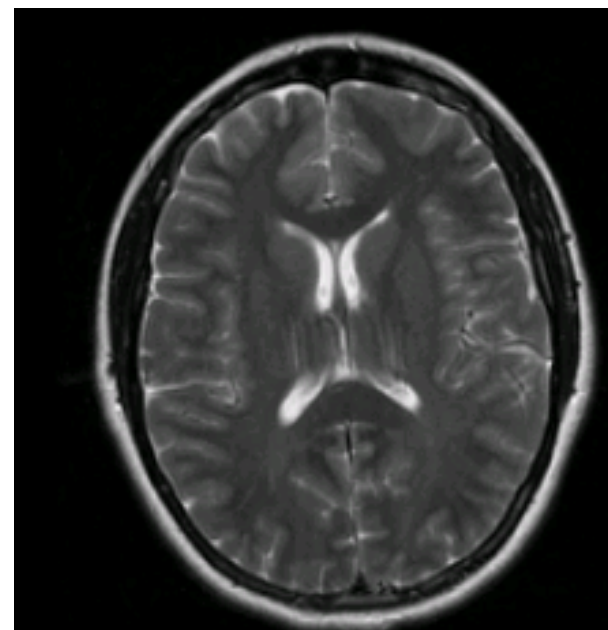


X- Ray Imaging



Medical Imaging

- Primary purpose is to identify pathologic conditions.
- Requires recognition of normal anatomy.

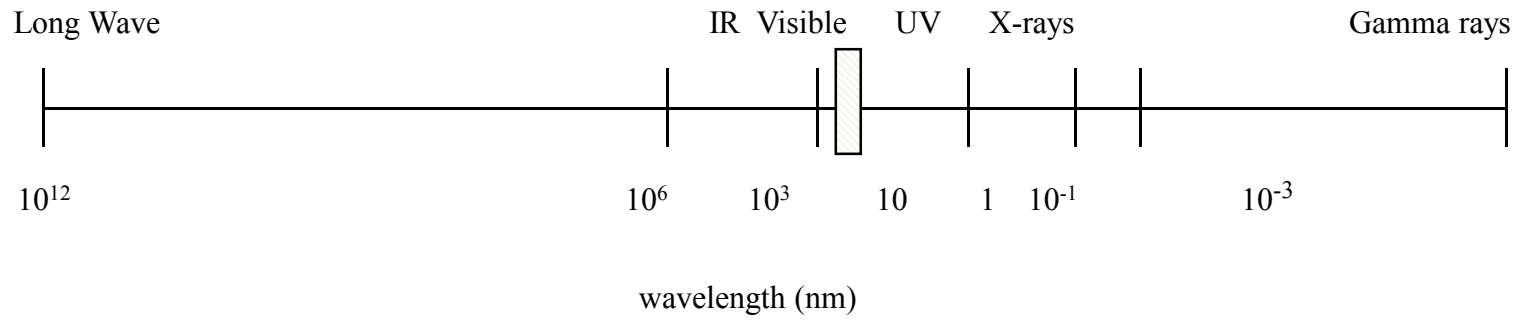
List of diagnostic imaging studies

- Plain x-rays
- CT scan
- MRI
- Nuclear imaging/PET
- Ultrasound
- Mammography
- Angiography
- Fluoroscopy

What are x-rays?

- No mass
- No charge
- Energy





X-rays



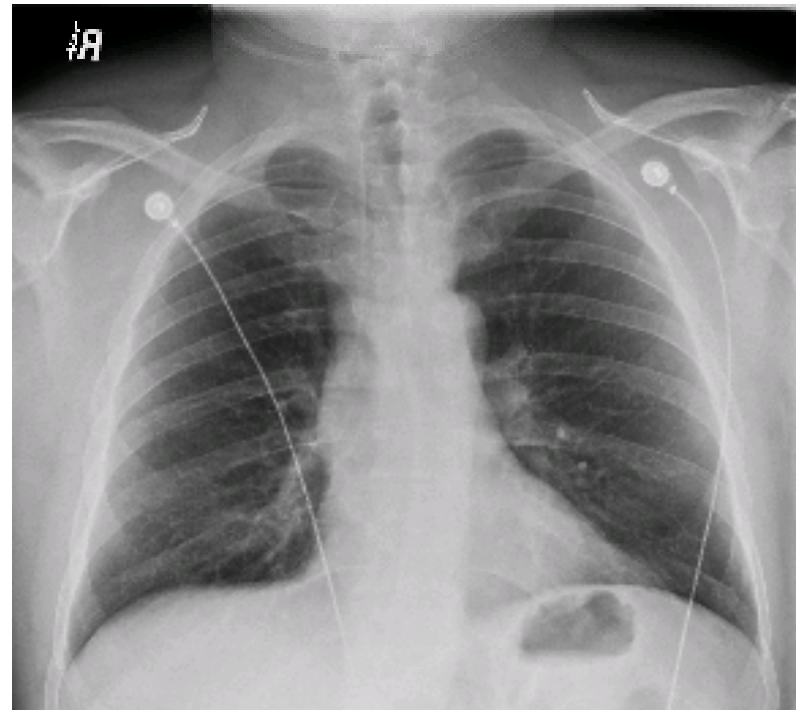
Basic x-ray physics

- X-rays: a form of electromagnetic energy
- Travel at the speed of light
- Electromagnetic spectrum
 - Gamma Rays **X-rays**
 - Visible light Infrared light
 - Microwaves Radar
 - Radio waves

Three things can happen

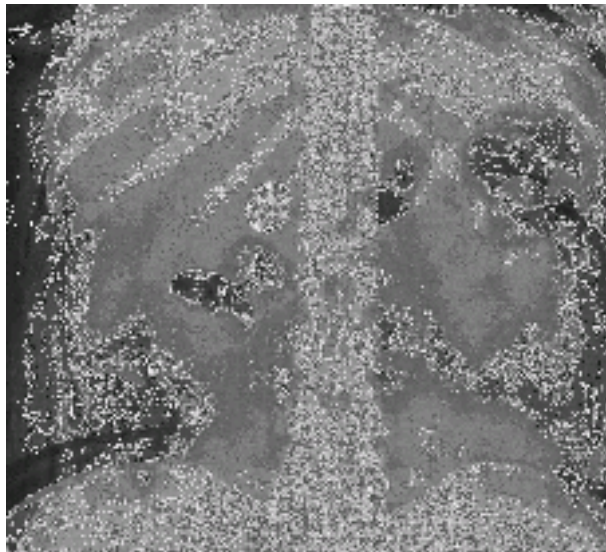
- X-rays can:
 - **Pass** all the way **through** the body
 - Be deflected or **scattered**
 - Be **absorbed**

Where on this image
have x-rays passed
through the body
to the greatest degree?



X-rays Passing Through Tissue

- Depends on the energy of the x-ray and the atomic number of the tissue
- Higher energy x-ray - more likely to pass through
- Higher atomic number - more likely to absorb the x-ray

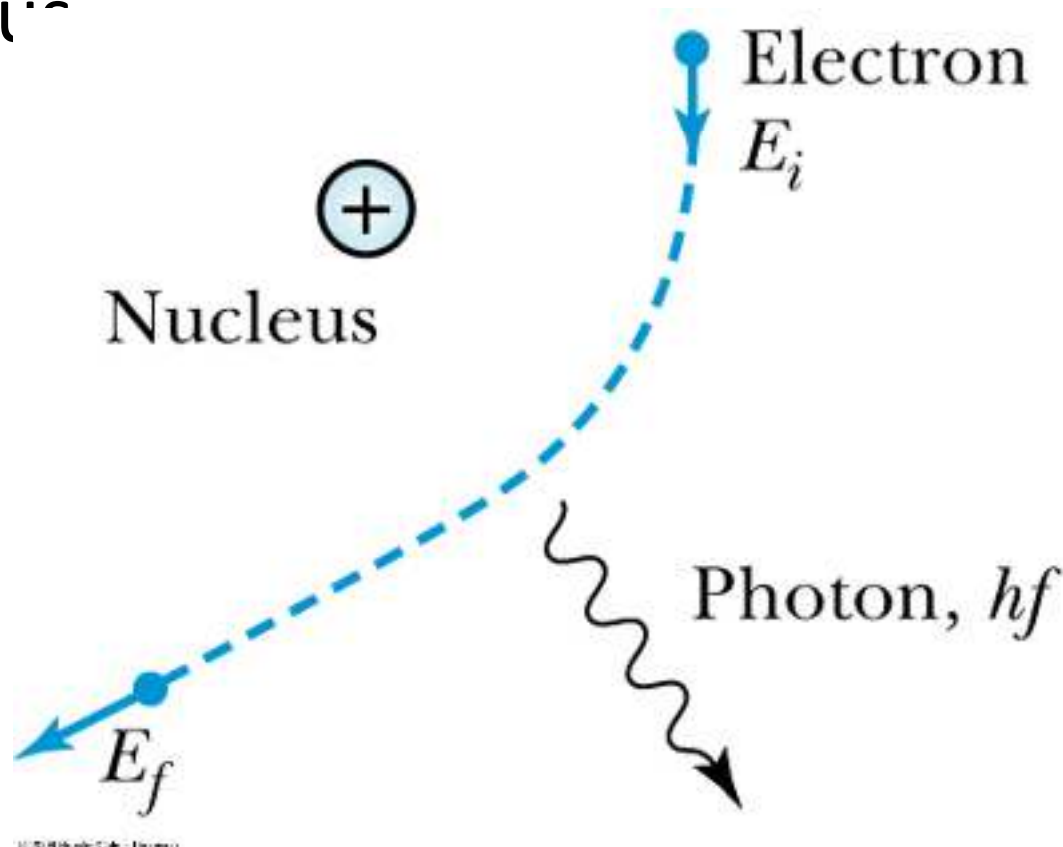


X-rays

- X-rays are produced when electrons are accelerated and collide with a target
 - Bremsstrahlung x-rays
 - Characteristic x-rays
- X-rays are sometimes characterized by the generating voltage
 - 0.1-20 kV soft x-rays
 - 20-120 kV diagnostic x-rays
 - 120-300 kV orthovoltage x-rays
 - 300 kV – 1 MV intermediate energy x-rays
 - > 1MV megavoltage x-rays

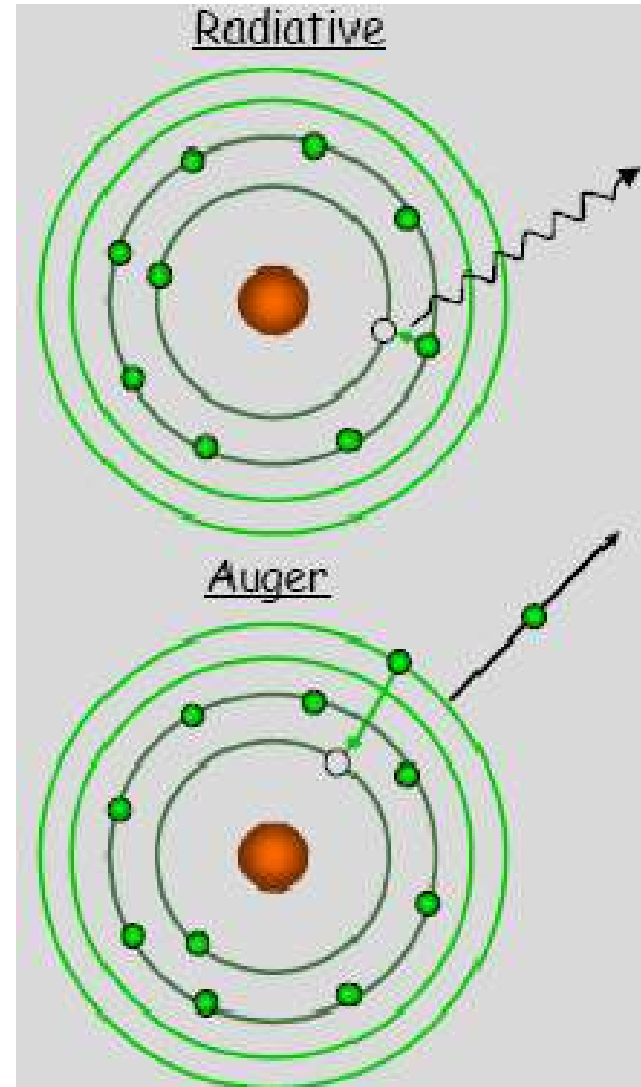
Bremmstrahlung

- Bremsstrahlung x-rays occur when electrons are (de)accelerated in the Coulomb field of a nucleus



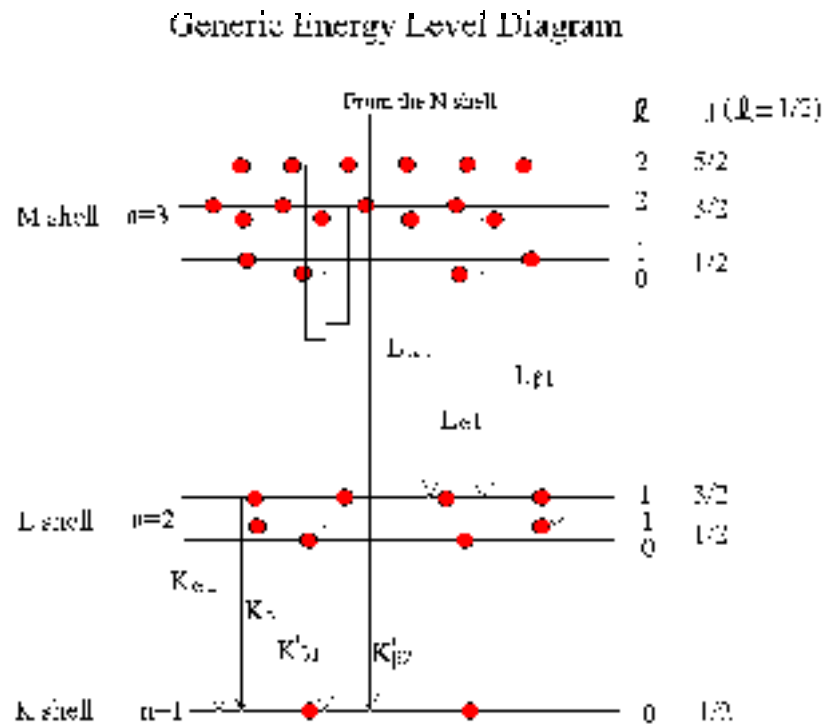
Characteristic x-rays

- After excitation, ions with a vacancy in their inner shell can de-excite
 - Radiatively through x-ray fluorescence
 - Non-radiatively through the emission of Auger electrons



Characteristic X-rays

- Thus an x-ray spectrum will also show characteristic x-rays arising from L to K and M to K transitions after ionization of a K electron
 - Usually transitions to higher shells absorbed by the filtration or are not x-rays



X-ray Tube

- X-ray tubes



X-ray Tube

- More detail

