SPECIAL MICROWAVE DEVICES

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Ferrite:

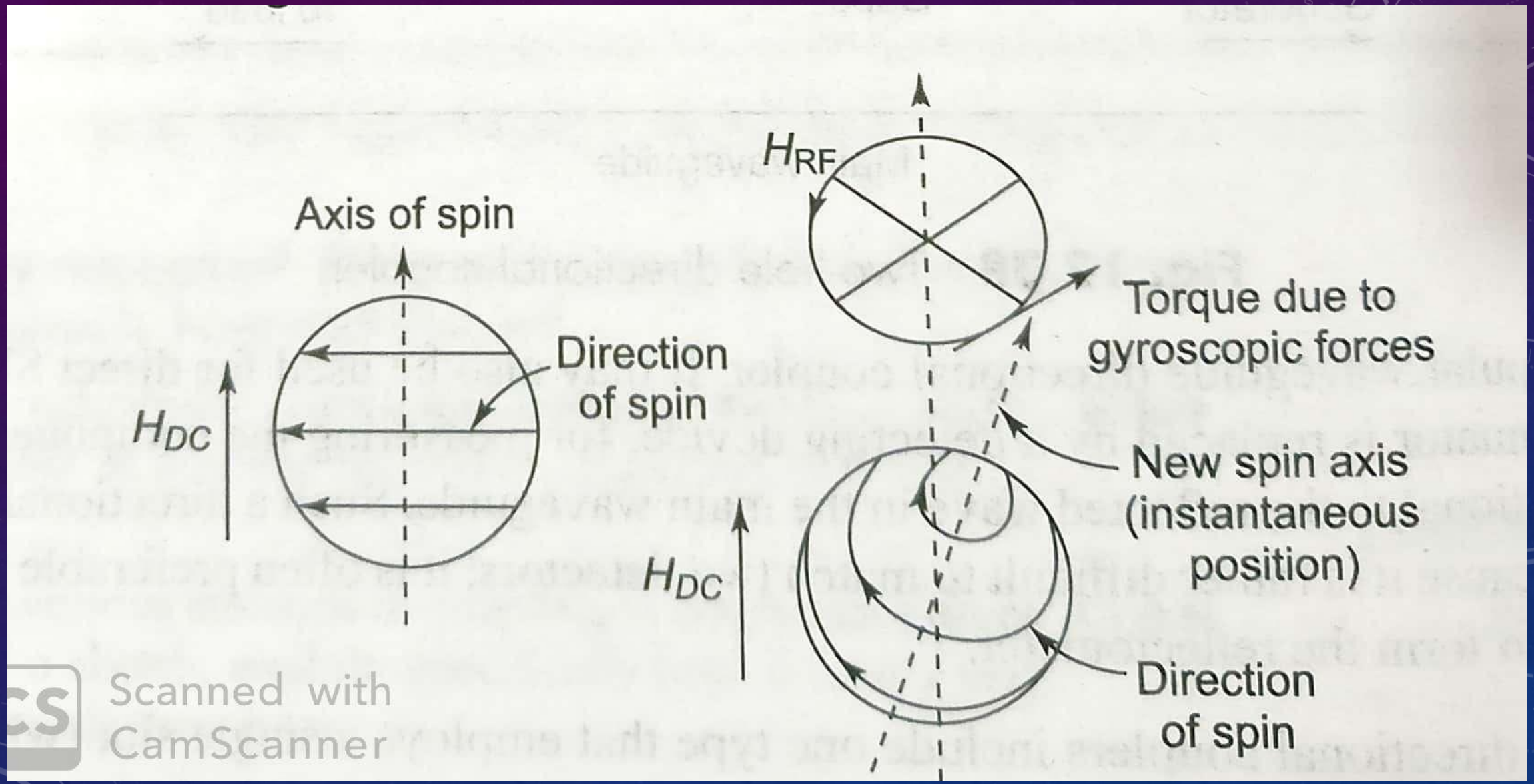
- It is a non-metallic material, often an iron oxide compound, which is an insulator.
- Magnetic properties similar to ferrous metal
- Ferrites are manganese – $MnFe_2O_3$, $ZnFe_2O_3$,
- Ferromagnetic oxide as yttrium-iron-garnet –$Y_3Fe_2(FeO_4)_3$
- Waves can propagate through them.
- Ferrites have strong magnetic properties, hence when an external magnetic field is applied to them the orientation of the waves changes.

This is called as Faraday rotation.

When electromagnetic waves travel through a ferrite, they produce a RF magnetic field which is at right angle to the direction of propagation if the mode of propagation is chosen correctly (the dominant mode).

When an axial magnetic field is applied, the spin axes of the electrons align themselves along the line of magnetic force ,electron spin as it’s a magnetic material.

The spin of unpaired electron causes individual electrons to have angular momentum and a magnetic moment along the axis of spin.



When the RF magnetic field due to the propagating electromagnetic waves is also applied, it is perpendicular to the axial magnetic field, so that the electron precess over their original spin axis. This is due to the gyroscope forces involved and occurs at a rate that depend on the strength of the dc magnetic field.

Because the precession, a magnetic component at right angles to the other two is produced. This has the effect of rotating the plane of polarisation of the waves propagating through the ferrite and is similar to the behaviour of light.

The amount by which the plane of polarisation of the waves will be rotated depends on the length and thickness of the ferrite material, and on the strength of the dc magnetic field. The field must provide atleast saturation magnetization, which is the minimum value required to ensure that the axes of the spinning electrons are suitably aligned. This property of ferrite whereby the plane of polarisation of propagating waves is rotated is basic for a number of nonreciprocal devices.

Nonreciprocal devices:

These are devices in which the properties in one direction differ from those in other direction. Metallic magnetic material cannot be used for such application because they are conductors. Thus, electromagnetic waves cannot propagate in them, whereas they can in ferrite with relatively low losses.