Section 3 of Paper 46 in Standard Notation of Dielectric Theory.

The homogeneous current is:

$$\underset{\sim}{\underline{j}} = \frac{\partial \underline{M}^a}{\partial t} - \frac{1}{\mu_0 \epsilon_0} \underline{\nabla} \times \underline{P}^a \quad -(1)$$

In the weak coupling limit:

$$\underset{\sim}{\underline{j}} \longrightarrow \underline{0} . \quad -(2)$$

In standard dielectric theory:

$$\underline{P}^a = (\epsilon_r - 1)\epsilon_0 \underline{E}^a \quad -(3)$$

$$\underline{M}^a = \frac{1}{\mu_0}\left(\frac{\kappa}{1+\kappa}\right)\underline{B}^a \quad -(4)$$

where

$$\epsilon_r = \epsilon / \epsilon_0 \quad -(5)$$

and

$$\mu_r = \mu / \mu_0 = 1 + \kappa . \quad -(6)$$

Here ϵ_r is the relative permittivity or dielectric constant and μ_r is the relative permeability. Here κ is the volume magnetic susceptibility. It follows that when:

$$\epsilon_r = \mu_r = 1 \quad -(7)$$

then:

$$\underline{M}^a = \underline{0} , \quad \underline{P}^a = \underline{0} . \quad -(8)$$

and:

$$\underset{\sim}{\underline{j}} = \underline{0} . \quad -(9)$$

Eqns (7) to (9) define zero EMG coupling.

2) The homogeneous current in standard dielectric notation is therefore:

$$\boxed{\tilde{\underline{j}}^a = \kappa \frac{\partial \underline{B}^a}{\partial t} - (\epsilon_r - 1)(1+\kappa)\, \underline{\nabla} \times \underline{E}^a \qquad -(10)}$$

It can be seen that the ECE spacetime can be treated as a medium with ϵ_r and μ_r. Thus gravitation changes the vacuum permittivity ϵ_0 to ϵ_r and the vacuum permeability μ_0 to μ_r.

The Refractive Index

This is a real quantity if there is no absorption, and:

$$n^2 = \frac{\mu \epsilon}{\mu_0 \epsilon_0} = \mu_r \epsilon_r \qquad -(11)$$

In the presence of absorption n is complex:

$$n = n' + i n'' \qquad -(12)$$

If $\mu_r = 1$:

$$\epsilon_r = n^2 \qquad -(13).$$

Therefore the influence of gravitation is to change the refractive index. Presumably this is often observed in cosmology.