GR1

Green's function Review

A) Allow soln of PDE with "source term"

$$-\nabla^2 \phi(r) = \rho(r)/\epsilon_0$$ 3D Poisson Eqn

$$G(\bar{r}-\bar{r}') \longrightarrow \nabla^2\left[-4\pi \frac{1}{|r-r'|}\right] = \delta(r-r')$$

$$\longrightarrow \quad \phi(r) = \frac{1}{4\pi\epsilon_0}\int d^3r' \frac{\rho(r')}{|r-r'|}$$

B) Allow soln of PDE w/o "source term" but with knowledge of initial conditions (bdy conditions)

i) 2D laplace eqn $\nabla^2\phi(xy) = 0$

$$\phi(x\,y) = \int_{-\infty}^{\infty} dx'\, \phi(x',0)\, \underbrace{\frac{y}{\pi(y^2+(x-x')^2)}}_{G(x-x',y)}$$

ii) 1D wave eqn $0<x<L$

$$y(x,t) = \int dx'\, G(x,x',t)\, y(x,t=0)$$

not $x-x'$ because boundaries

iii) Diffusion Eqn ...

iv) 3D Laplace Eqn (HW)

$\leftarrow \phi(x,y,z=0)$

GR2

$$\vec{\nabla}\times\vec{B} = \mu_0 \vec{J} \qquad \vec{J} = \sigma\vec{E}$$

$$\uparrow \qquad\qquad \uparrow$$

$$\vec{\nabla}\times\vec{A} \qquad -\partial\vec{A}/\partial t$$

$$\bar{\nabla}\times(\bar{\nabla}\times\bar{A}) = \mu_0\sigma(-\partial\vec{A}/\partial t)$$

$$-\nabla^2 A \mp \nabla(\vec{\nabla}\cdot\vec{A}) = -\mu_0\sigma\,\partial\vec{A}/\partial t$$

Starting pt of 6.3 $\rightsquigarrow$ $\partial\vec{A}/\partial t = \frac{1}{\mu_0\sigma}\nabla^2 A$ $\leftarrow$ Diffusion Eqn

Physics as $\vec{A}$ changes in time

it produces an $\vec{E}$ field

which produces a current $\vec{J}$

which produces a $\vec{B}$ field $\rightsquigarrow \vec{A}$

Diffusive because $\vec{J} = \sigma\vec{E}$

represents flow with friction

($\vec{J}$ is uniform even though there is a constant push $\vec{E}$ on charge carriers)