Generation of electromagnetic radiation

Previous chapter: 5.1.1 Magnetic Spectrum

Electromagnetic radiation is produced whenever **a charged particle, such as an electron, changes its velocity** i.e., whenever it is accelerated or decelerated. The energy of the electromagnetic radiation thus produced comes from the charged particle and is therefore lost by it. A common example of this phenomenon is the oscillating charge or current in a radio antenna. The antenna of a radio transmitter is part of an electric resonance circuit in which the charge is made to oscillate at a desired frequency. An electromagnetic wave so generated can be received by a similar antenna connected to an oscillating electric circuit in the tuner that is tuned to that same frequency. The electromagnetic wave in turn produces an oscillating motion of charge in the receiving antenna. In general, one can say that **any system which emits electromagnetic radiation of a given frequency can absorb radiation of the same frequency.**

Such man-made transmitters and receivers become smaller with decreasing wavelength of the electromagnetic wave and prove impractical in the millimetre range. At even shorter wavelengths down to the wavelengths of X rays, which are one million times smaller, the oscillating charges arise from moving charges in molecules and atoms.

One may classify the generation of electromagnetic radiation into two categories:

1. systems or processes that produce radiation covering a broad continuous spectrum of frequencies and
2. those that emit (and absorb) radiation of discrete frequencies that are characteristic of particular systems.

The Sun with its continuous spectrum is an example of the first, while a radio transmitter tuned to one frequency exemplifies the second category.

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