356(1): Velocity Fields Generated by Plane Waves and the $B^{(3)}$ Field.

Consider the plane waves of electric field strength $\underline{E}^{(1)}$ in volts per metre and magnetic flux density $\underline{B}^{(1)}$ in tesla. Here:

$$\underline{E}^{(1)} = \underline{E}^{(2)*} \quad -(1)$$

and

$$\underline{B}^{(1)} = \underline{B}^{(2)*} \quad -(2)$$

where * denotes complex conjugate. Therefore:

$$\underline{E}^{(1)} = \frac{E^{(0)}}{\sqrt{2}} (\underline{i} - i\underline{j}) e^{i\phi} \quad -(3)$$

$$\underline{E}^{(2)} = \frac{E^{(0)}}{\sqrt{2}} (\underline{i} + i\underline{j}) e^{-i\phi} \quad -(4)$$

$$\underline{B}^{(1)} = \frac{B^{(0)}}{\sqrt{2}} (i\underline{i} + \underline{j}) e^{i\phi} \quad -(5)$$

$$\underline{B}^{(2)} = \frac{B^{(0)}}{\sqrt{2}} (-i\underline{i} + \underline{j}) e^{-i\phi} \quad -(6)$$

$$\underline{B}^{(3)} = B^{(0)} \underline{k} \quad -(7)$$

where:

$$\phi = \omega t - \kappa Z. \quad -(8)$$

Here ω is the angular frequency of the wave at an instant t and κ is the magnitude of its wave number at a position Z along the $\underline{k}$ axis.

Each of these electric and magnetic waves

2) and $\underline{B}^{(3)}$ field generate a velocity field $\underline{v}$ in the matter. Denote:

$$x = \left(\frac{f_m}{\rho} \right) \quad -(9)$$

This is the ratio of effective mass to charge density in a material through which the plane wave is propagating. This is a simple first approximation, more accurately a plane wave propagating in a medium of refractive index n must be considered and that can be done at a later stage.

The simplest calculation is:

$$\underline{B}^{(3)} = B^{(0)} \underline{k} = x \, \underline{\nabla} \times \underline{v}^{(3)} \quad -(10)$$

so $\underline{v}^{(3)}$ has components in the $\underline{i}$ and $\underline{j}$ directions:

$$\underline{v}^{(3)} = \frac{B^{(0)}}{2x} \left(-Y \underline{i} + X \underline{j} \right) \quad -(11)$$

and is a divergenceless function that can be graphed straightforwardly. We also have:

$$\underline{B}^{(1)} = \frac{B^{(0)}}{\sqrt{2}} \left(i \underline{i} + \underline{j} \right) e^{i\phi} = x \, \underline{\nabla} \times \underline{v}^{(1)}, \quad -(12)$$

$$\underline{B}^{(2)} = \frac{B^{(0)}}{\sqrt{2}} \left(-i \underline{i} + \underline{j} \right) e^{-i\phi} = x \, \underline{\nabla} \times \underline{v}^{(2)} \quad -(13)$$

3) and it is also straightforward to use computer algebra to work out $\underline{v}^{(1)}$ and $\underline{v}^{(2)}$.

Finally:

$$\underline{E}^{(1)} = \frac{E^{(0)}}{\sqrt{2}}(\underline{i} - i\underline{j})e^{i\phi} = x(\underline{v}^{(1)} \cdot \underline{\nabla})\underline{v}^{(1)} \quad -(14)$$

and $$\underline{E}^{(2)} = \frac{E^{(0)}}{\sqrt{2}}(\underline{i} + i\underline{j})e^{-i\phi} x(\underline{v}^{(2)} \cdot \underline{\nabla})\underline{v}^{(2)} \quad -(15)$$

and in this case also it is not difficult to work out the velocity fields set up in the aether by the electric component of plane waves.

A static electric field can be defined by:

$$\underline{E} = \frac{-e^2 \underline{e}_r}{4\pi\epsilon_0 r^2} \quad -(16)$$

and the velocity flow set up by this field is defined by:

$$\underline{E} = -\frac{e^2 \underline{e}_r}{4\pi\epsilon_0 r^2} = \left(\frac{f_m}{\rho}\right)(\text{material})(\underline{v} \cdot \underline{\nabla})\underline{v} \quad -(17)$$

where $\underline{e}_r$ is the radial unit vector.

4) Finally, a static magnetic (material) field is defined by:

$$\underline{\nabla} \times \underline{B} = \mu_0 \underline{J} \text{ (material)} \quad -(18)$$

where:

$$\underline{B} \text{ (material)} = \left(\frac{\rho_m}{\rho}\right) \text{(material)} \ \underline{\nabla} \times \underline{v} \text{ (aether)}$$

so

$$\underline{\nabla} \times \left(\left(\frac{\rho_m}{\rho}\right) \text{(material)} \ \underline{\nabla} \times \underline{v} \text{ (aether)} \right) = \mu_0 \underline{J} \text{ (material)} \quad -(19)$$

If it is assumed that (ρ_m / ρ) (material) is independent of $\underline{r}$, then:

$$\left(\frac{\rho_m}{\rho}\right) \text{(material)} \ \underline{\nabla} \times \left(\underline{\nabla} \times \underline{v} \text{ (aether)} \right) = \mu_0 \underline{J} \text{ (material)} \quad -(20)$$

which can be solved for a given $\underline{J}$ (material).

Any type of electric or magnetic field can be considered in general, including pulsed fields.