



Lecture 1 – Atomic Structure

Lecture 2 – The Ultraviolet Catastrophe

Lecture 3 – Particle Nature of Light

Lecture 4 – Atomic Energy Levels and Spectra

Lecture 5 – X-ray Production and Diffraction

Lecture 6 – X-ray Spectra

Lecture 7 – Matter Waves

Lecture 8 – Wave-Particle Duality

Lecture 9 – Wave functions for Quantum Particles

Lecture 10 – A Quantum Mechanical Wave Equation

Lecture 11 – Applications of Schrödinger's Equation



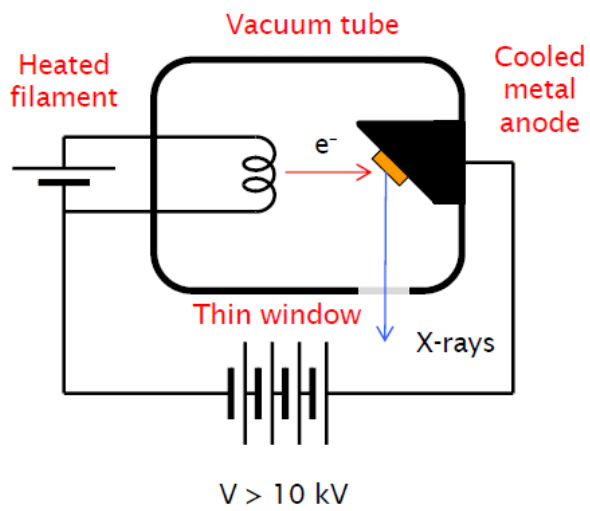
Recap of Lecture 4

- Atomic emission/absorption spectra
- Sharp lines in these are more evidence for quantised energy levels
- Bohr model lets us predict energy level splittings for H, single electron ions
- In general, spectra are very complex – orbitals, fine splitting, hyperfine..

In this lecture

- The production of X-rays
- How to measure the wavelength of X-rays
- Bragg scattering of X-rays by crystals and the Bragg conditions

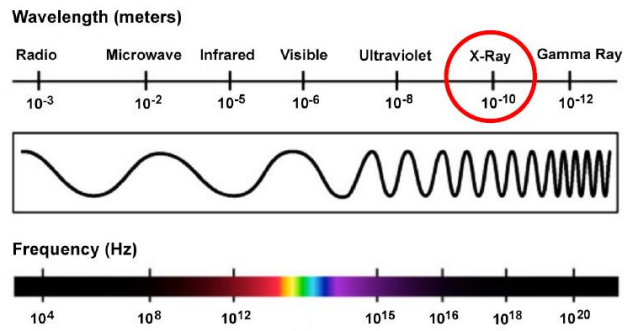
X-Ray source



Wilhelm Röntgen
(1845–1923)



X-Rays



$E_{X\text{-ray}}$ keV	λ nm
0.1	10
1	1
10	0.1
100	0.01
1000	0.001

Soft X-rays

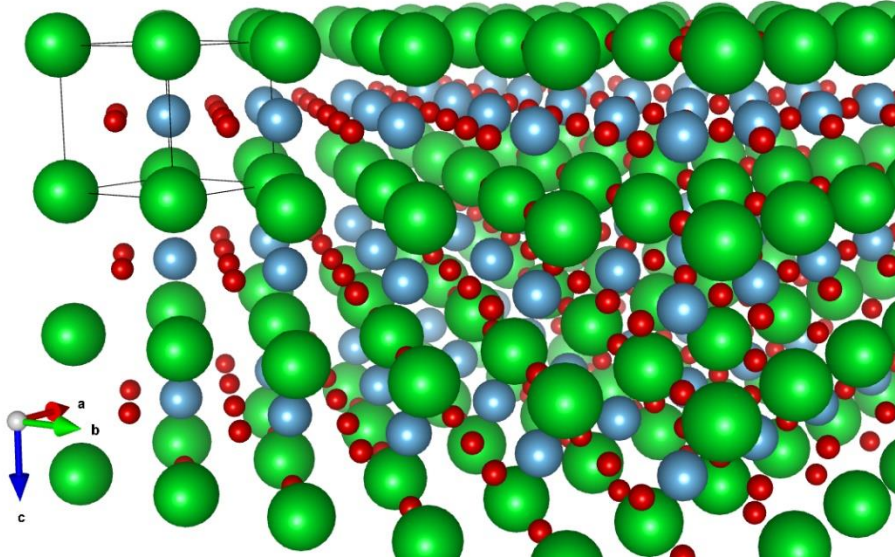
Hard X-rays

Gamma rays

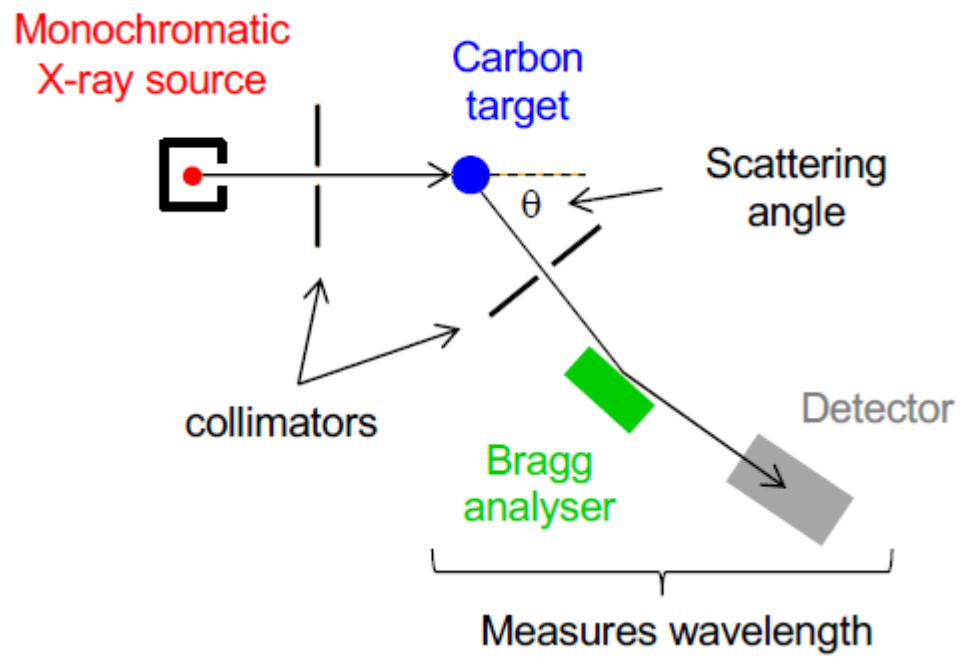
X-ray crystallography
Medical X-rays
Airport security

Crystalline materials as diffraction gratings

(SrTiO_3) – 0.389 nm spacing between green Sr atoms



Compton Scattering - Setup



X-Rays for crystallography

