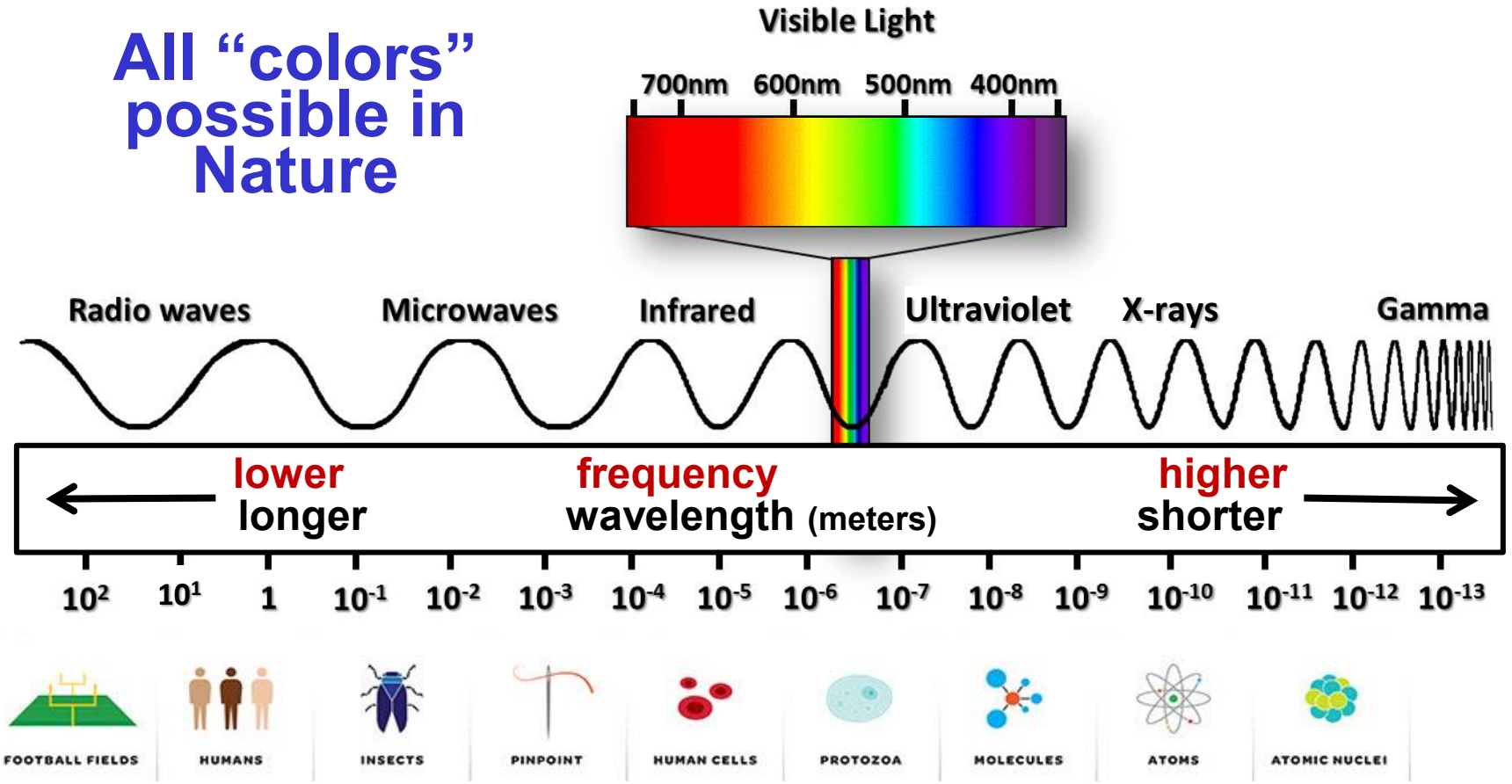
Measured the effect of different colors of light on a light-sensitive chemical, silver chloride.

- **In the red portion of the spectrum darkening of the chemical was relatively slow.**
- **Darkening grew faster through orange, yellow, green, blue, and violet…**

….and the greatest effect was observed just outside the violet portion of the spectrum in an area that – to the human eye – contained no light at all…

Electromagnetic Spectrum

All "colors" possible in Nature

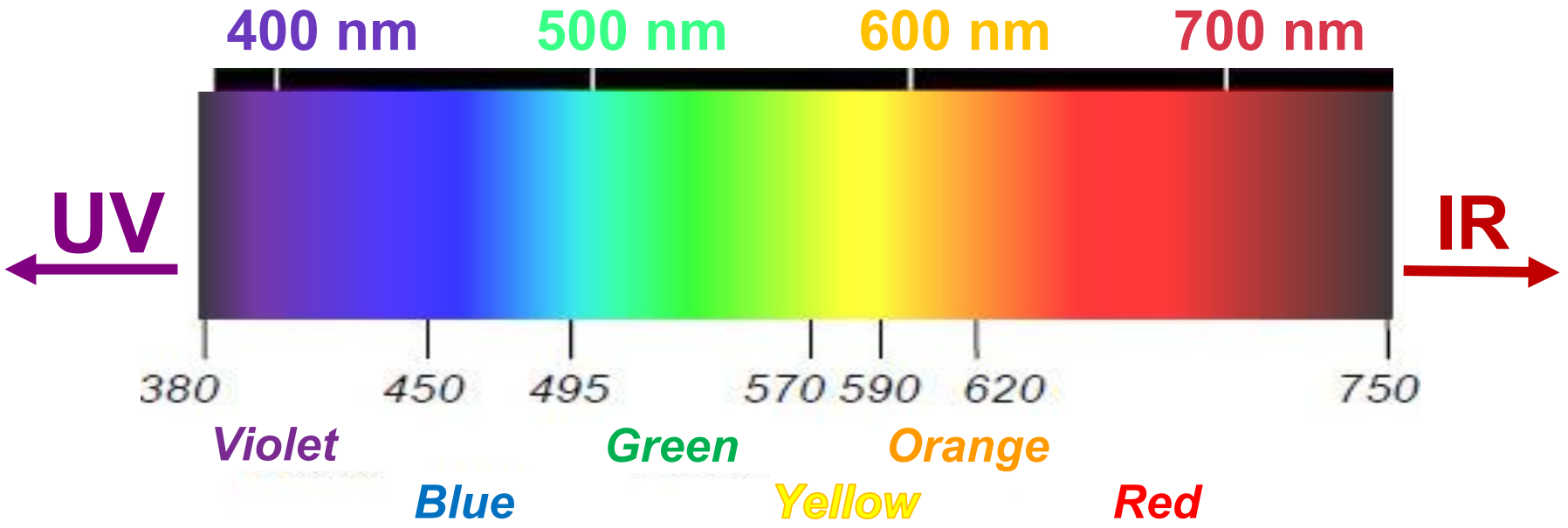


$$\text{Wavelength} = \frac{c}{\text{Frequency}}$$

where c is the speed of light

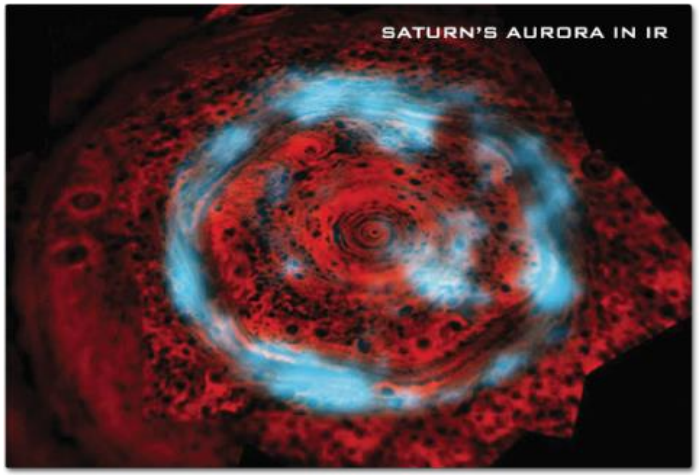
Visible Light

Only a small fraction of electromagnetic spectrum is visible to human eye.



A typical human eye will respond to wavelengths from about 380 to 750 nanometers.

“Seeing” the Invisible with Infrared



From elusive leopards…

…to hiding young stars!