1) Note 115(13): Sagnac Effect and Faraday Disk in ECE Theory

These are both explained by the potential due to rotating spacetime. In the Sagnac effect the platform rotates at Ω, and the Faraday disk also rotates at Ω.

Sagnac Effect (GCUFT, vol. 3 paper 1)

A vector potential rotates around the platform of the Sagnac interferometer (ring laser gyroscope). Rotation to the left is described by:

$$\underline{A}_L^{(1)} = \frac{A^{(0)}}{\sqrt{2}} \left(\underline{i} - i\underline{j} \right) \exp(i\omega_1 t) \quad -(1)$$

and to the right by:

$$\underline{A}_R^{(1)} = \frac{A^{(0)}}{\sqrt{2}} \left(\underline{i} + i\underline{j} \right) \exp(i\omega_1 t) \quad -(2)$$

When the platform is at rest the time delay is:

$$\Delta t = 2\pi \left(\frac{1}{\omega_1} - \frac{1}{\omega_1} \right) = 0 \quad -(3)$$

Eqs. (1) and (2) are tetrad equations of spinning spacetime, a concept that does not exist in standard electrodynamics.

Now spin the platform left at angular frequency Ω:

$$\omega_1 \rightarrow \omega_1 + \Omega \quad -(4)$$

for the left rotating beam and

$$\omega_1 \rightarrow \omega_1 - \Omega \quad -(5)$$

for the right rotating beam.

2)

This causes a time delay:

$$\Delta t = 2\pi \left(\frac{1}{\omega_1 - \Omega} - \frac{1}{\omega_1 + \Omega} \right) \quad - (6)$$

$$\boxed{\Delta t = \frac{4\pi\Omega}{\omega_1^2 - \Omega^2}} \quad - (7)$$

which is the Sagnac effect.

Experimentally it is found that:

$$\Delta t = \frac{4\pi Ar}{c^2} \quad - (8)$$

where Ar is the area of the platform. For a circular platform:

$$Ar = \pi r^2, \quad - (9)$$

and experimentally:

$$\Omega << \omega_1 \quad - (10)$$

so:

$$\boxed{\omega_1 = \frac{c}{r} = \kappa c}. \quad - (11)$$

Eq. (7) gives the Sagnac effect as an effect of spinning spacetime, and eq. (11) defines the frequency ω_1 and wavenumber κ for a platform radius r. The standard model of classical electrodynamics has no explanation for the Sagnac effect because the Maxwell Heaviside equations are invariant under Z axis rotation in the Minkowski spacetime.

3) Faraday Disk (GCUFT 2, Paper 19)

The same explanation is used, except that the platform of the Sagnac effect is replaced by the disk of the Faraday generator. The disk rotates at Ω and generates the tetrad potential:

$$\underline{A}^{(1)} = \underline{A}^{(2)*} = \frac{A^{(0)}}{\sqrt{2}} \left(\underline{i} - i\underline{j} \right) e^{i\Omega t} \quad -(12)$$

and the electric field:

$$\underline{E}^{(2)} = \underline{E}^{(1)*} = -\left(\frac{\partial}{\partial t} + i\Omega \right) \underline{A}^{(2)} \quad -(13)$$

i.e.

$$\boxed{\text{Real}\left(\underline{E}^{(1)}\right) = \frac{2}{\sqrt{2}} A^{(0)} \Omega \left(\underline{i} \sin \Omega t - \underline{j} \cos \Omega t \right)} \quad -(14)$$

As observed experimentally, $\underline{E}^{(1)}$ is proportional to Ω multiplied by $A^{(0)}$, the magnitude of the vector potential of the magnetic flux density $\underline{B}$. Note that Ω is the spin connection.

The ability of ECE to explain both the Sagnac and Faraday paradoxes in a very simple way makes ECE a powerful theory.