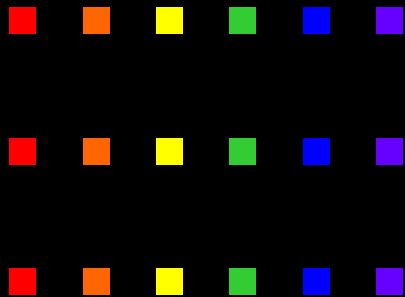


# Electromagnetic Radiation

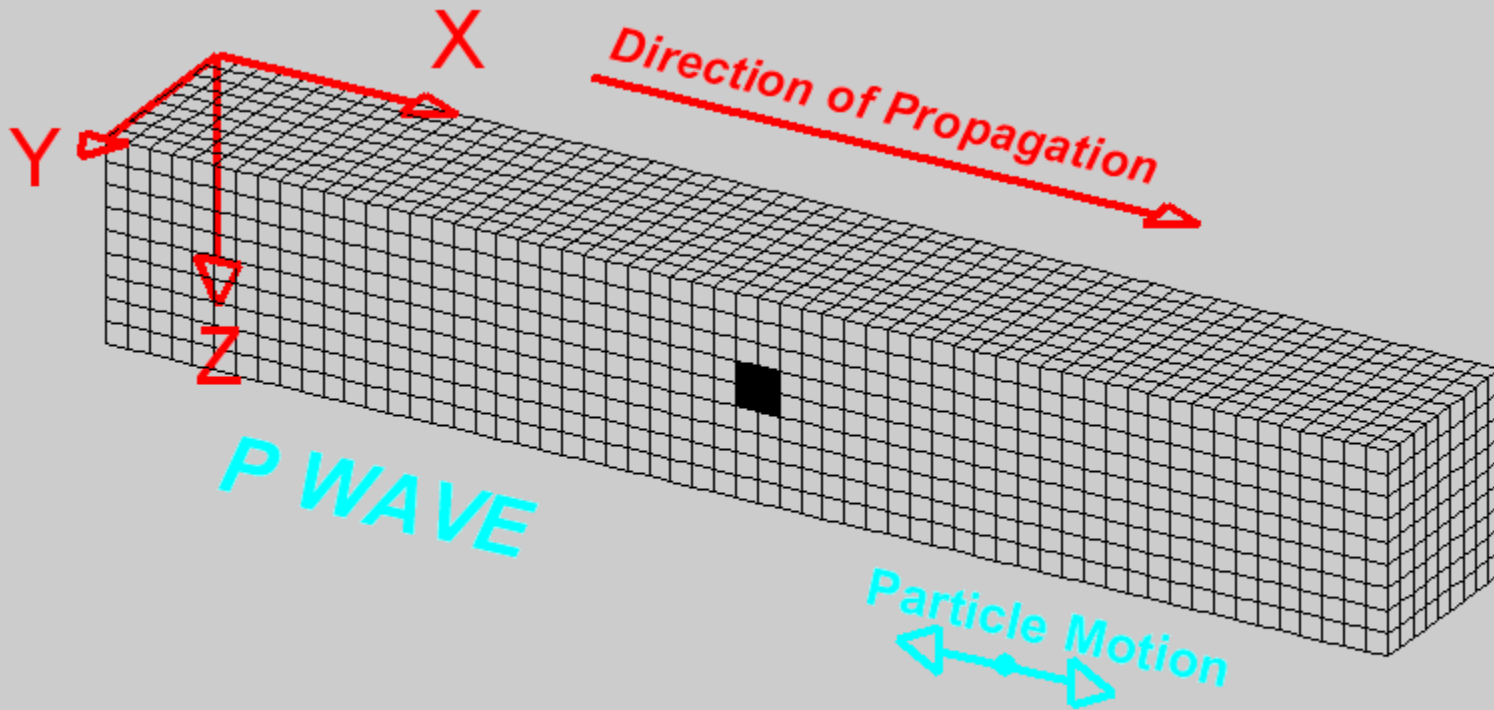


# Waves...

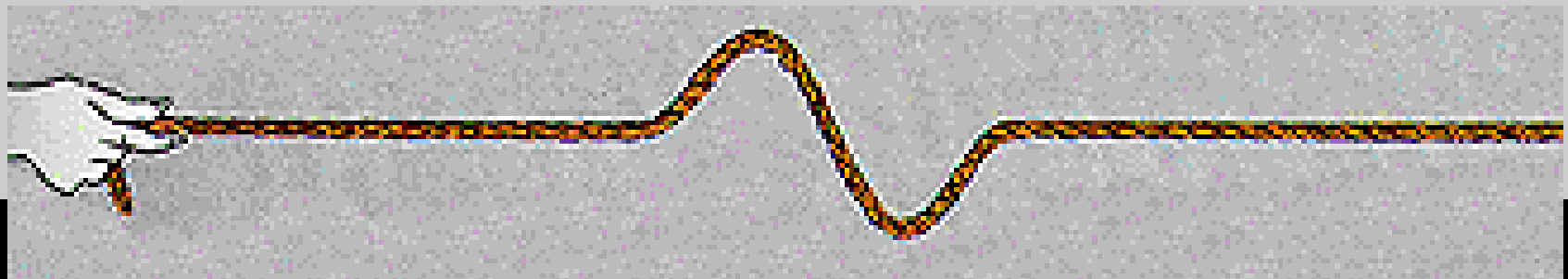
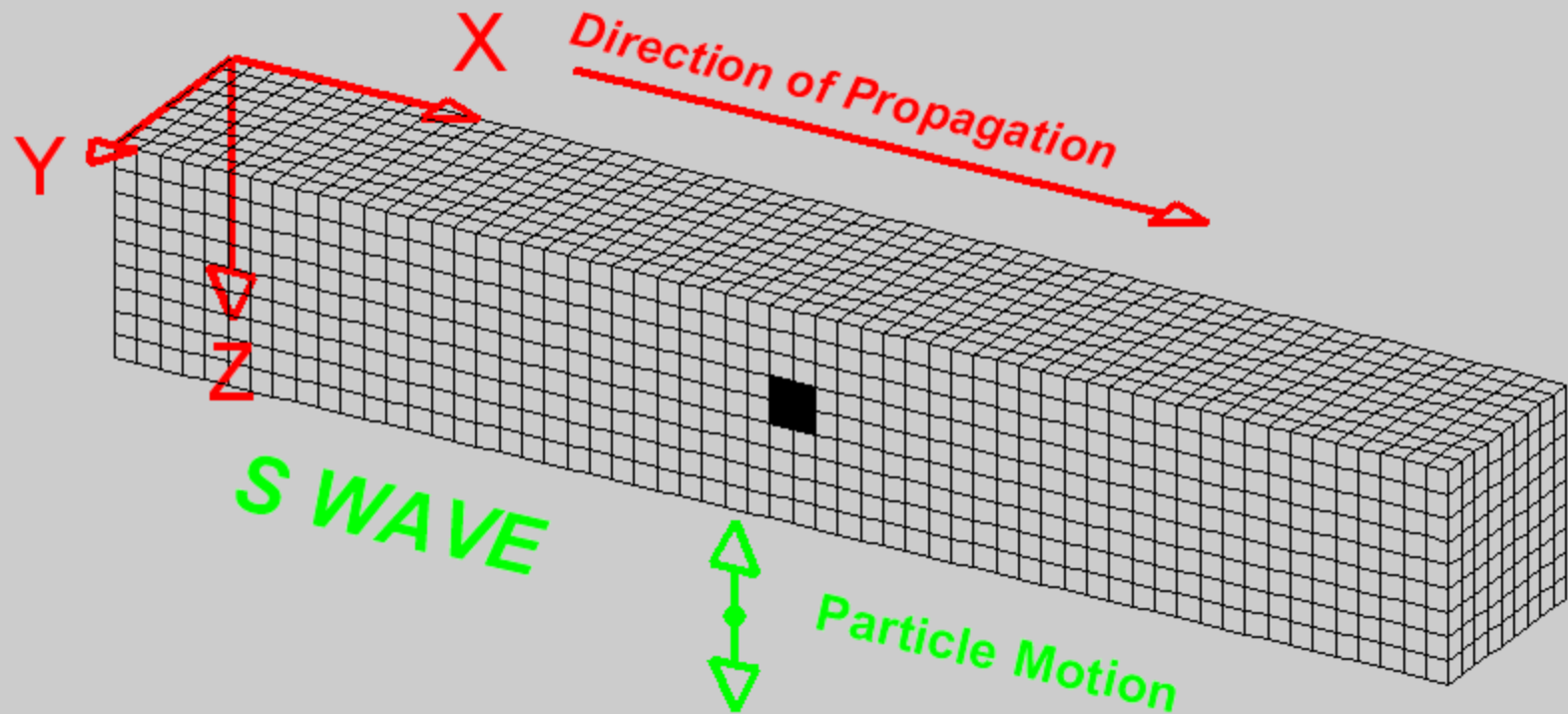
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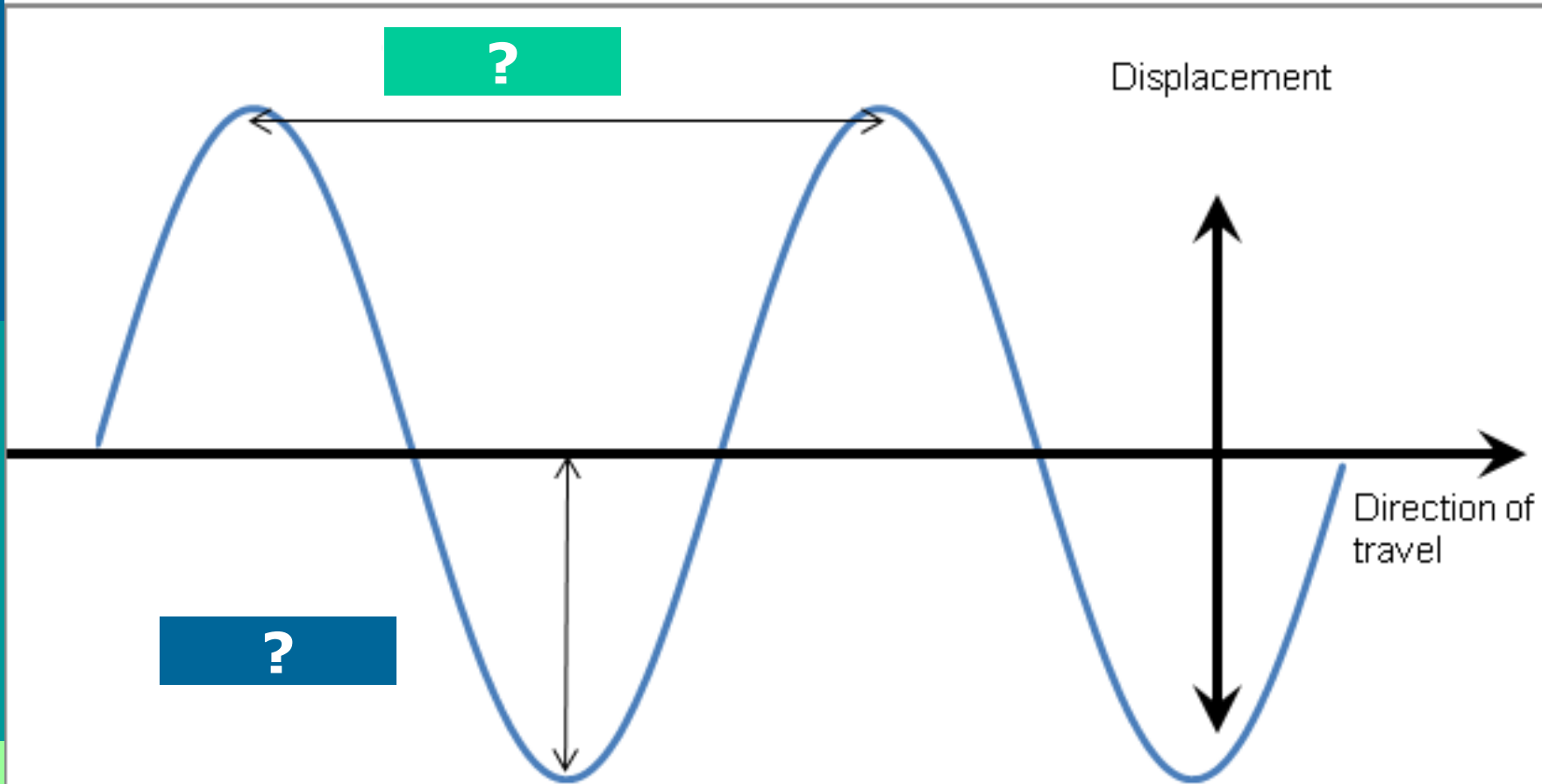
- Most waves are either compressional (aka longitudinal) or transverse.
- Sound waves are compressional.
- **Electromagnetic** waves are transverse...

# Compressional waves



# Transverse waves

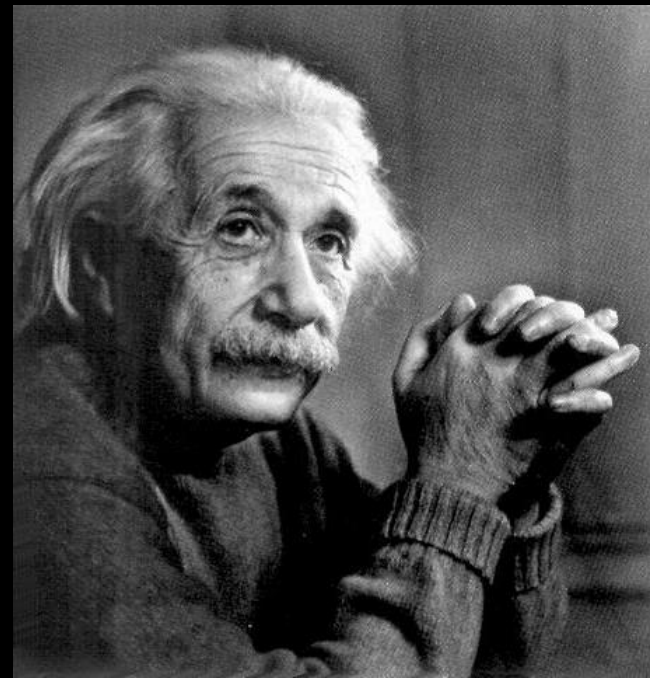




# Electromagnetic waves

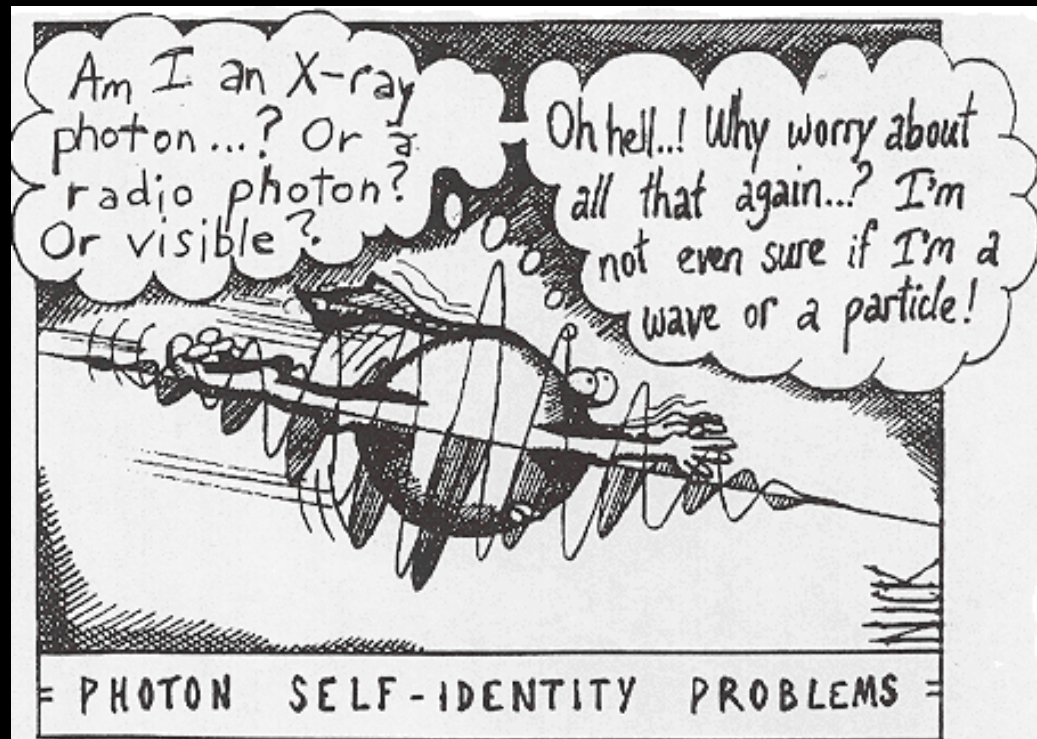
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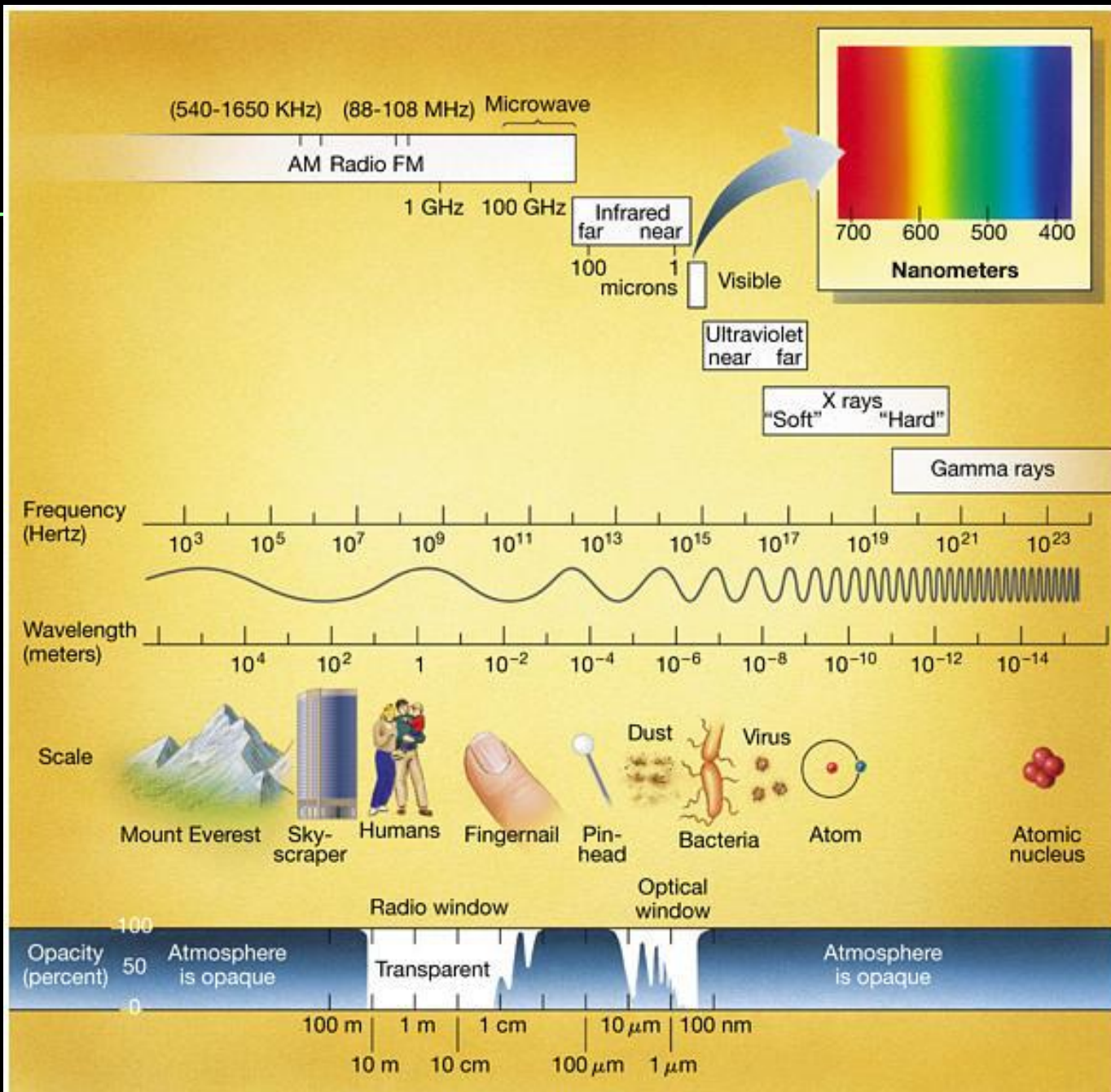
- ❑ Produced by the movement of electrically charged particles
- ❑ Can travel in a “vacuum” (they do NOT need a medium)
- ❑ Travel at the speed of light
- ❑ Also known as EM waves



# Wave-particle Duality

- Light can behave like a wave or like a particle
- A “particle” of light is called a **photon**



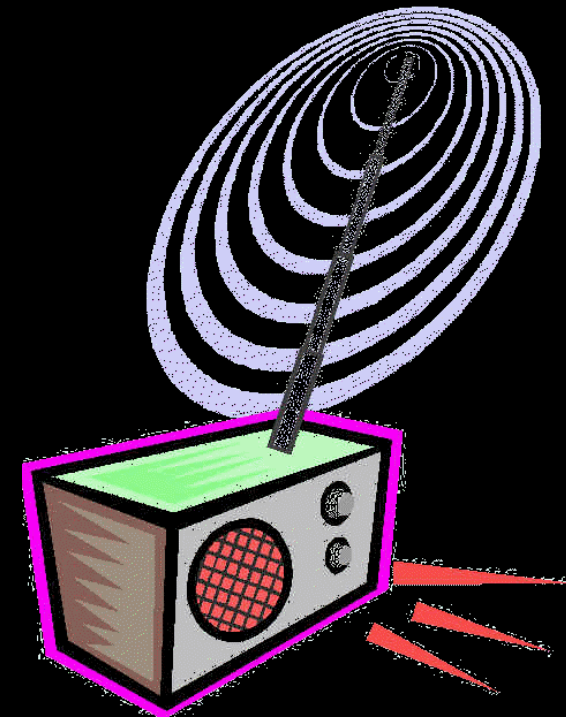
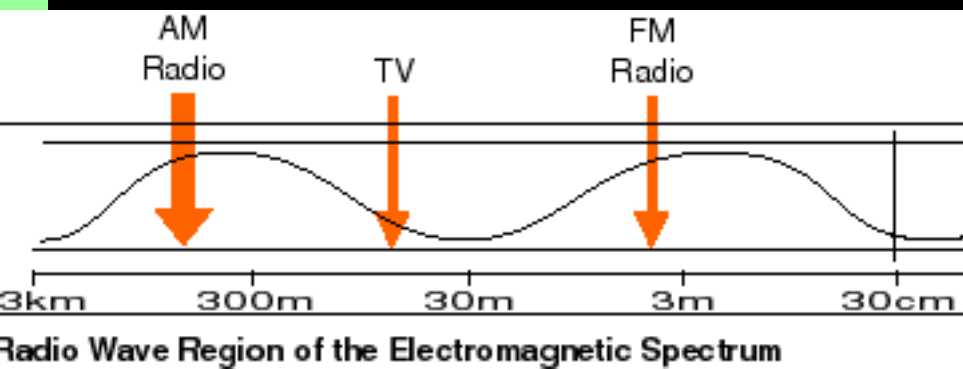






# Radio waves

- Longest wavelength EM waves
- Uses:
  - TV broadcasting
  - AM and FM broadcast radio
  - Avalanche beacons
  - Heart rate monitors
  - Cell phone communication



# Microwaves

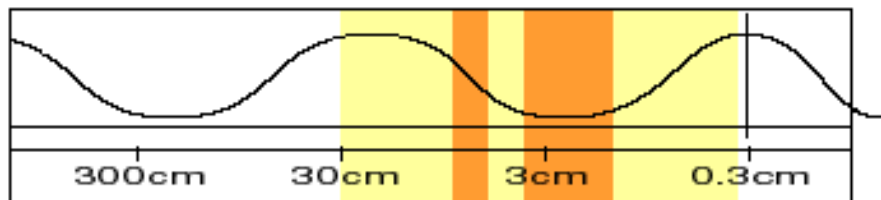
Wavelengths from 1 mm- 1 m

Uses:

- Microwave ovens
- Bluetooth headsets
- Broadband Wireless Internet
- Radar
- GPS

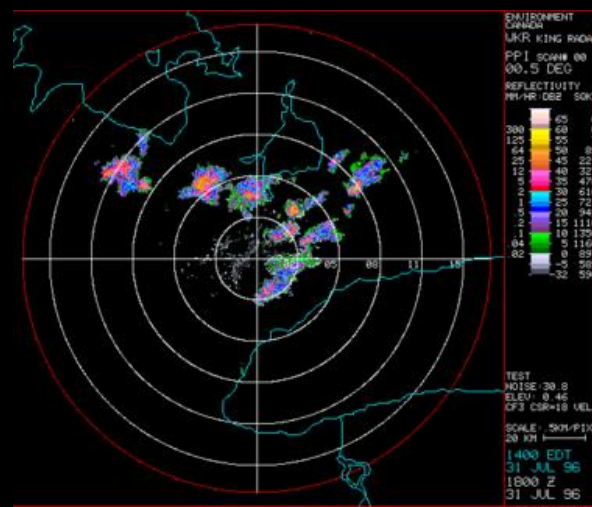


Microwave region of the Electromagnetic Spectrum



Radar Bands:

L S C X K



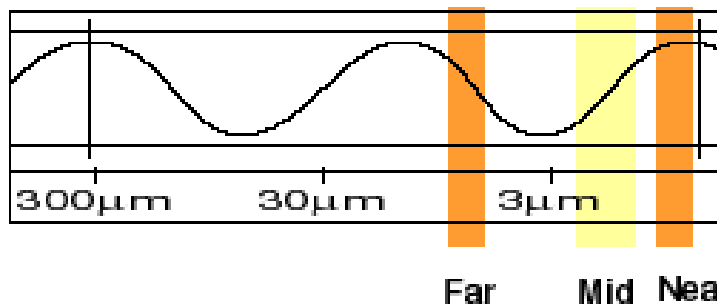


# Infrared Radiation

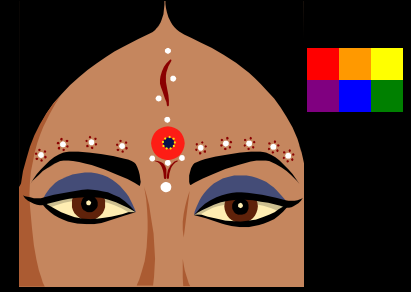
- Wavelengths in between microwaves and visible light
- Uses:
  - Night vision goggles
  - Remote controls
  - Heat-seeking missiles



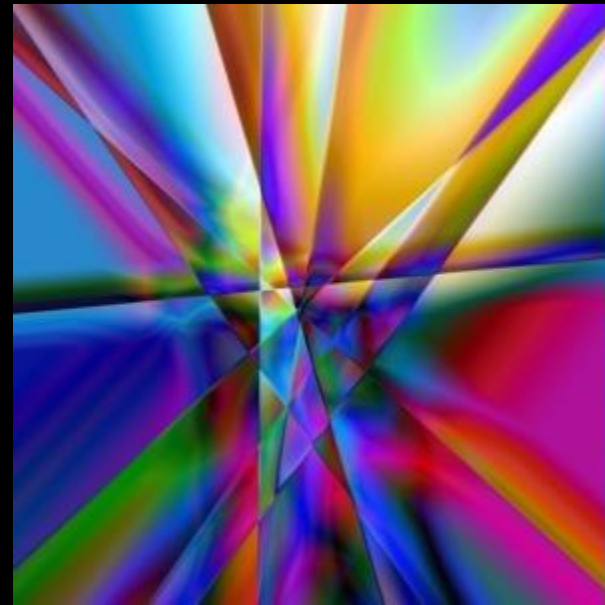
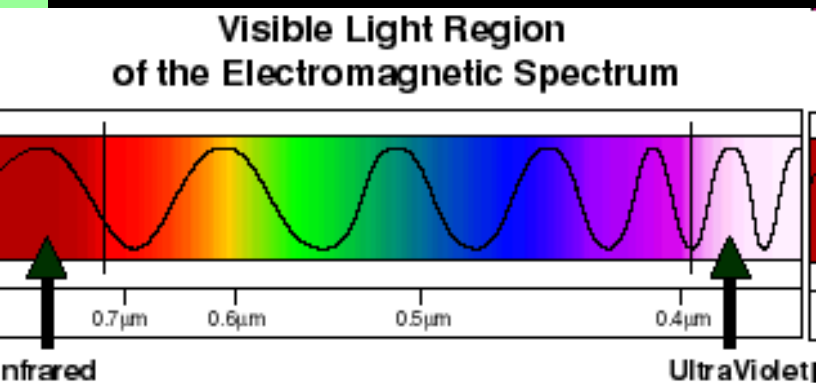
Infrared Region of the Electromagnetic Spectrum



# Visible light



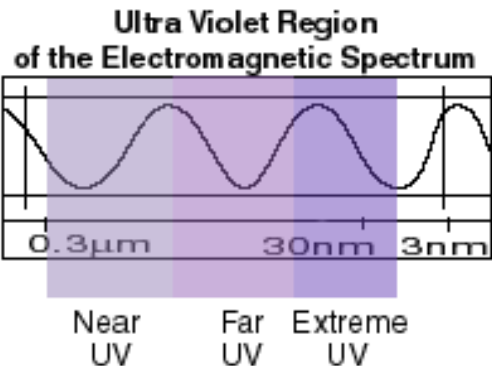
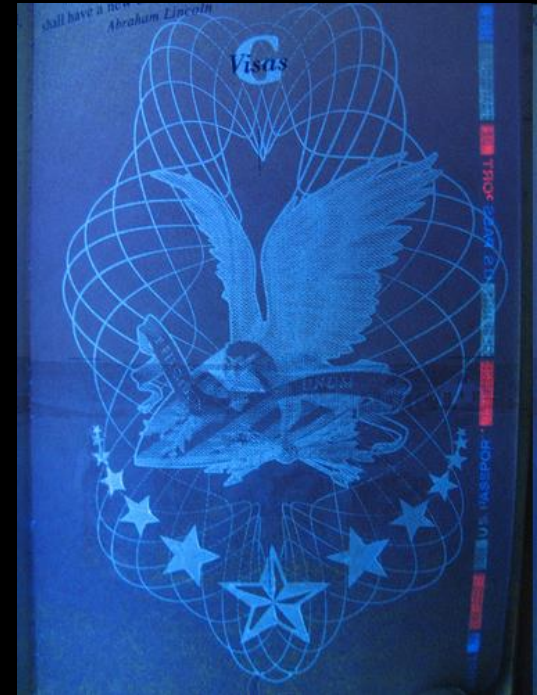
- Only type of EM wave able to be detected by the human eye
- Violet is the highest frequency light
- Red light is the lowest frequency light





# Ultraviolet

- Shorter wavelengths than visible light
- Uses:
  - Black lights
  - Sterilizing medical equipment
  - Water disinfection
  - Security images on money





# Ultraviolet (cont.)

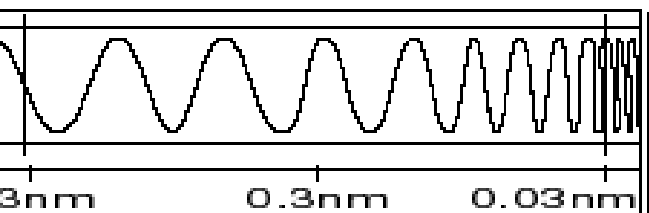
	UVA	UVB and UVC
Energy		
Health risks		

# X-rays

- Tiny wavelength, high energy waves
- Uses:
  - Medical imaging
  - Airport security
  - Inspecting industrial welds



X-Ray Region of the  
Electromagnetic Spectrum



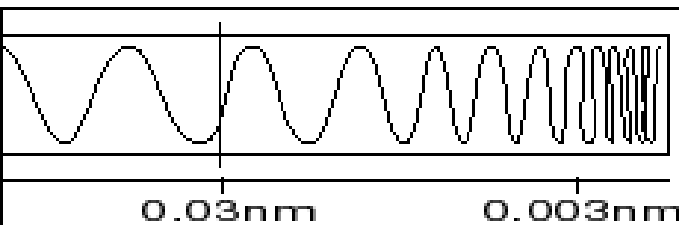


# Gamma Rays

- Smallest wavelengths, highest energy EM waves
- Uses
  - Food irradiation
  - Cancer treatment
  - Treating wood flooring



Gamma Ray Region of the Electromagnetic Spectrum





# Image credits

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5. <http://science.hq.nasa.gov/kids/imagers/ems/radio.html>
6. <http://www.nentjes.info/Palace/radio-6.gif>
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17. <http://www.epinion.eu/wordpress/wp-content/uploads/2008/05/airport-security1.jpg>
18. <http://science.hq.nasa.gov/kids/imagers/ems/gamma.html>
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