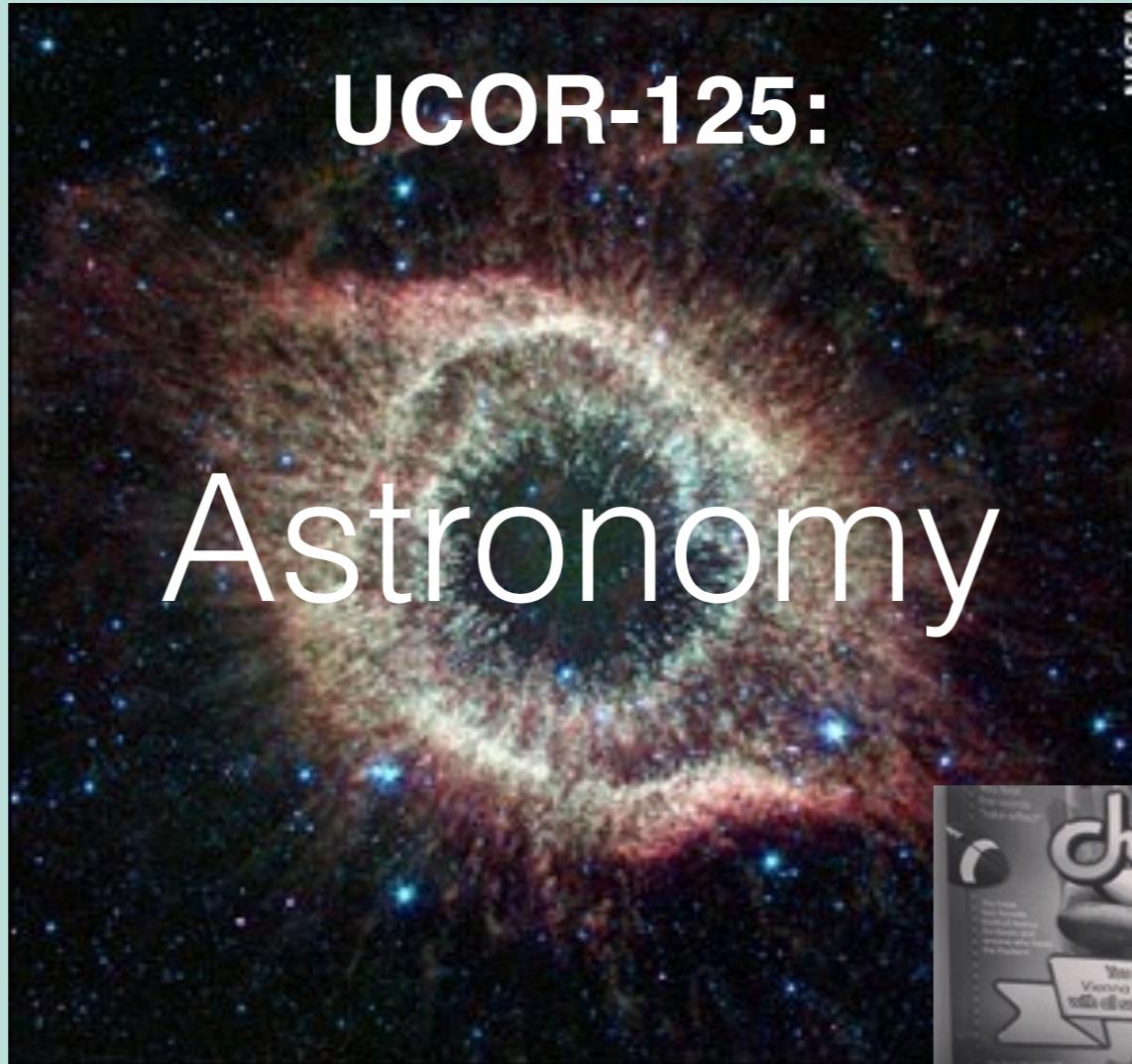
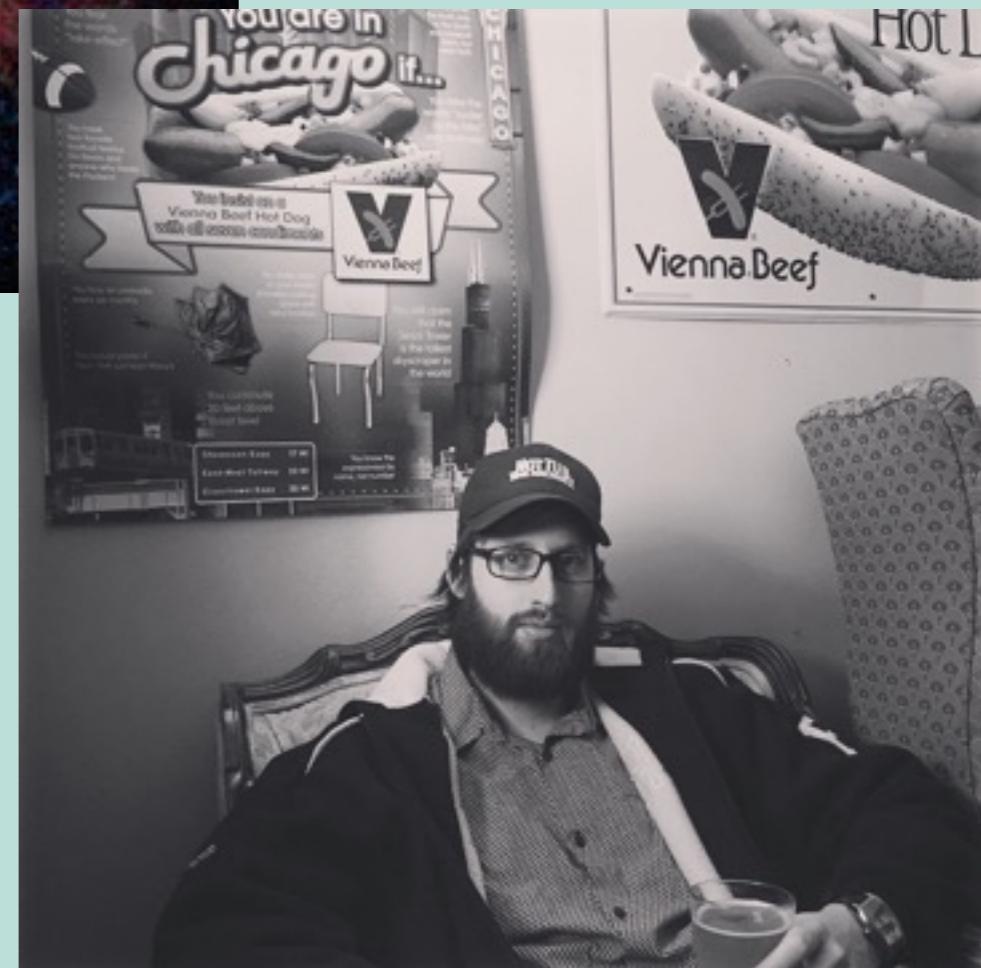




Lecture 3: Radiation



with your host:



Coop

Even the CLOSEST galaxy is 2500000 years away

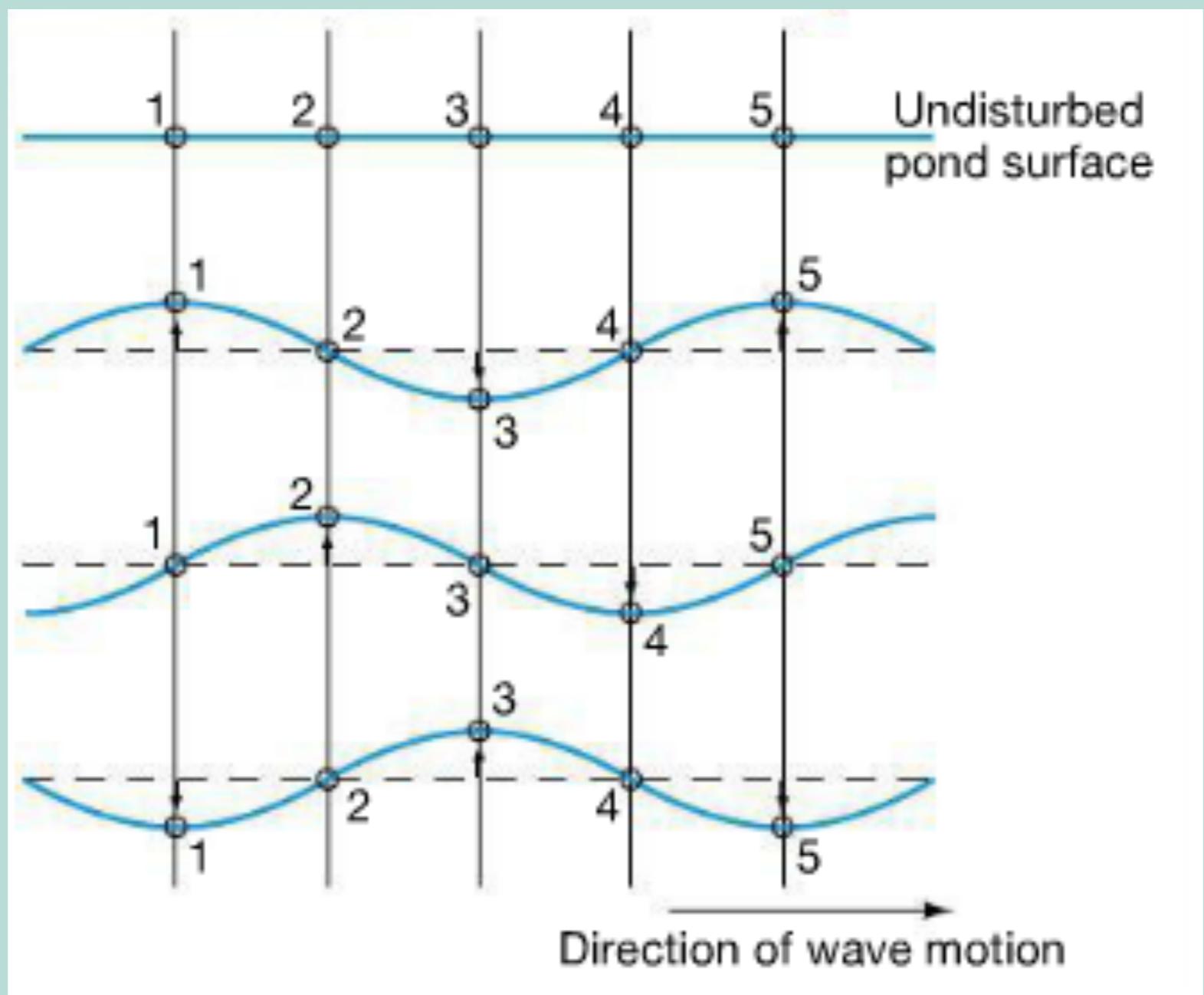


The only way we learn about the cosmos is through energy propagating in the form of a wave

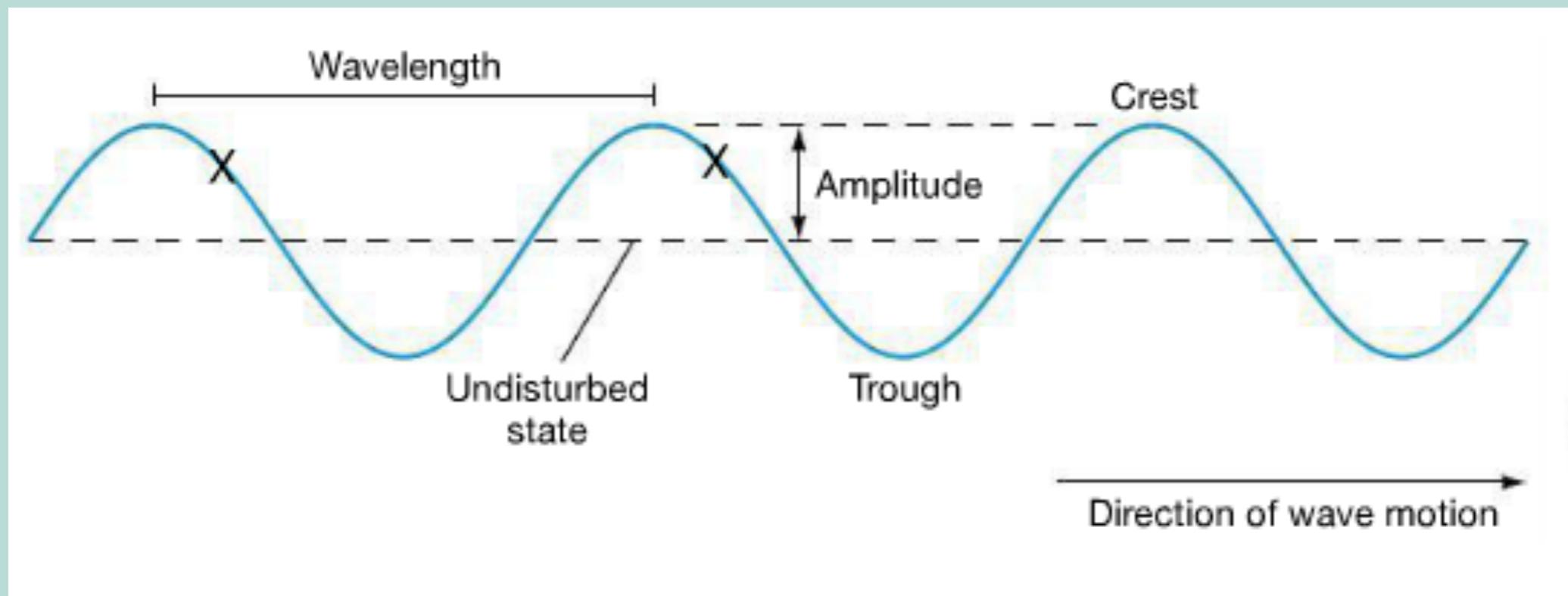
Any energy transfer without mass transfer* is known as *radiation*

from 10,000 BCE - 2016 AD we have only had one kind of wave...





Definitions

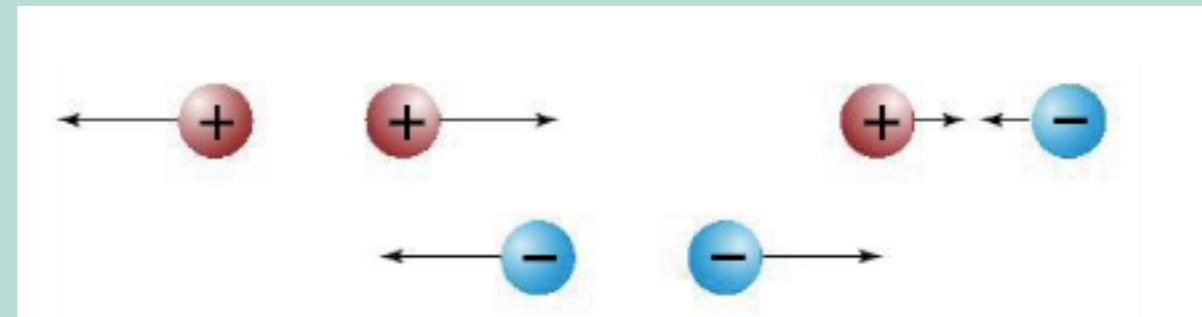


But between us and the stars is empty space



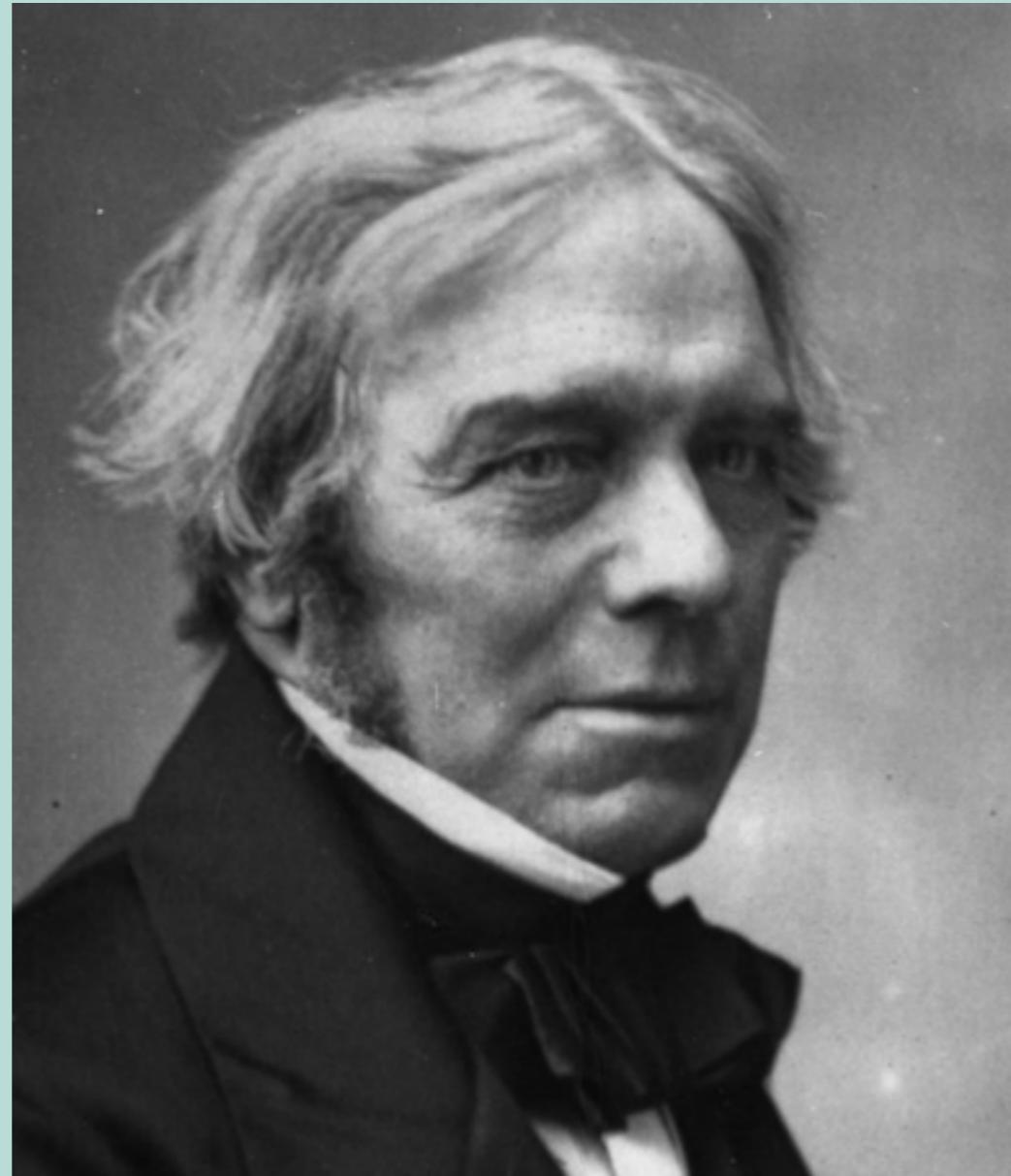
So what's doing the “waving”

Electricity

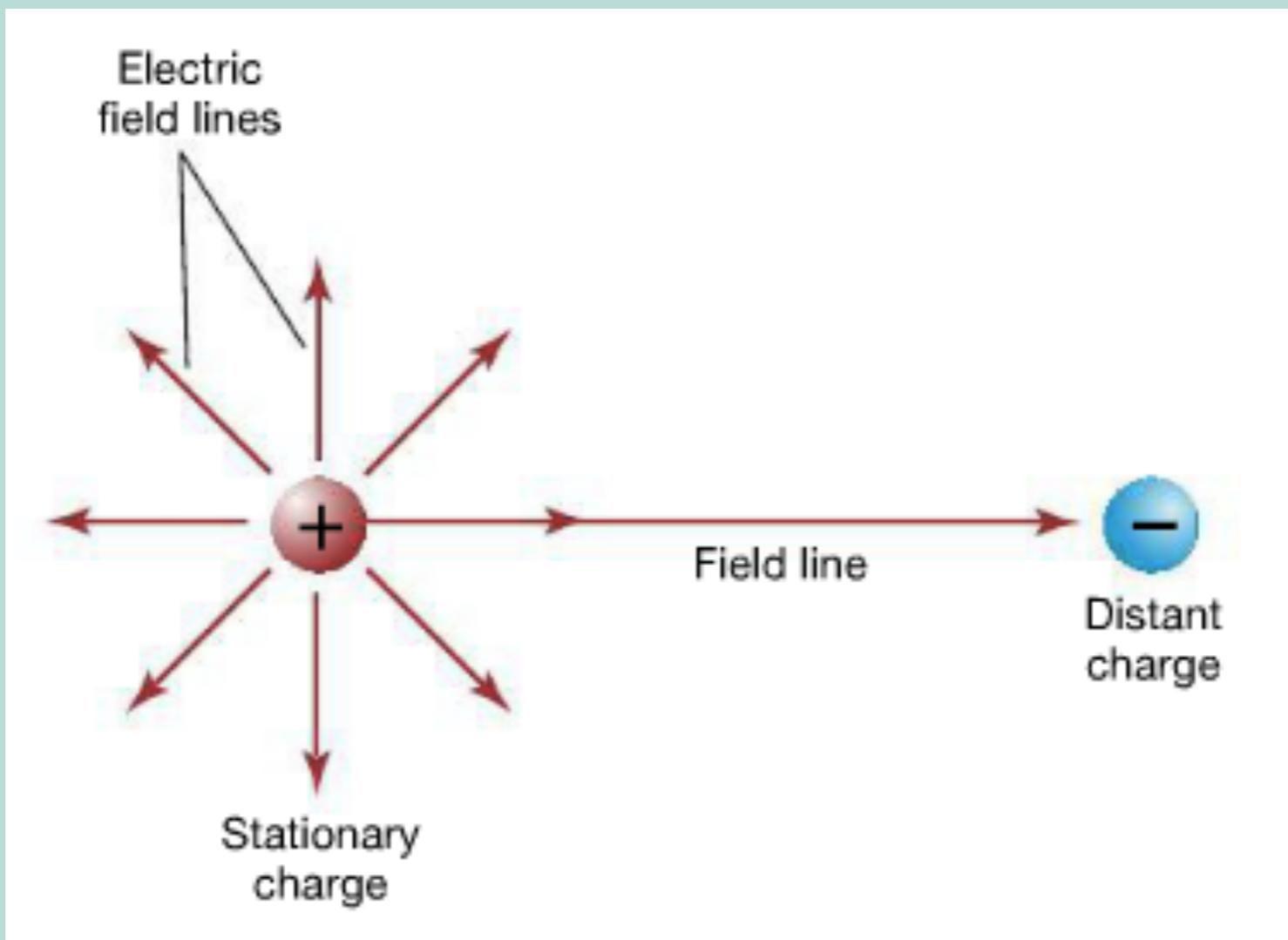


$$F_{\text{grav}} = -\frac{\mathcal{G}m_1 m_2}{r^2} \quad F_{\text{electric}} = \frac{\mathcal{K}q_1 q_2}{r^2}$$

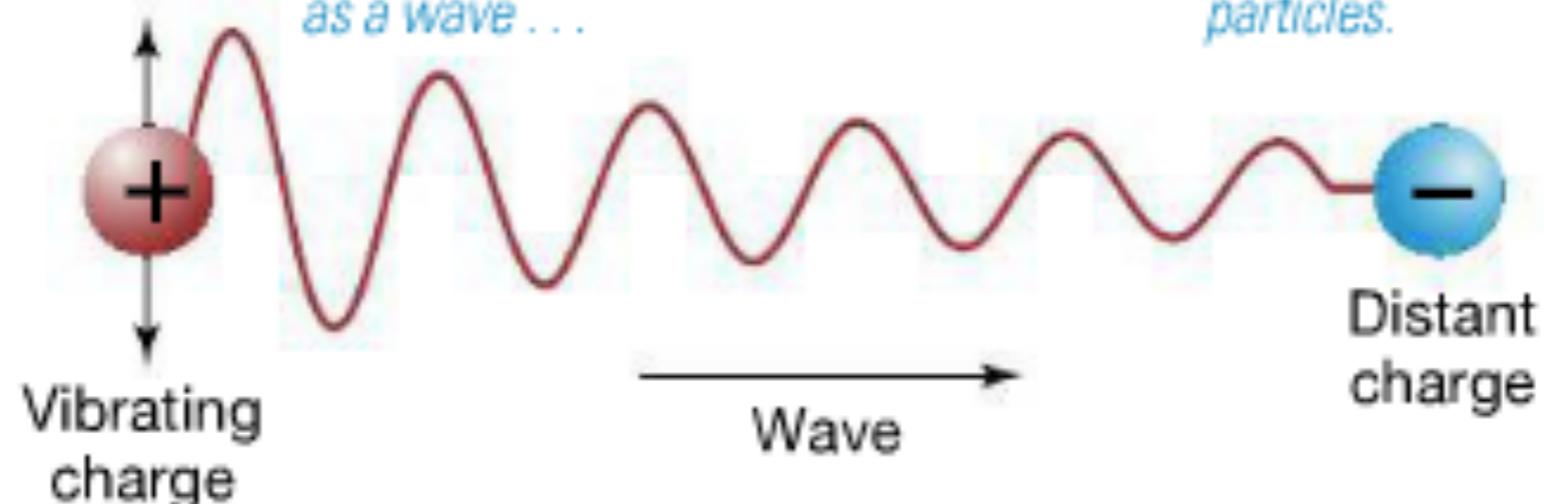
Michael Faraday



Born in Newington Butts, England
1791 - 1867

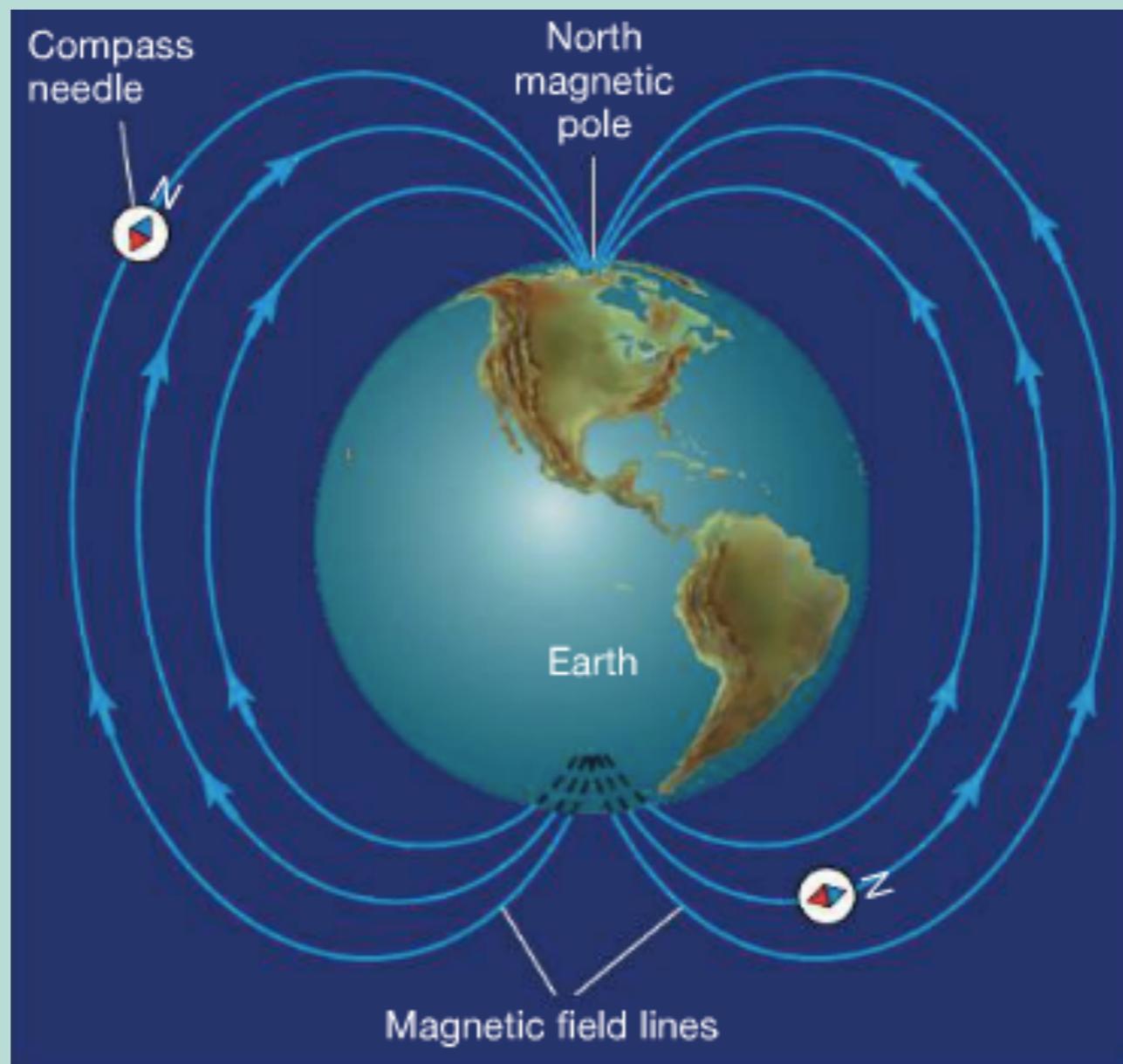


Due to a moving charge, the disturbance travels through space as a wave ...

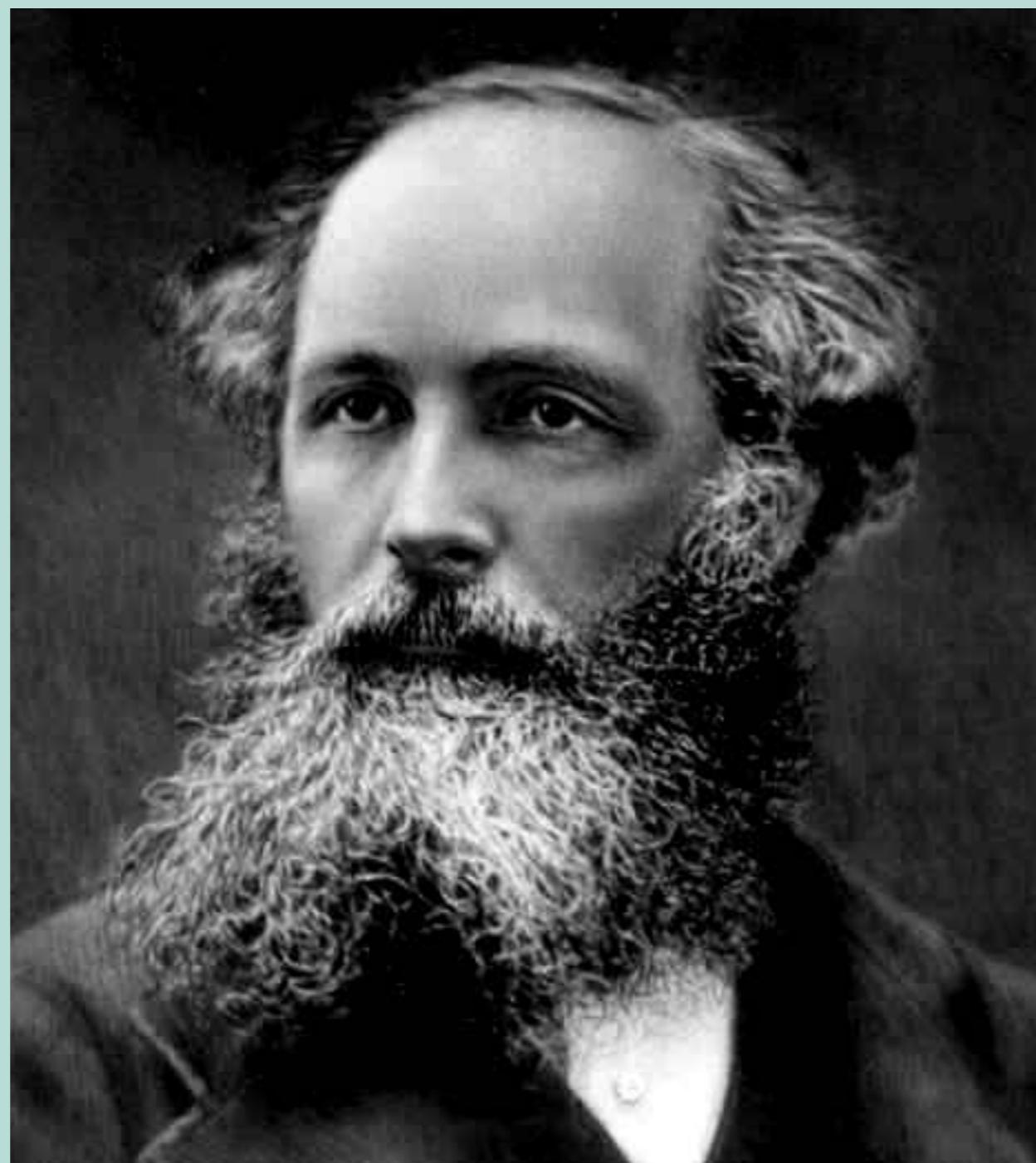


... eventually interacting with distant charged particles.

Magnetism

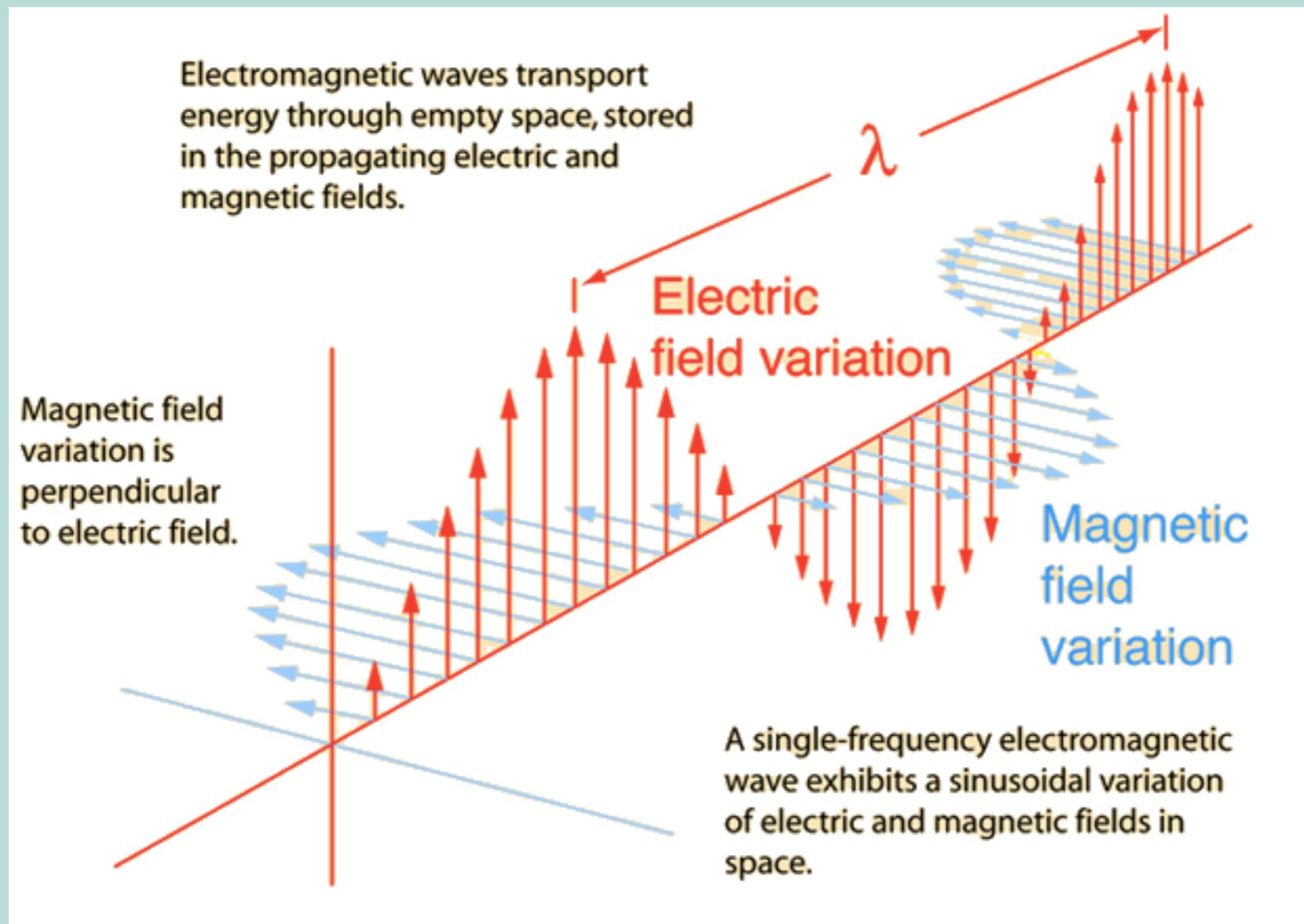


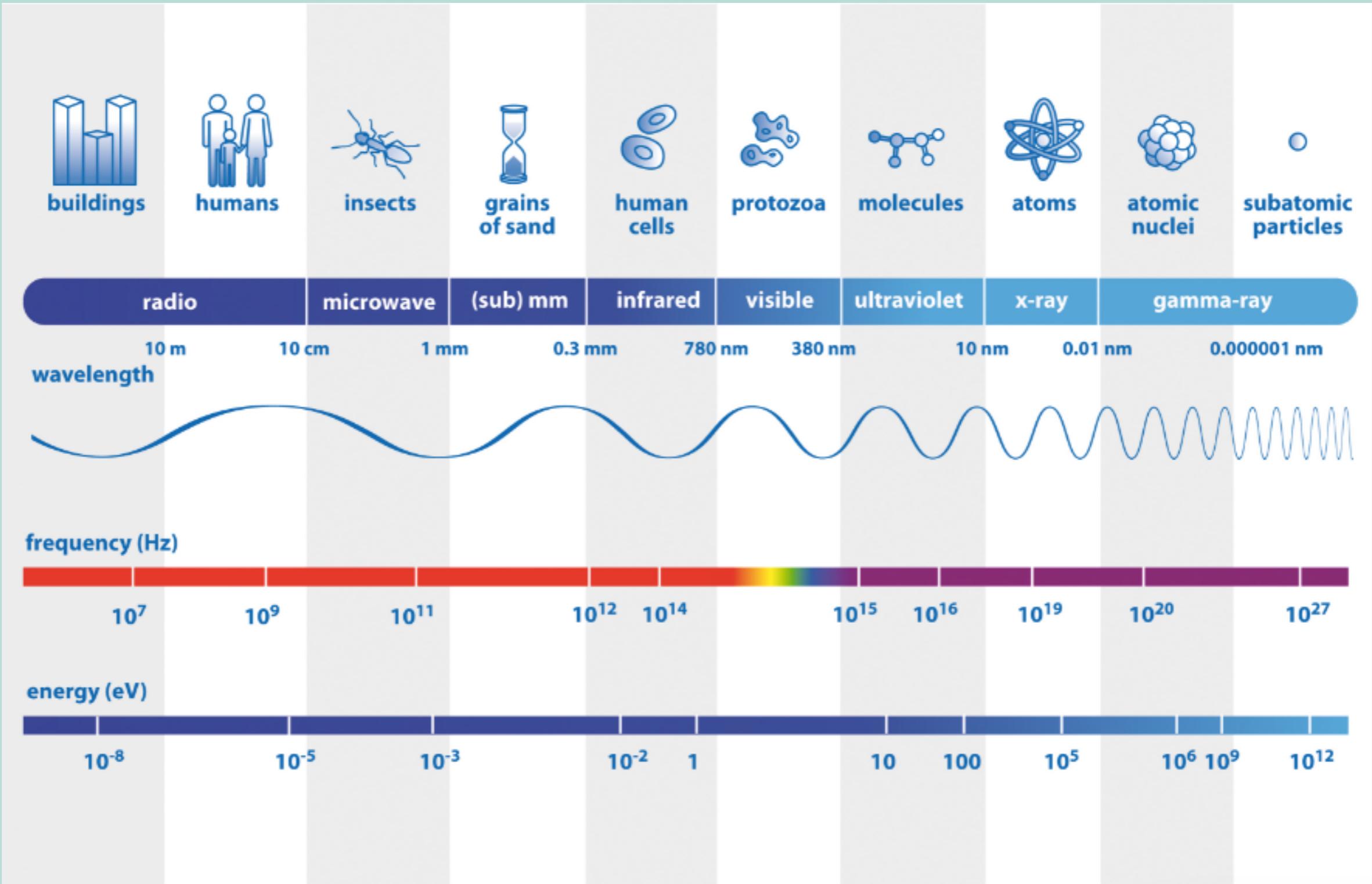
James Clerk Maxwell



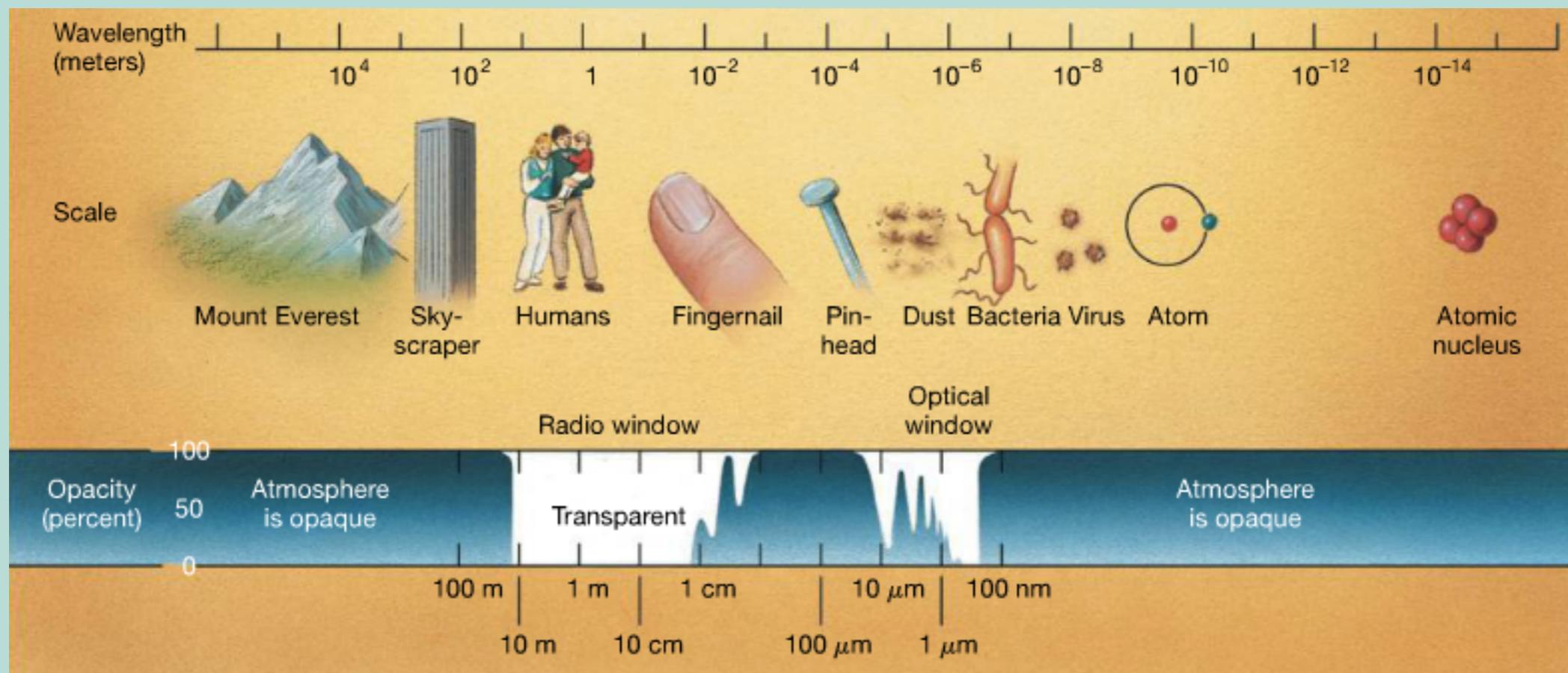
Born in Edinburgh, Scotland
1831 - 1879

Electromagnetic Radiation





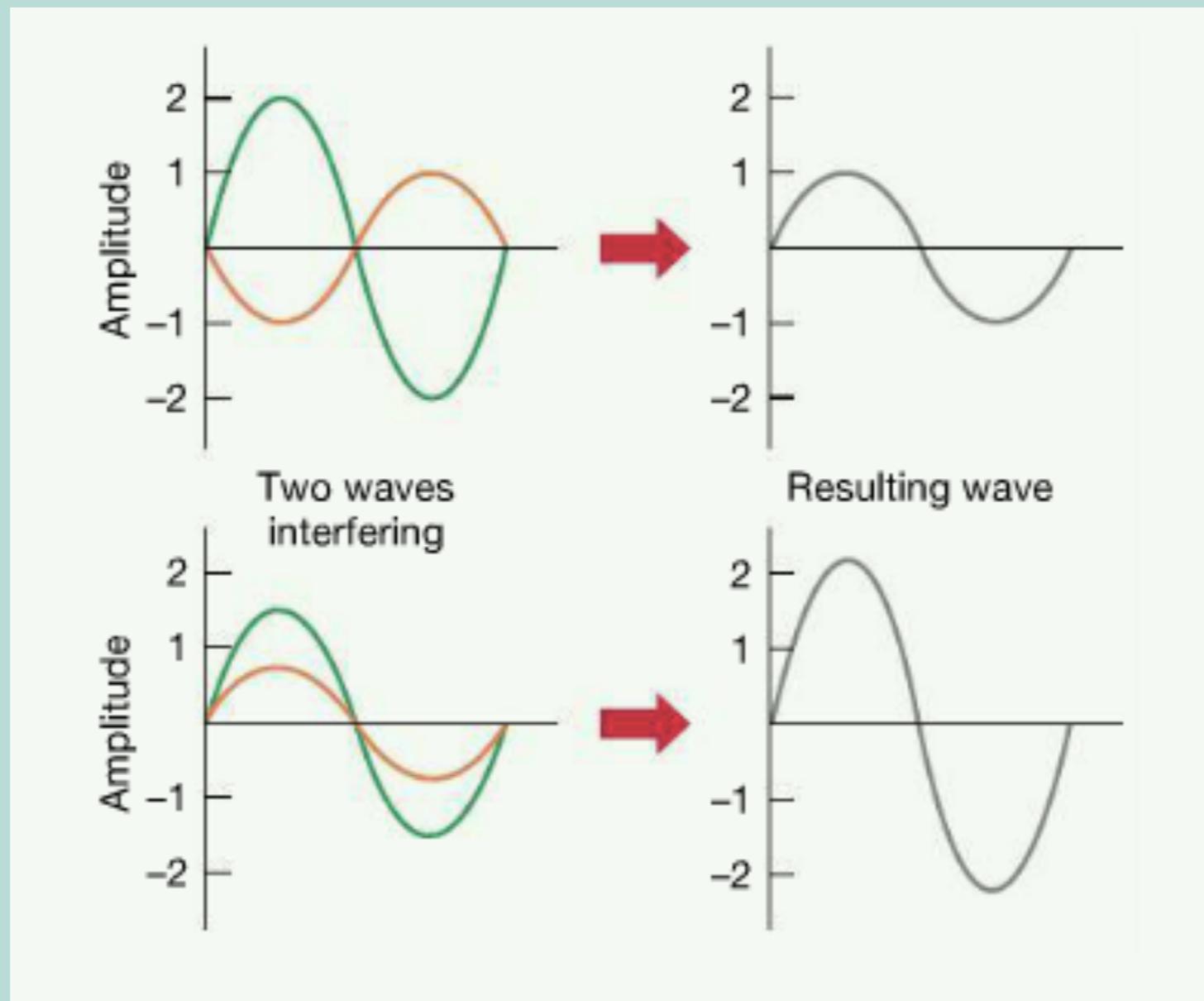
Earth's Atmosphere as a window



IR absorbers: H₂O, CO₂

UV absorbers: O₃ (ozone)

Superposition

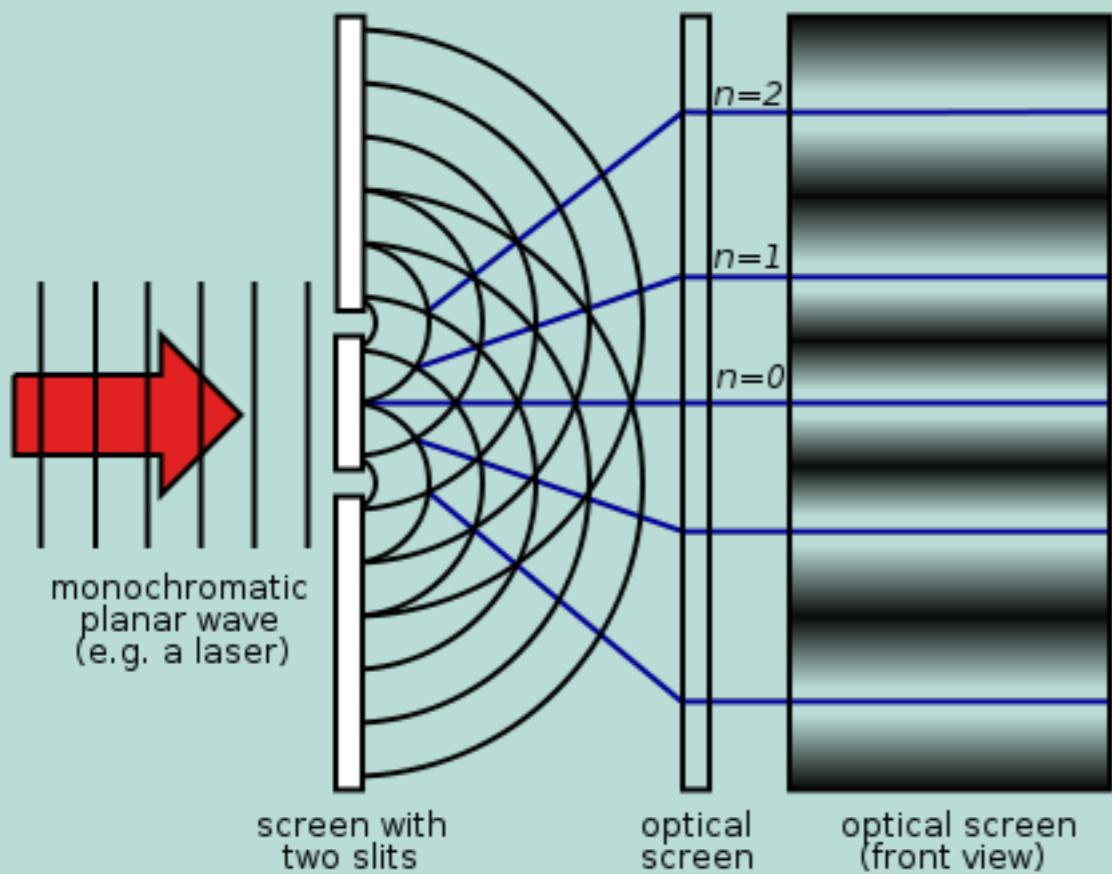


Thomas Young

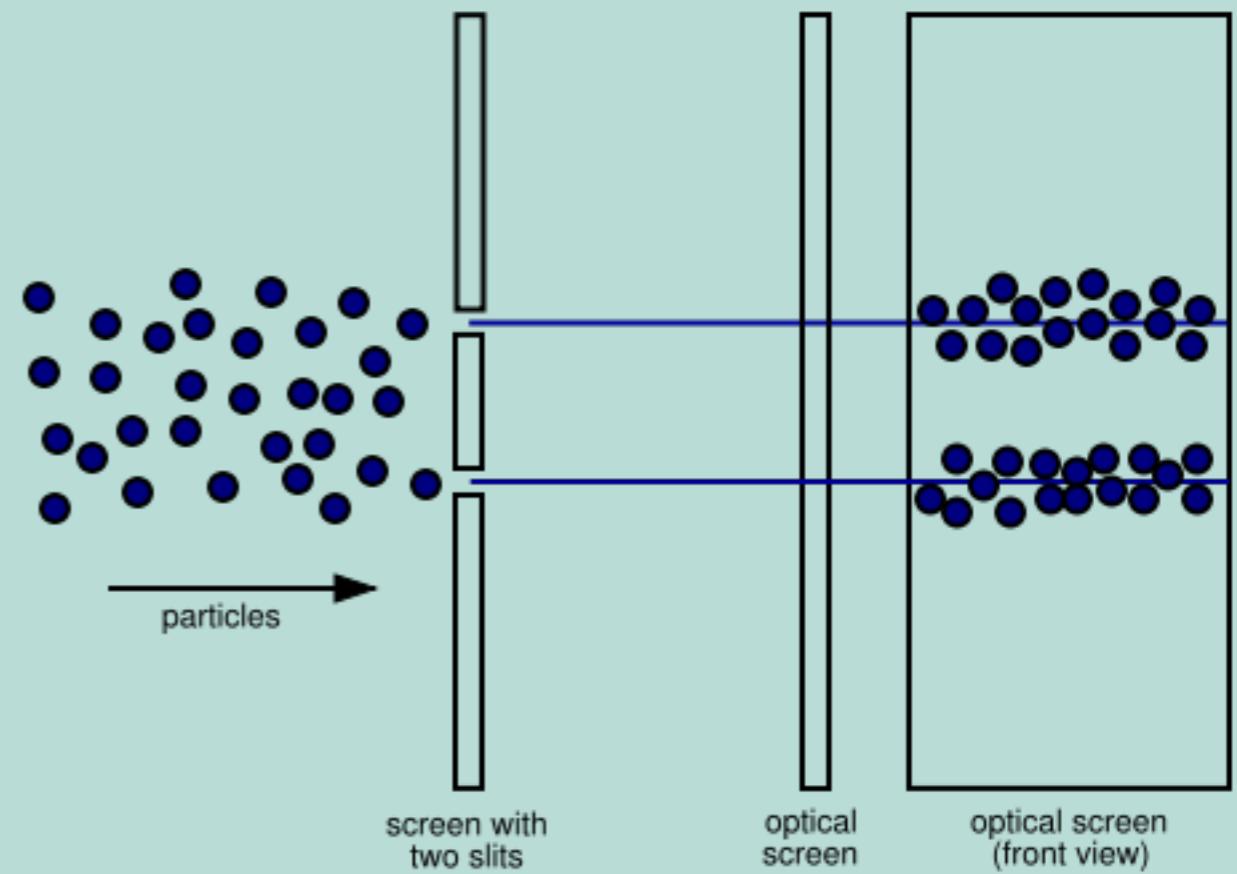


Born in Milverton, England
1773 - 1829

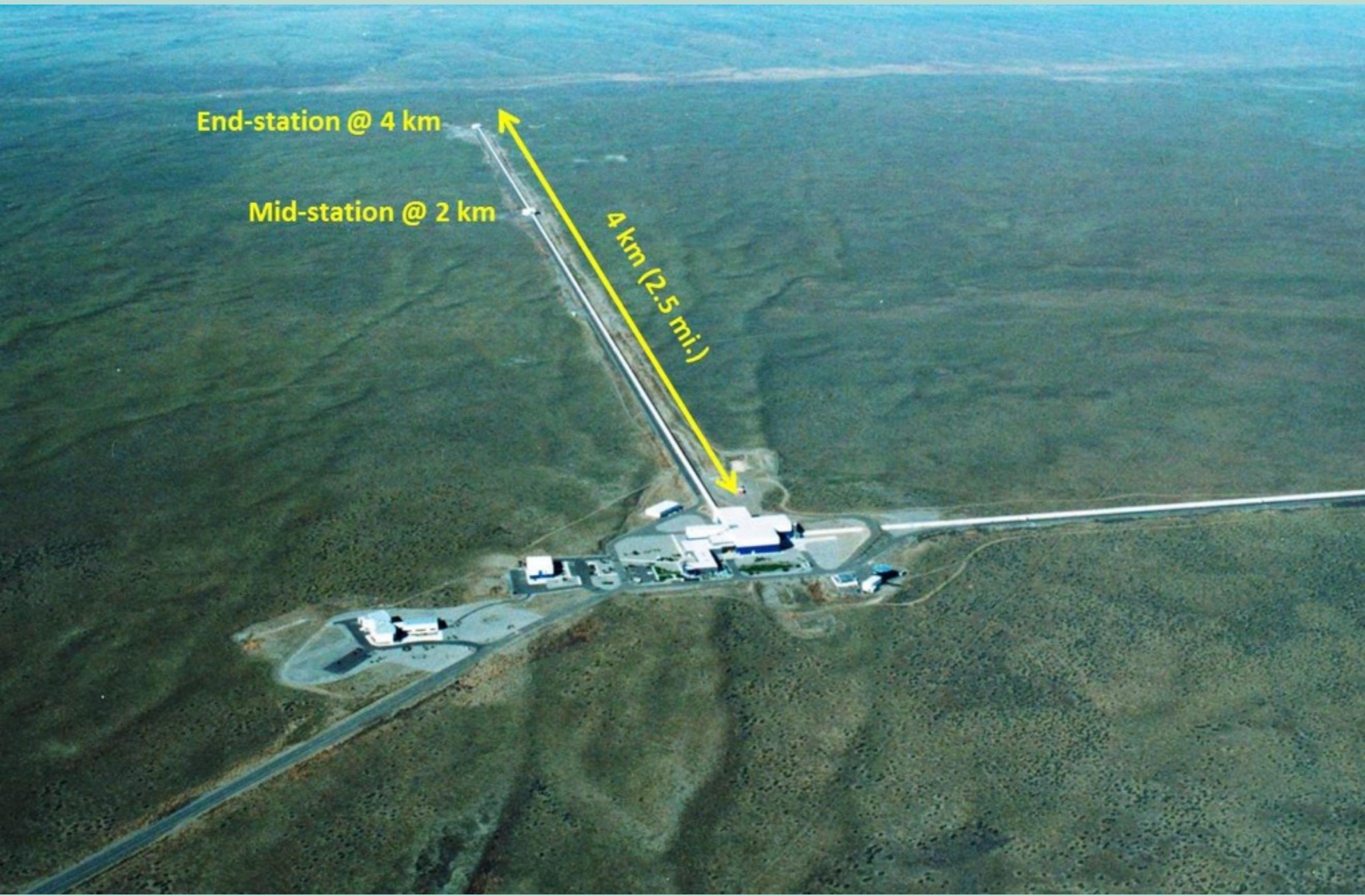
Wave Phenomenology



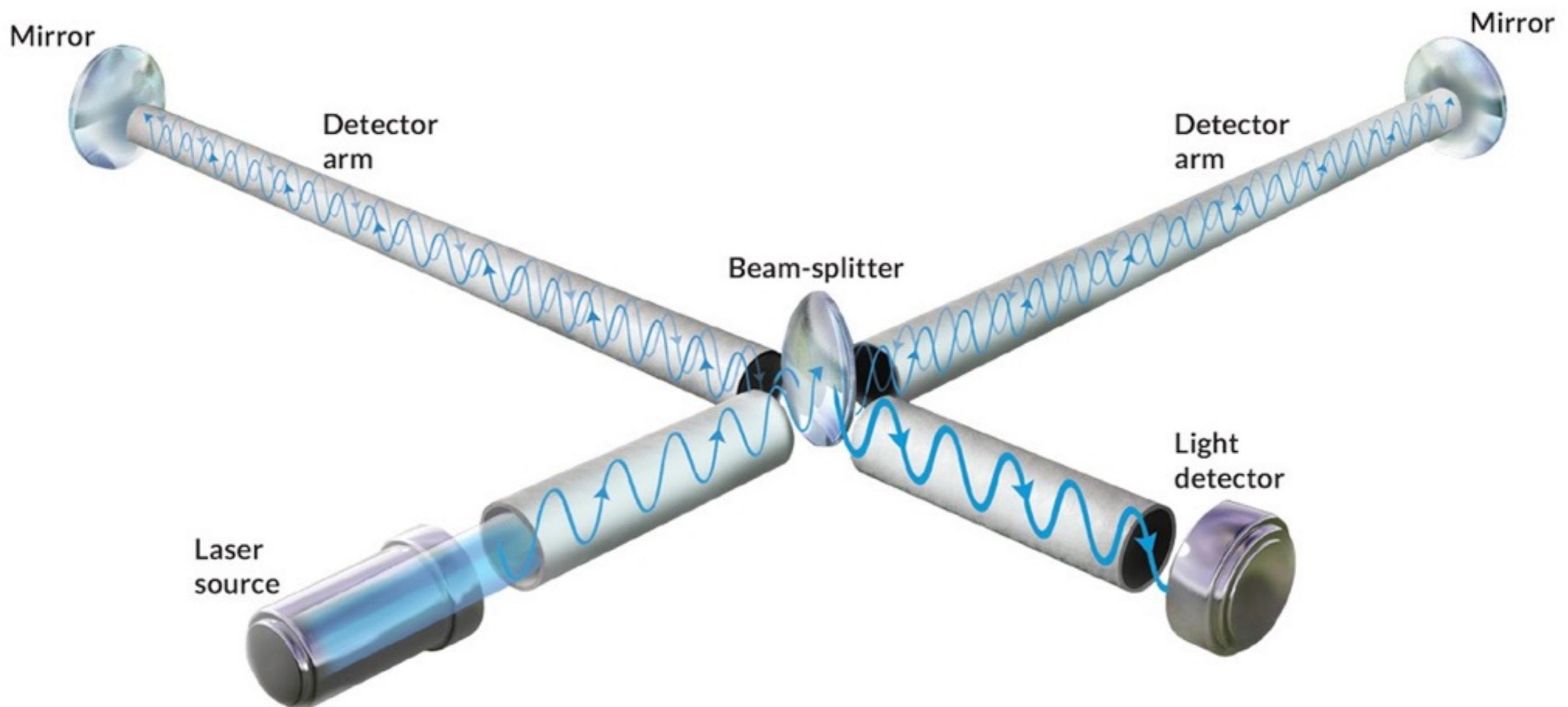
Particle Phenomenology



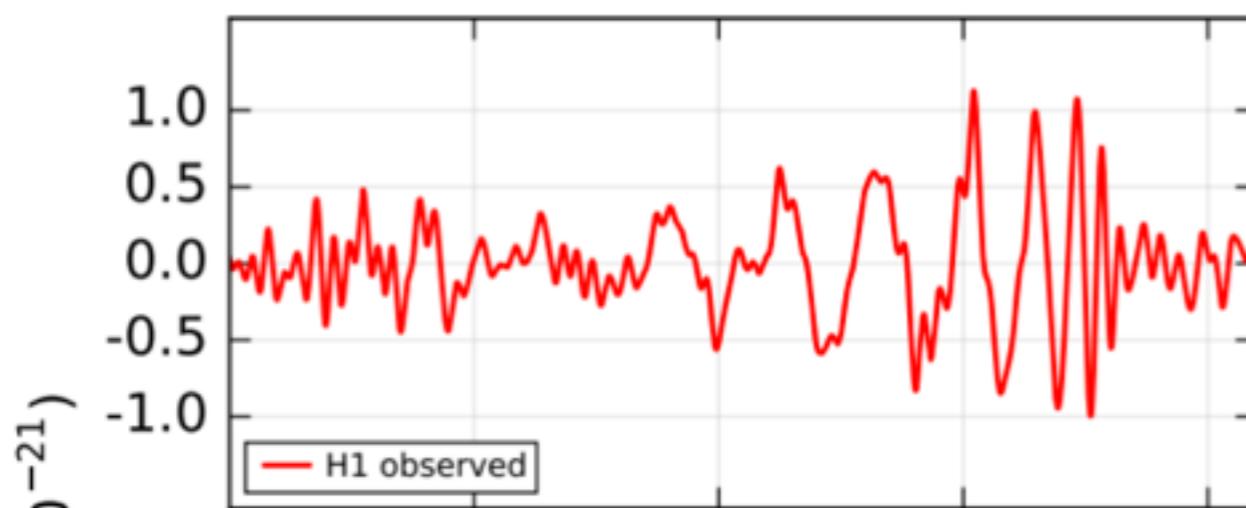
Light must be a wave! (...to be continued)



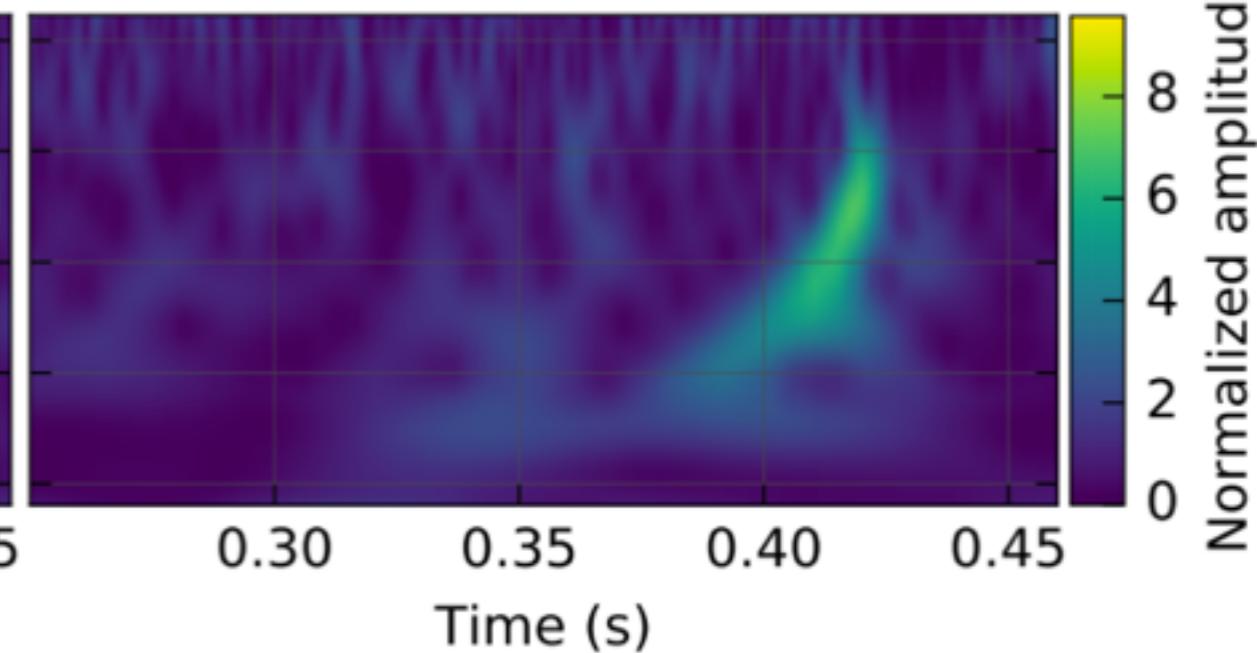
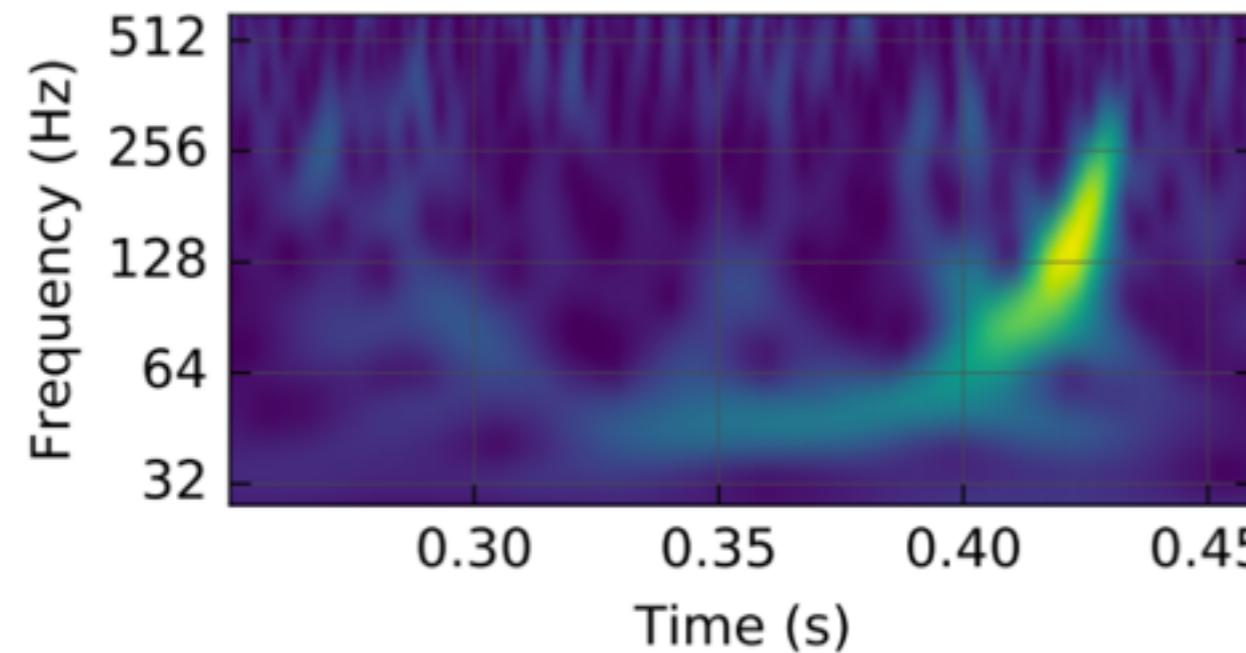
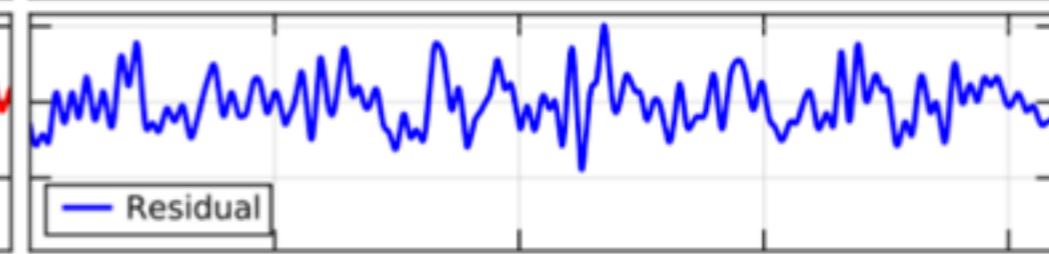
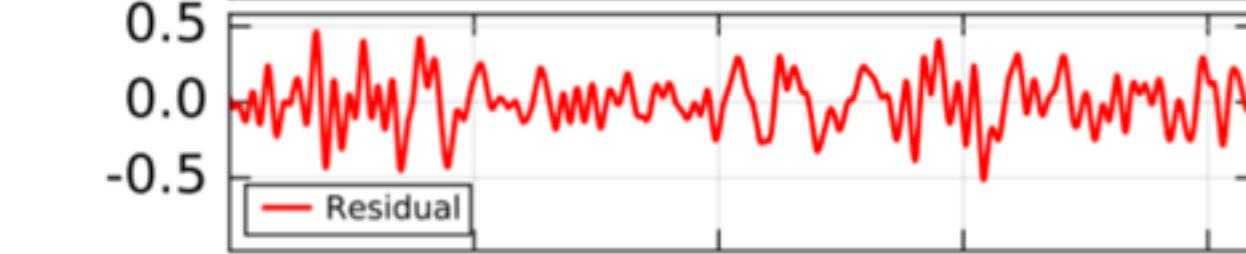
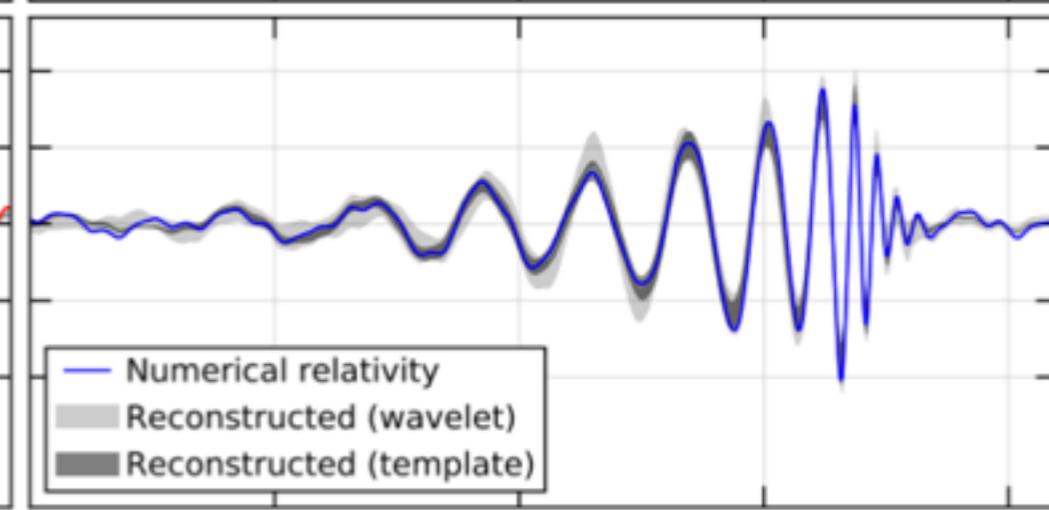
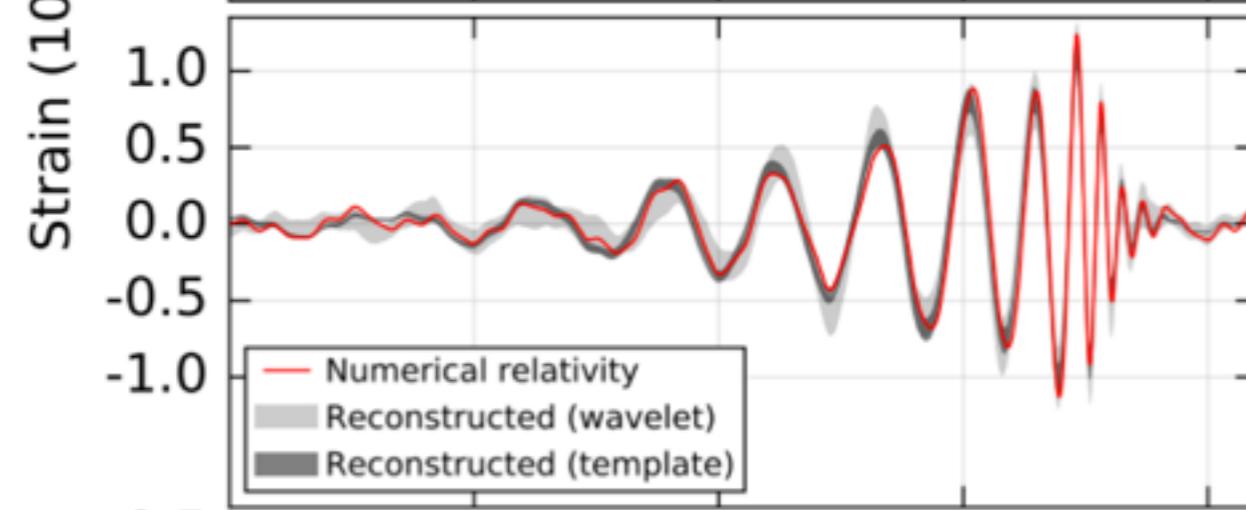
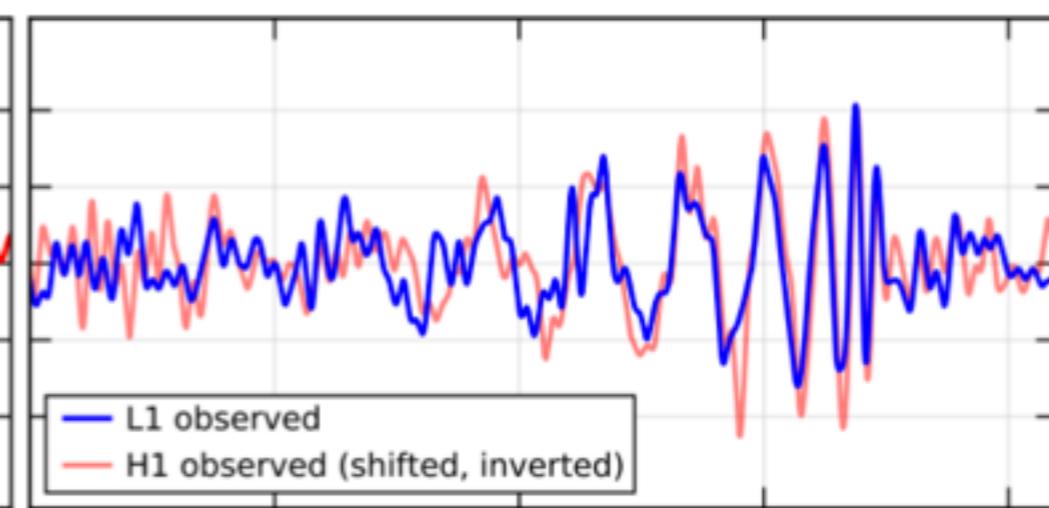
Interferometry



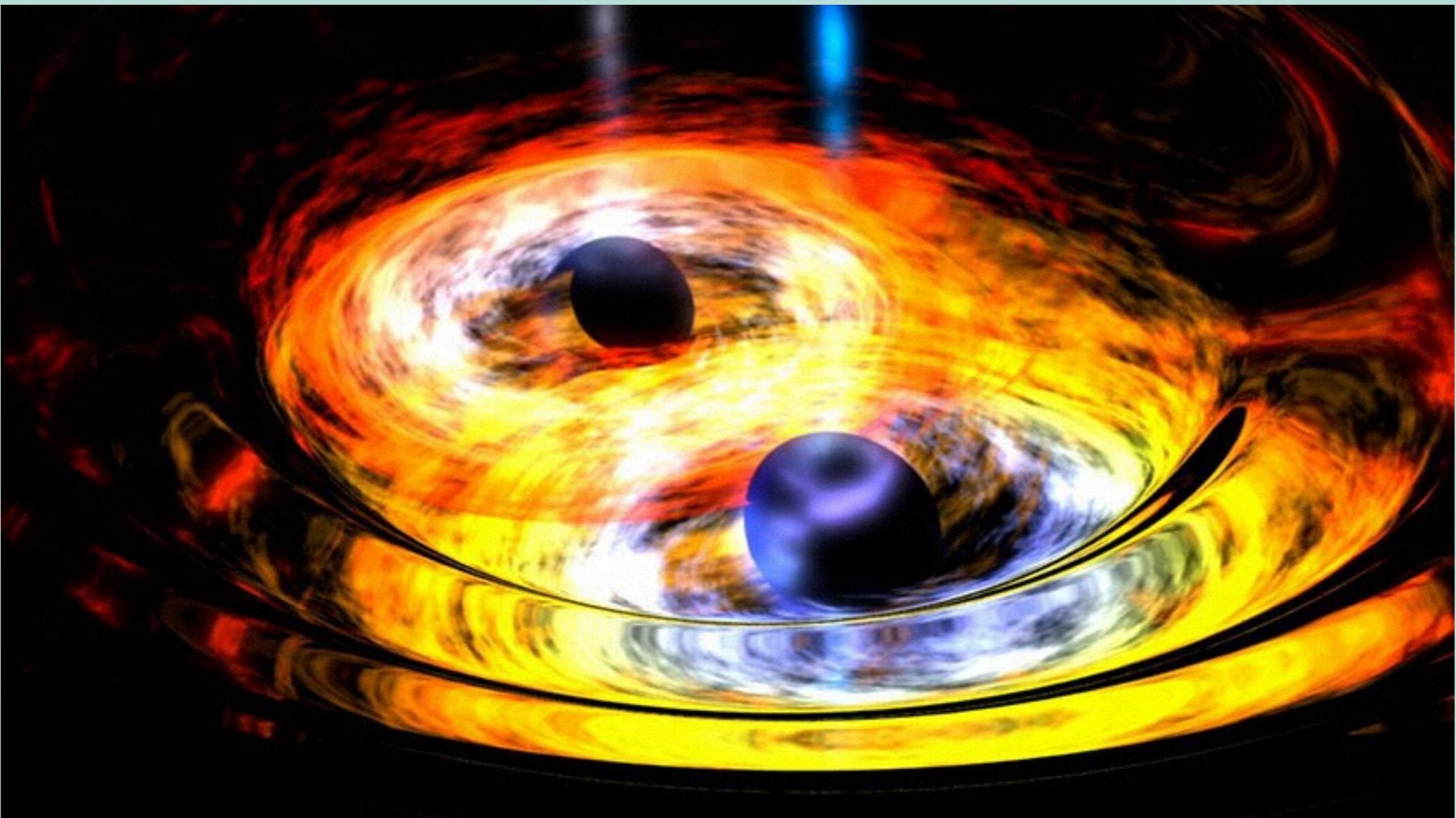
Hanford, Washington (H1)



Livingston, Louisiana (L1)

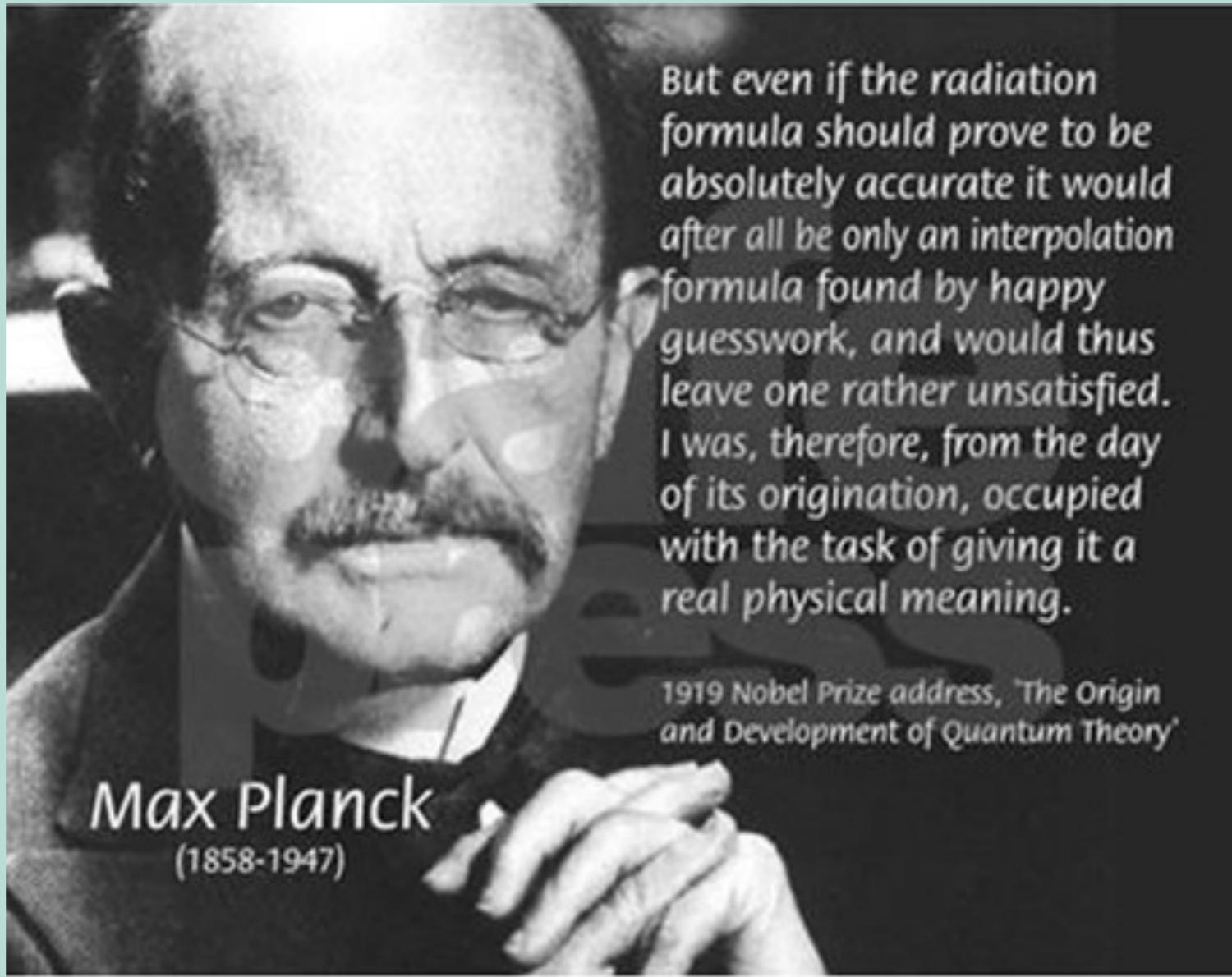


Actual picture!!!!



just kidding...

Max Karl Ernst Ludwig Planck



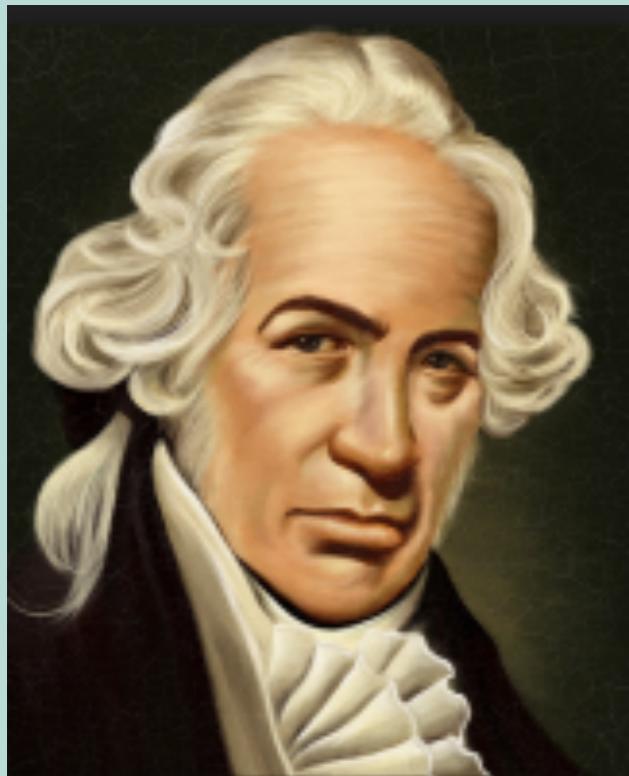
But even if the radiation formula should prove to be absolutely accurate it would after all be only an interpolation formula found by happy guesswork, and would thus leave one rather unsatisfied. I was, therefore, from the day of its origination, occupied with the task of giving it a real physical meaning.

1919 Nobel Prize address, 'The Origin and Development of Quantum Theory'

Max Planck
(1858-1947)

Born in Kiel, Duchy of Holstein

Daniel
Gabriel
Fahrenheit



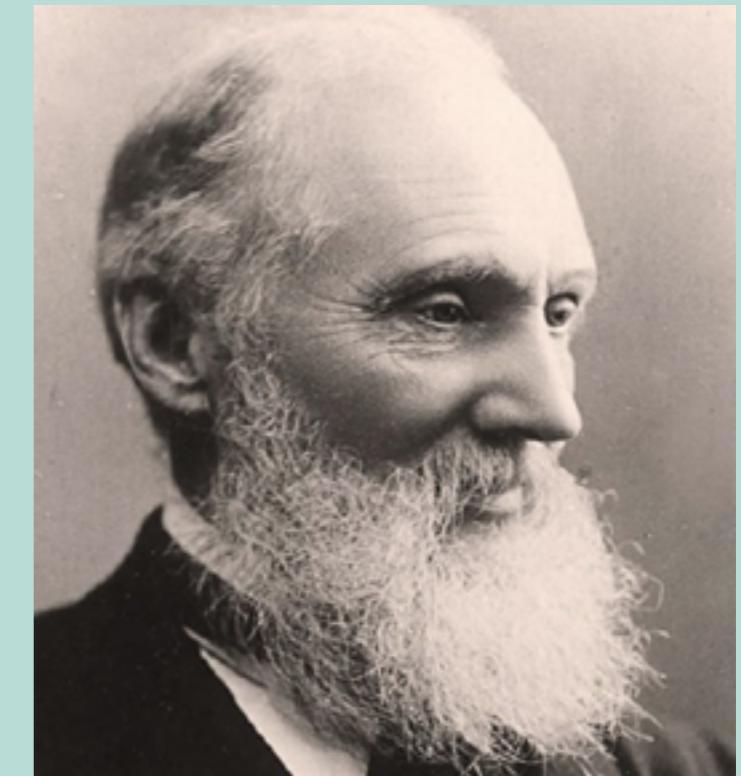
<

Anders
Celcius



<

William Thomson,
1st Baron Kelvin

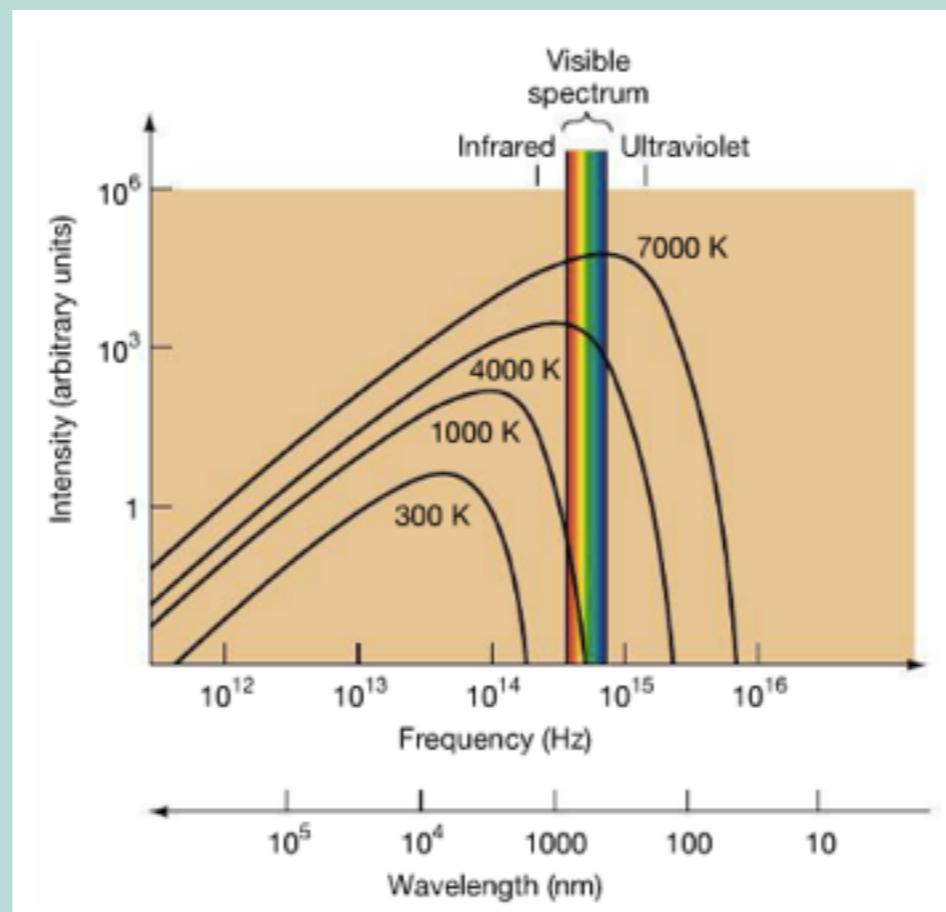
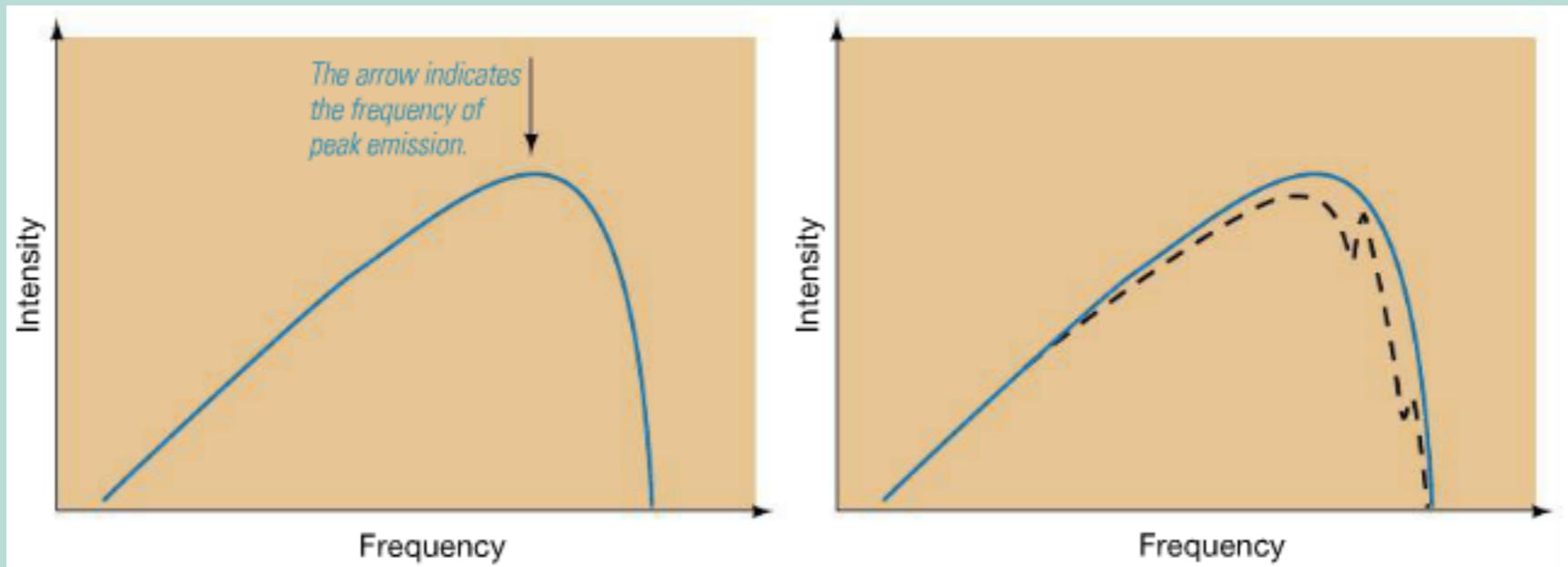


Danzig
1686-1736

Uppsala
1701-1944

Belfast
1824-1927

Black Body Spectrum

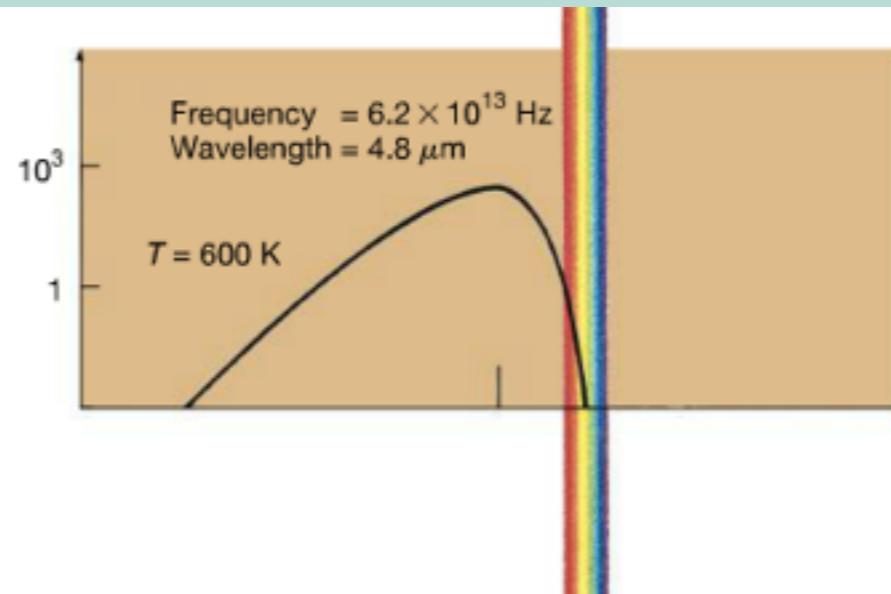
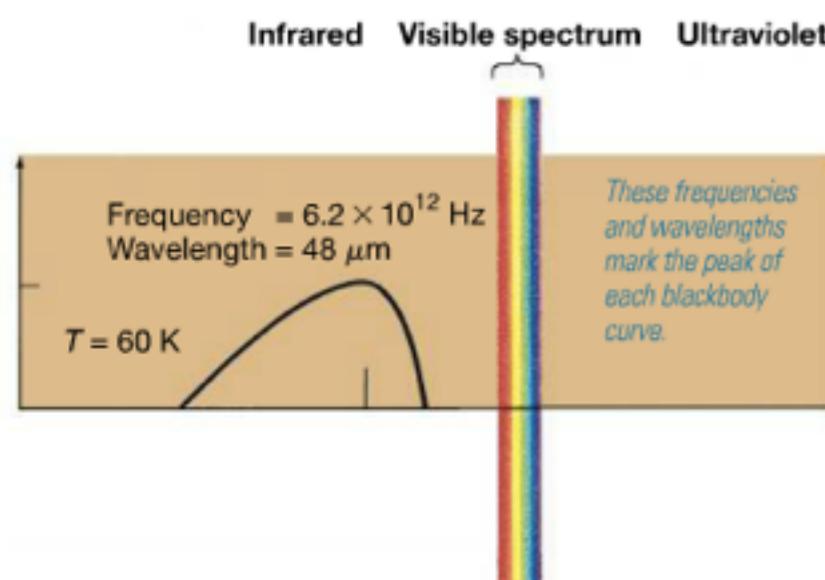


Wien's Law

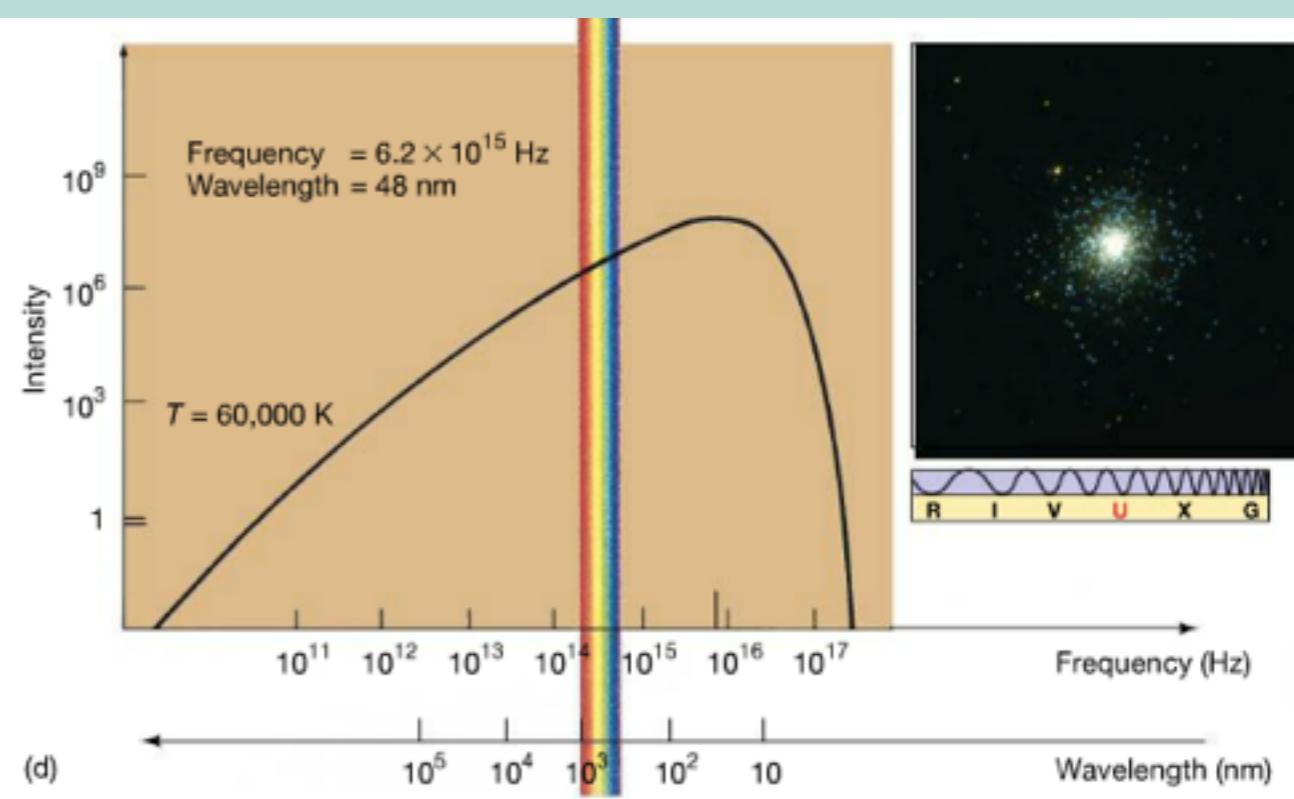
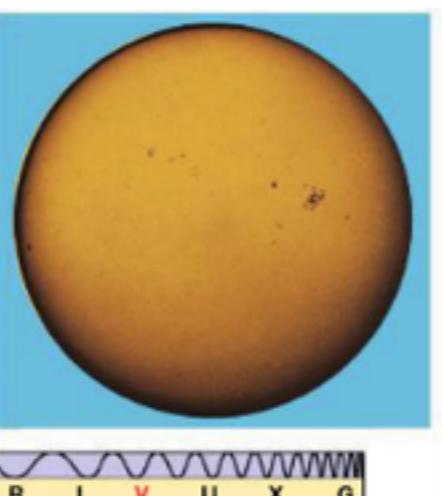
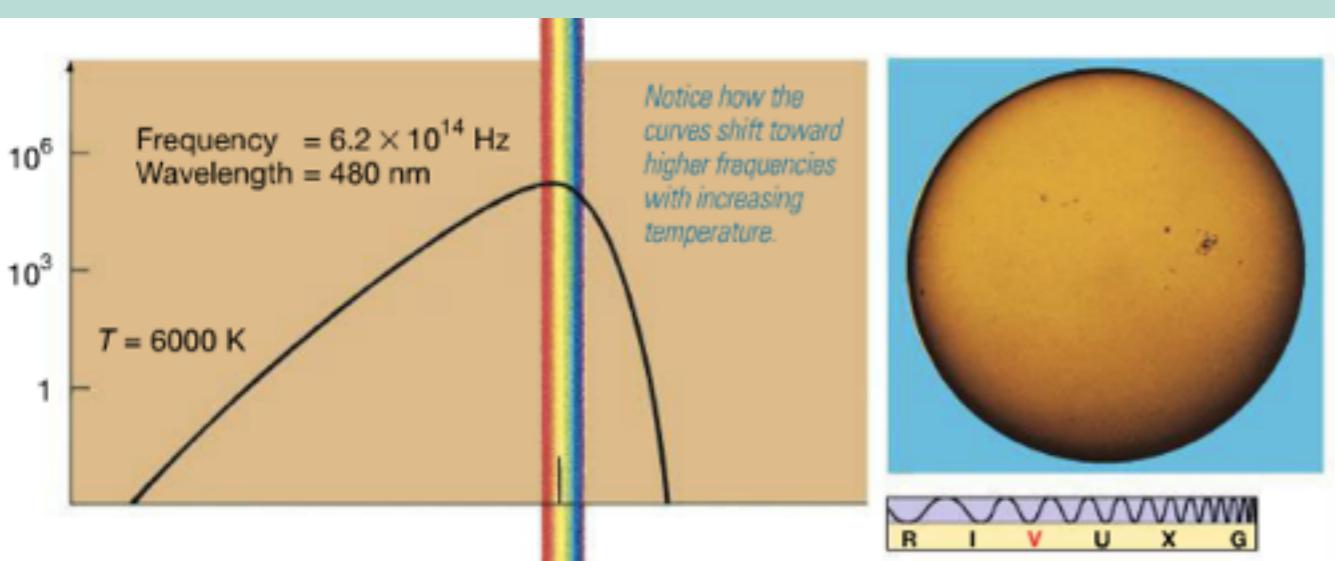
$$\lambda_{\max} \sim \frac{1}{T}$$

Stefan's Law

$$E \sim T^4$$

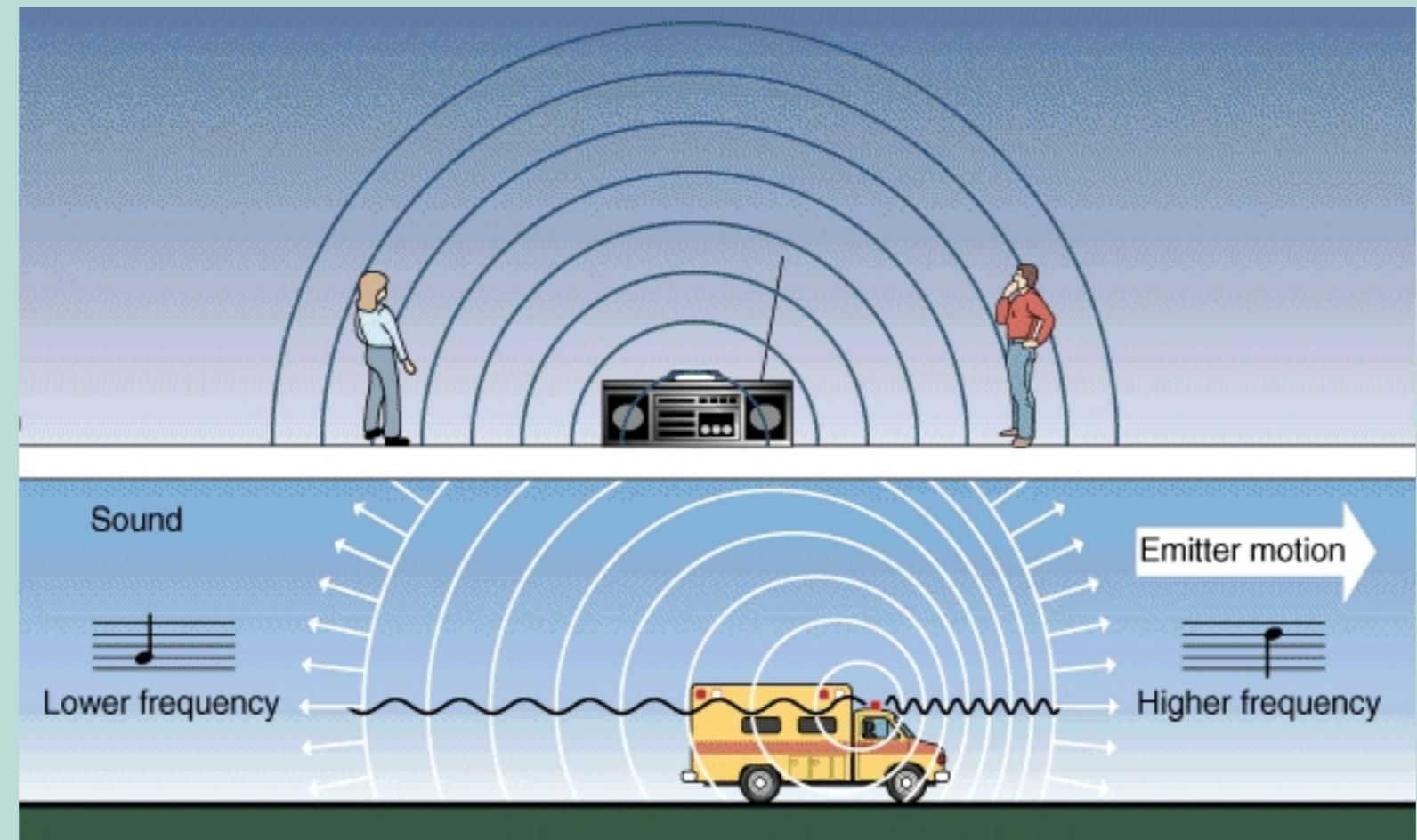


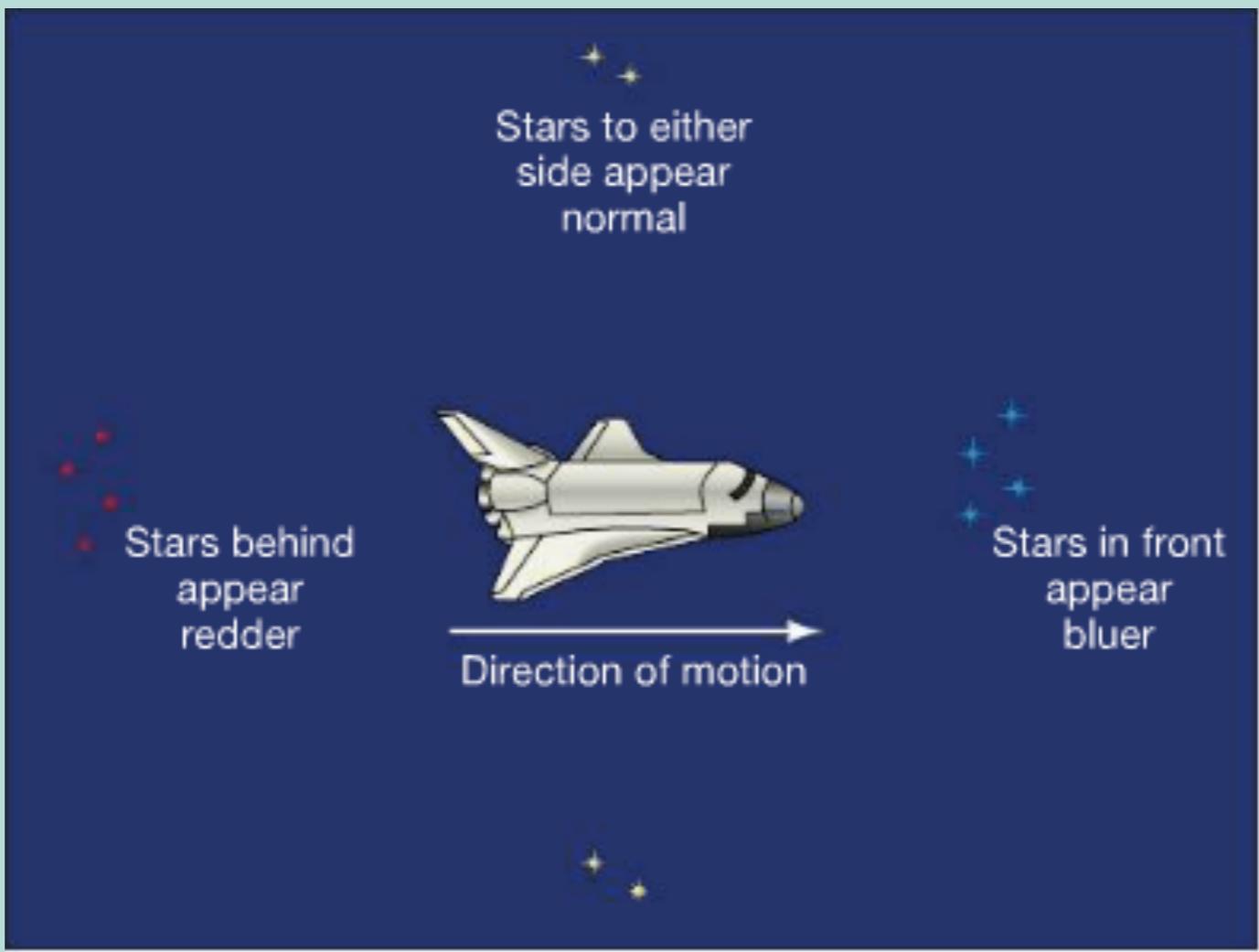
SCIENCE IS ALL A LIE!!!





Doppler Effect





$$\frac{\text{apparent } \lambda}{\text{true } \lambda} = \frac{\text{true } f}{\text{apparent } f} = 1 + \frac{\text{recession } v}{c}$$

