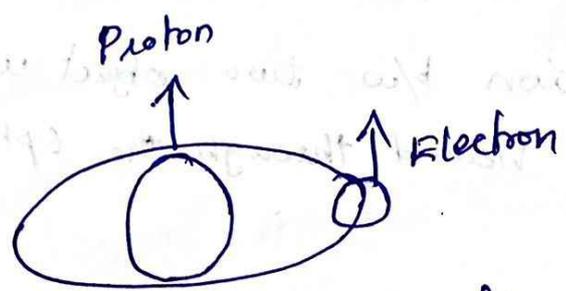


# Radio Telescope

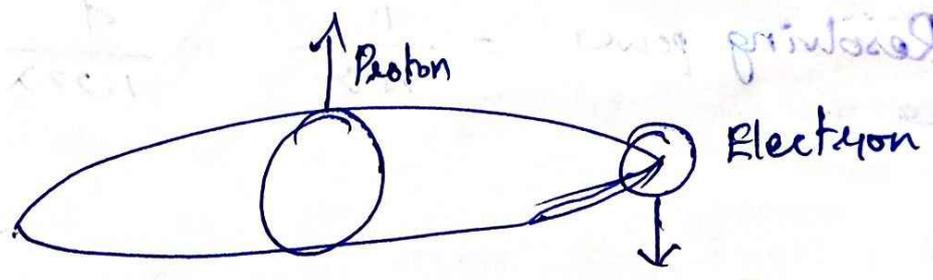
The first nonvisual spectral region that was used extensively for astronomical observations was the radio frequency (RF) band. Telescopes observing at these wavelengths are commonly called radio telescopes.

Radio telescopes deal with wavelength radiation. Their resolution is intrinsically poor. Thus most radio telescopes are large. The largest in the world is the Arecibo observatory.

In neutral hydrogen (H I) the proton and electron can be imagined to spin like tops with their spin axes either parallel or antiparallel.

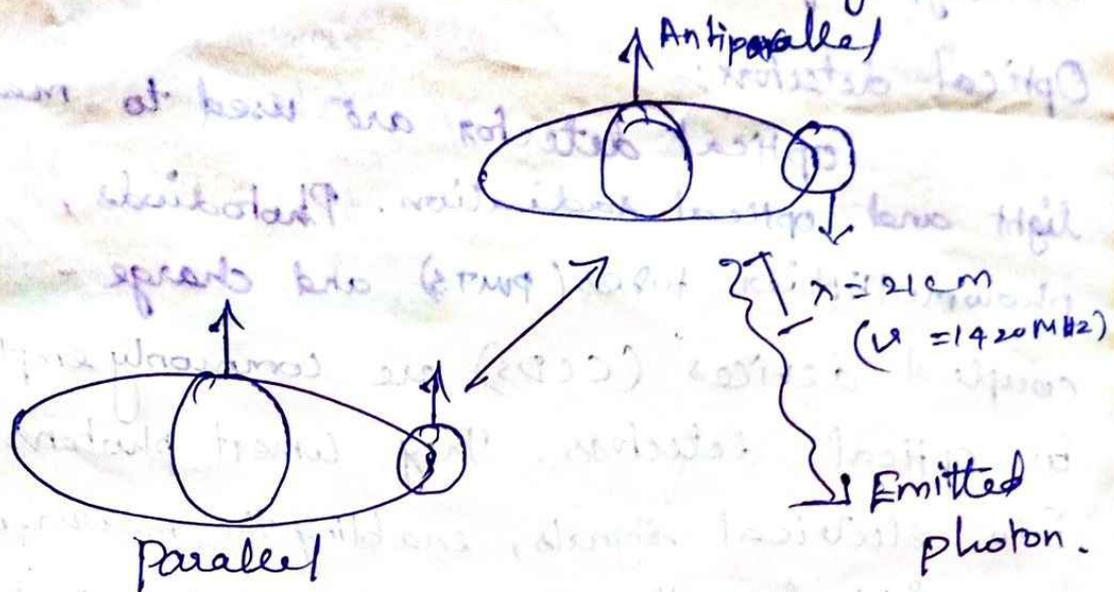


Parallel spin configuration  
(higher energy)



Antiparallel spin configuration  
(lower energy)

When hydrogen atom switch from the parallel to the antiparallel configuration, they emit radio waves with a wavelength of 21 centimeters and a corresponding frequency of exactly 1420 MHz.



This is called the 21cm line. It occurs in the RF part of the spectrum.

The 21cm line can be seen only in cold low density clouds of neutral atomic hydrogen (H I). In hotter, denser clouds the hydrogens collide too often to permit the 21cm photon to be radiated before something else happens to the atom.

**Detector :-**

Detectors are devices or instrument designed to measure and detect different forms of energy or physical quantities.

Detectors are used to convert the target energy or quantity into a measurable signal, enabling scientists, engineers and researchers to gather valuable data and

insights.

Detectors come in many forms and utilise different principles of operation depending on type of energy being detected.

Optical detectors:-

Optical detectors are used to measure light and optical radiation. Photodiodes, photomultiplier tubes (PMTs) and charge-coupled devices (CCDs) are commonly employed in optical detectors. They convert photons into electrical signals, enabling the measurement of light intensity, wavelength or polarization.

Radiation detectors:

Radiation detectors are designed to detect ionizing radiation, such as alpha particles, beta particles, gamma rays and x-rays.

Geiger-Muller counters, scintillation detectors and solid state detectors like silicon detectors are frequently used for radiation detection. These detectors register the energy and intensity of the incoming detector.

Particle detectors:-

Particle detectors are used to identify and measure particles produced in high energy physics experiment or cosmic rays.

Detectors use with Telescope :-

**Imaging** : This involves taking direct of stars fields and extended objects like gas clouds or galaxies. Since sharp images are required over a wide field which may extend up to square degree, careful optical design is a natural requirement.

**photometry** :-

This involves measuring total brightness, spectrum etc. of single objects. Compared to imaging mode, poorer images are acceptable in this case. ~~by the stellar image has~~

**Types of detectors** :-

Detectors used in the imaging mode are mainly 2-dimensional (2D type). since we are trying to form images of objects in a given area. Examples of such detectors are the photographic emulsion.

human eye and the most modern detectors. The charge coupled device (CCD).

Detectors used for photometry of signal objects are 1D type. since they receive photons from one objects. The photometer is a 1D detector.

Detector limits with telescopes :-

- (i) Aperture: size
- (ii) Sensitivity of the detector
- (iii) Background Noise
- (iv) Exposure Time
- (v) Observing Condition
- (vi) Data Analysis Techniques.