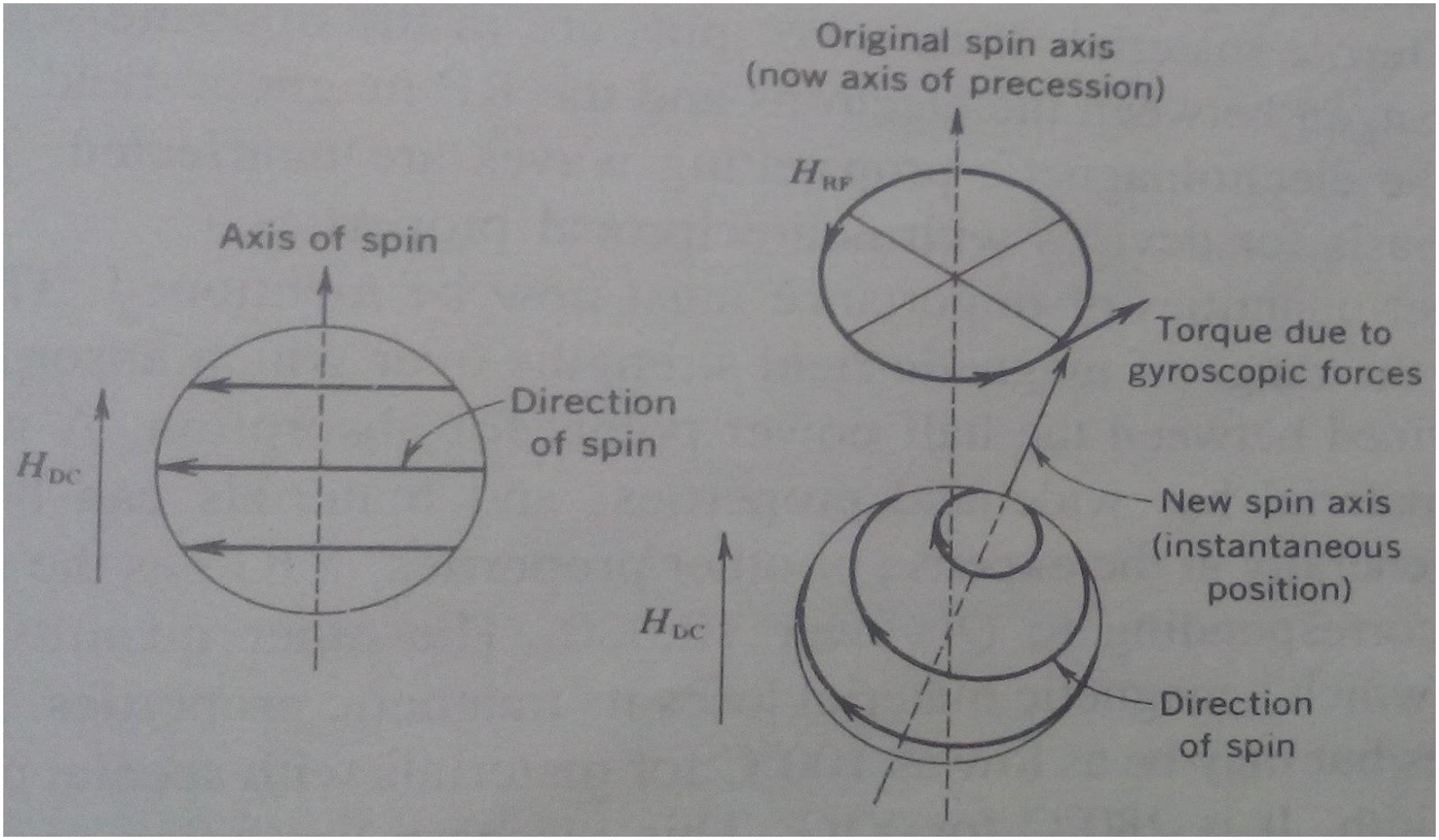
FARADAY ROTATION EFFECT

Ferrites:

Non metallic material, Iron oxide compound, Insulator, Magnetic properties similar to ferrous metal Ferrites are manganese – $MnFe_2O_3$, $ZnFe_2O_3$, Ferromagnetic oxide as yttrium-iron-garnet –$Y_3Fe_2(FeO_4)_3$



DC Field only

DC & RF Magnetic Fields

Effect of Magnetic Field on Spinning electron

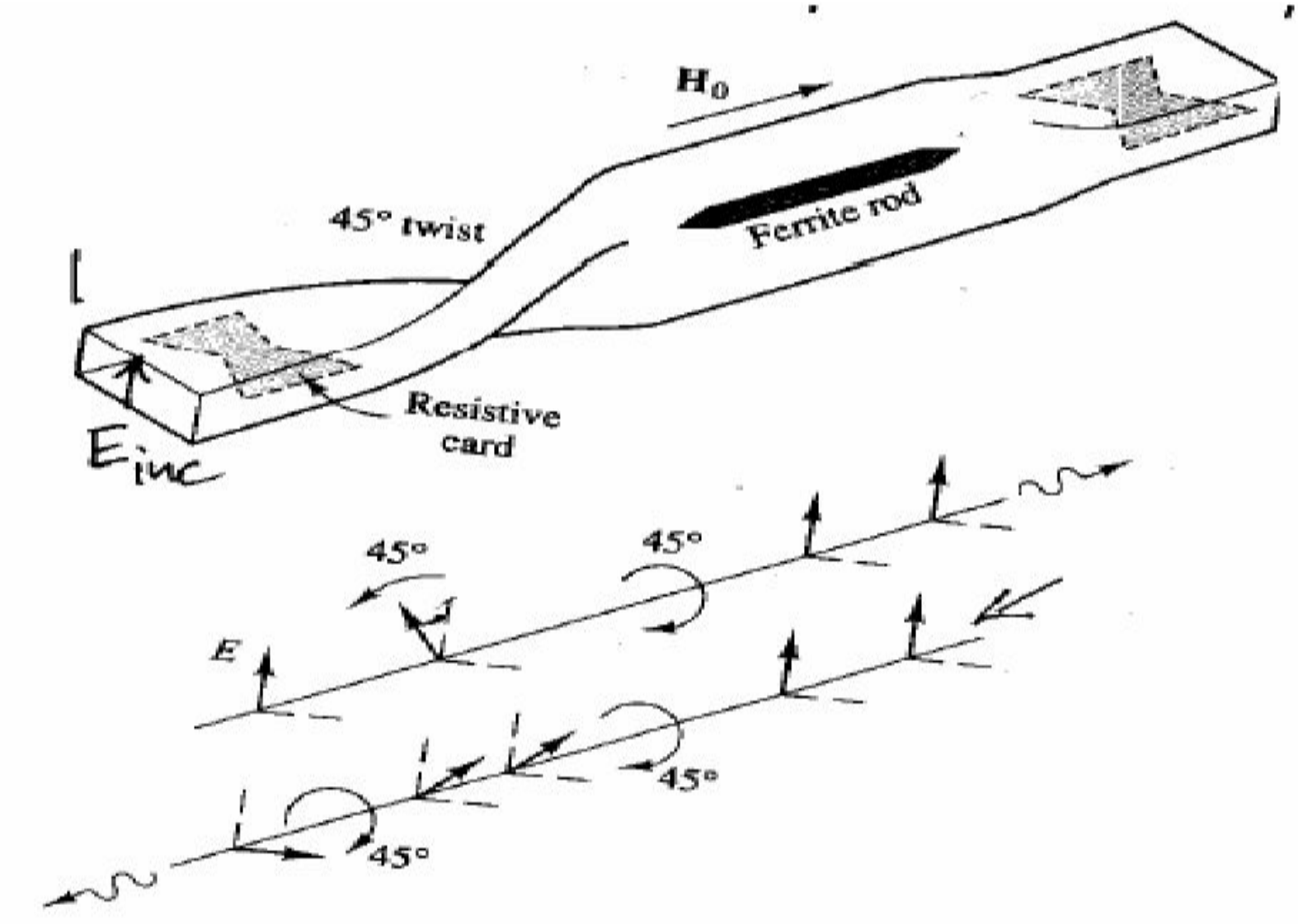
When EM wave travelled to ferrite produce RF magnetic field in material at right angle to the direction of propagation. If axial magnetic field from permanent magnetic field applied as well complex interaction takes place.

Axial DC magnetic field only- A spin axis of spinning electron align themselves along the line of magnetic force. Electrons spin because this is magnetic material. In other material it does not happened.

When RF magnetic field due to propagating EM waves is also applied perpendicular to axial DC magnetic field so that the electrons presses about their original spin axis – gyroscope forces involved at the rate that depends on strength on DC magnetic field. Due to this pression a magnetic component at right angle to other two is produced as shown in fig. B this has the effect of rotating the plane of polarization of waves propagation through the ferrite- Faraday rotation effect.

- Depends on length and thickness of ferrite material.
- Strength of DC magnetic field.
- Field must provide at least saturation magnetization.
- This property of ferrite where by the plane of polarization is rotated is
  basis for number of non reciprocal devices.
- Non reciprocal devices means it has properties in one direction differ
  from those of other direction.

- An ideal isolator is a 2-port device with unidirectional transmission, i.e. the mw power is transmitted from port 1 to port 2 but not from port 2 to 1.
- Isolators are lossy and non-reciprocal.
- *Faraday Rotation Isolator. This was the earliest type of microwave isolator, but is* difficult to manufacture, has inherent power handling limitations due to the resistive cards and is rarely used in modern systems.


H0
45° twist
Ferrite rod
Resistive card
Einc
45°
45°
E
45°
45°

From Left to Right:

45 Twist Section: Polarization is rotated by 45 Anti clockwise.

Ferrite Rod: Polarization is rotated by 45 clockwise.

Resistive Card: It absorbs higher modes with cross polarization.

From Right to Left :

45 Twist Section: Polarization is rotated by 45 clockwise.
Ferrite Rod: Polarization is rotated by 45 clockwise.

Wave will have E field parallel to attenuating pad and it will be it absorbed