Telescope → 1st one 1608

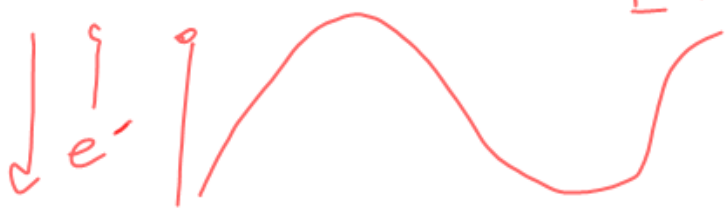
Hans Lippeshy *

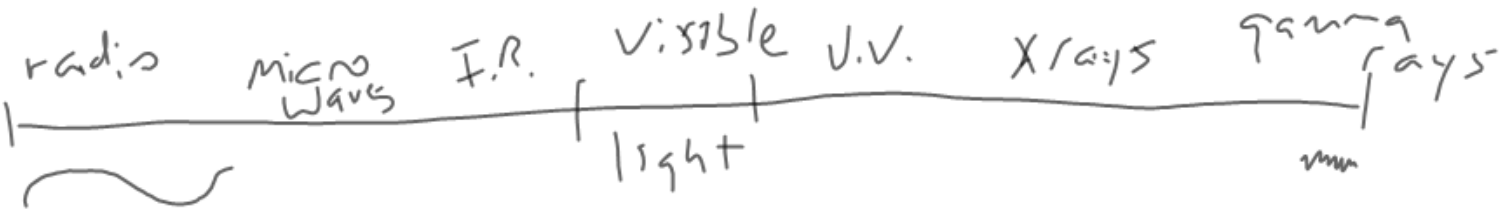
year after - Galileo *

refracting - lenses *

reflecting - mirrors

EM spectrum

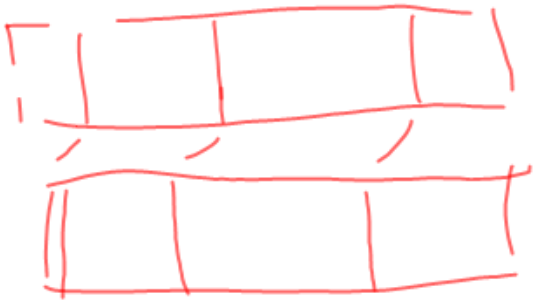




P. 757 Parallax

Parallax out to 200 ly. away!

Red Shift -

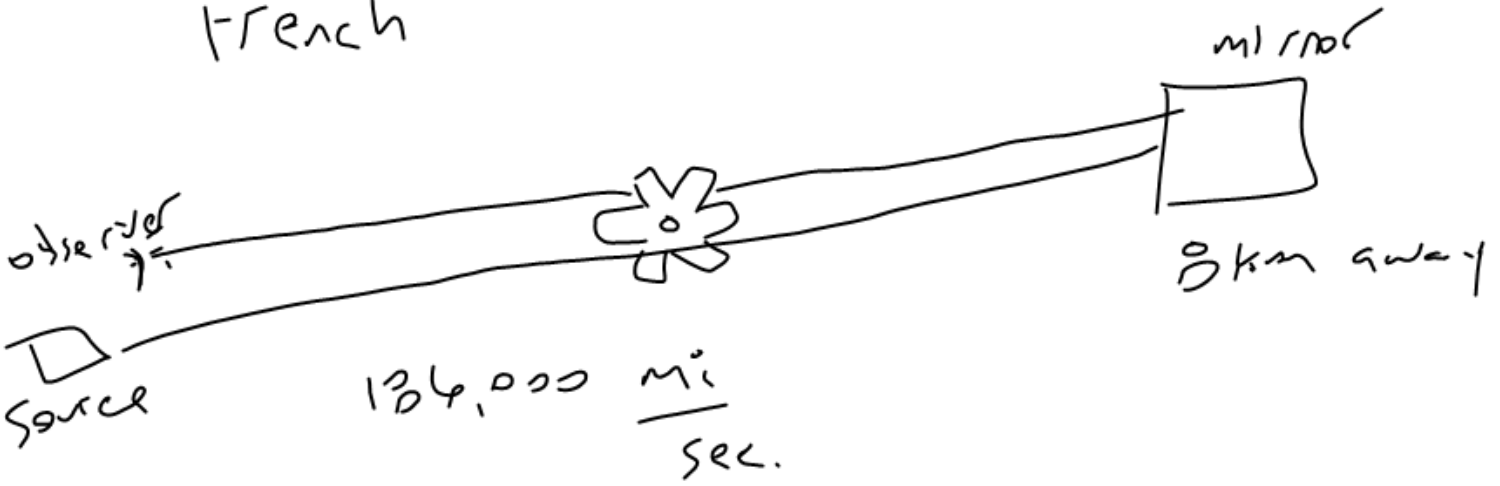


Same spectral lines shift down in spectrum, the further in space that stars are.

Wollaston - 1800
British
gunpowder

spectral lines
Finger Prints of the elements

- Fizeau & Foucault Speed of light 1840s
French



Dimensional Analysis

$$300{,}000 \frac{\text{km}}{\text{sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} \cdot \frac{24 \text{ hr}}{1 \text{ day}} \cdot \frac{365 \text{ days}}{1 \text{ yr}} = 9.4 \text{ trillion km}$$

Furthest spare object 13 billion ly. $\times$ 9.4 trillion

$= 122.2 \times 10^{21}$ km