Maxwell's equations

$$\oint E \bullet dA = Q/\varepsilon_0$$ (Gauss's Law for electricity)

$$\oint B \bullet dA = 0$$ (Gauss's Law for magnetism)

$$\oint E \bullet d\ell = \frac{-d\Phi_B}{dt}$$ (Faraday's Law)

$$\oint B \bullet d\ell = \mu_0 i_c + \mu_0\ \varepsilon_0 \frac{d\Phi_E}{dt}$$ (Ampere-Maxwell Law)

Oscillating electric and magnetic fields

$E = E_x(t) = E_0 \sin(kz - \omega t)$

$$= E_0 \sin\left[2\pi\left(\frac{z}{\lambda} - vt\right)\right] = E_0 \sin\left[2\pi\left(\frac{z}{\lambda} - \frac{t}{T}\right)\right]$$

$E_0/B_0 = c$

$c = 1/\sqrt{\mu_0\varepsilon_0}$ c is speed of light in vaccum

$v = 1/\sqrt{\mu\varepsilon}$ v is speed of light in medium

$p = \frac{U}{c}$ energy transferred to a surface in time t is U, the magnitude of the total momentum delivered to this surface (for complete absorption) is p

Electromagnetic spectrum

Type	Wavelength range	Production	Detection
Radio	> 0.1m	Rapid acceleration and decelerations of electrons in aerials	Receiver's aerials
Microwave	0.1m to 1mm	Klystron value or magnetron value	Point contact diodes
Infra-red	1mm to 700nm	Vibration of atoms and molecules	Thermopiles Bolometer, Infrared photographic film
Light	700nm to 400nm	Electrons in atoms emit light when they move from one energy level to a lower energy	The eye, photocells, Photographic film
Ultraviolet	400nm to 1nm	Inner shell electrons in atoms moving from one energy level to a lower level	photocells photographic film
X-rays	1nm to 10^{-3} nm	X-ray tubes or inner shell electrons	Photograpic film, Geiger tubes, Ionisation chamber
Gamma rays	< 10^{-3}nm	Radioactive decay of the nucleus	do