## The properties of electromagnetic (e/m) radiation

In 1887, Heinrich Hertz experimentally confirmed Maxwell's electromagnetic theory, by being first to transmit and receive radio waves.

In 1895, Wilhelm Röntgen serendipitously (accidentally) discovered X-rays.

They were named X-rays because their nature was unknown, at first. (The symbol X denotes an unknown.)

In a series of experiments, Hertz showed that radio waves are e/m radiation, with wavelengths over 1000 times *longer* than visible light.

In a similar series of experiments, Röntgen showed that X-rays are also e/m radiation, with wavelengths 1000 times *shorter* than visible light.

Both series of experiments did this by showing that radio waves and X-rays have these properties:

- They have speed v = *c*, the speed of light, in empty space.
- They are *transverse* waves, with $\vec{E} \perp \vec{B} \perp$ the direction of travel.
- They have $E/B = E_{max}/B_{max} = c$ in empty space.
- They *reflect* (Chapters 34 and 35).
- They *refract* (Chapters 34 and 35).
- They *interfere* with other waves (Chapter 36).
- They *diffract* (which means bend around corners) (Chapter 37).
- They can be *polarized* (which means they can have E fields only in a specific direction) (Chapter 37).

Visible light does all this too!

So do all other forms of e/m radiation, including infrared and ultraviolet radiation, microwaves, etc.