$$\vec{E}(\vec{r},t) = -\vec{\nabla}\phi(\vec{r},t) - \partial_t \vec{A}(\vec{r},t)$$
$$\vec{B}(\vec{r},t) = \vec{\nabla}\times\vec{A}(\vec{r},t)$$

$$\vec{\mathcal{R}} = \vec{\mathcal{R}}(t_r) \longrightarrow \vec{\mathcal{R}} = \vec{r} - \vec{r}'(t_r) = \vec{r} - \vec{v}\cdot t_r = \vec{r} - \vec{v}\cdot\left(t - \frac{|\vec{r}-\vec{r}'|}{c}\right)$$

Jefimenko

$$\vec{E}(\vec{r},t) = \frac{1}{4\pi\epsilon_0}\int d\tau' \left[\frac{\rho(\vec{r}',t_r)}{\mathcal{R}^2}\hat{\mathcal{R}} + \frac{\partial_t \rho(\vec{r}',t_r)}{c\mathcal{R}}\hat{\mathcal{R}} - \frac{\partial_t \vec{J}(\vec{r}',t_r)}{c^2\mathcal{R}}\hat{\mathcal{R}} \right]$$

$$\vec{B}(\vec{r},t) = \frac{\mu_0}{4\pi}\int d\tau' \left[\frac{\vec{J}(\vec{r}',t_r)}{\mathcal{R}^2}\times\hat{\mathcal{R}} + \frac{\partial_t \vec{J}(\vec{r}',t_r)}{c\mathcal{R}}\times\hat{\mathcal{R}} \right]$$

$$\circledast \; d\tau' = \frac{|\vec{\mathcal{R}}|}{|\vec{\mathcal{R}}| - \vec{\beta}\cdot\vec{\mathcal{R}}}\cdot d\tau'' \Longrightarrow d\tau'' = |\vec{\mathcal{R}}|\cdot\left(1 - \vec{\beta}\cdot\frac{\vec{\mathcal{R}}}{|\vec{\mathcal{R}}|}\right)$$

$$\circledast \; \hat{\mathcal{R}} = \frac{\vec{\mathcal{R}}}{|\vec{\mathcal{R}}|} \qquad \circledast \; K = 1 - \frac{\vec{\beta}\cdot\vec{\mathcal{R}}}{|\vec{\mathcal{R}}|} = 1 - \vec{\beta}\cdot\hat{\mathcal{R}}$$

$$\circledast \; \vec{J}/c \rightarrow q\vec{\beta}\cdot\delta \;\;\&\;\; \rho \rightarrow q\delta$$

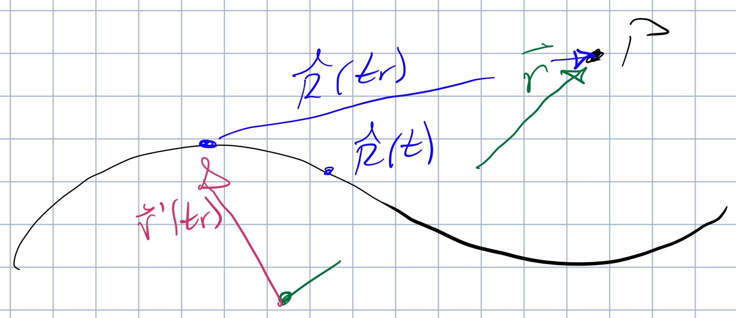
$$\vec{E}(\vec{r},t) = \frac{q}{4\pi\epsilon_0}\left[\frac{\hat{\mathcal{R}}}{K\mathcal{R}^2} + \frac{1}{c}\partial_t\left(\frac{\hat{\mathcal{R}}}{K\mathcal{R}}\right) - \frac{1}{c}\partial_t\left(\frac{\vec{\beta}}{K\mathcal{R}}\right) \right]^{-1}_{@t=t_r}$$

$$\vec{B}(\vec{r},t) = \frac{\mu_0 q}{4\pi}\left[\frac{\vec{\beta}\times\hat{\mathcal{R}}}{K\mathcal{R}^2} + \frac{1}{c}\partial_t\left(\frac{\vec{\beta}\times\hat{\mathcal{R}}}{K\mathcal{R}}\right) \right]^{-1}_{@t=t_r}$$

$\mathcal{R}$ no longer static

$\vec{\mathcal{R}}$ - point @ charge to now wrt my time

$$\frac{\partial\vec{\mathcal{R}}}{\partial t} = -\vec{v}\,\frac{\partial t_r}{\partial t} \quad \& \quad \frac{\partial \mathcal{R}}{\partial t} = -(\hat{\mathcal{R}}\cdot\vec{v})\cdot\frac{\partial t_r}{\partial t_r} \longrightarrow \frac{\partial t_r}{\partial t} = K^{-1}$$



how aligned is line of sight to particle's trajectory

$$\frac{\partial\hat{\mathcal{R}}}{\partial t} = \frac{1}{\mathcal{R}K}\left[\hat{\mathcal{R}}\cdot(\hat{\mathcal{R}}\cdot\vec{v}) - \vec{v}\right]$$

$$\frac{\partial\vec{\beta}}{\partial t} = \frac{\vec{a}}{c}\;\frac{\partial t_r}{\partial t}$$

$$\frac{\partial(\kappa R)}{\partial t} = \frac{1}{c}\left[(-\hat{R}\cdot\vec{\beta}) + (\vec{\beta}\cdot\vec{\beta}) - (\vec{R}\cdot\vec{a})\right]\frac{\partial t_r}{\partial t}$$

$$\vec{E}(\vec{r},t) = \frac{q}{4\pi\epsilon_0}\left[\underbrace{\frac{(\hat{R}-\vec{\beta})(1-\beta^2)}{\kappa^3 R^2}}_{\text{velocity}} + \underbrace{\frac{\hat{R}\times\{(\hat{R}-\vec{\beta})\times\vec{a}\}}{c^2\kappa^3 R}}_{\text{acceleration}}\right]$$

$$= \frac{q}{4\pi\epsilon_0}\left[\frac{R}{(\vec{R}\cdot\vec{v})^2}\right]\left[(c^2-v^2)\vec{v} + \vec{R}\times(\vec{v}\times\vec{a})\right]$$

$$\vec{B}(\vec{r},t) = \frac{\mu_0 q}{4\pi}\left[\frac{(\vec{\beta}\times\hat{R})(1-\beta^2)}{\kappa^3 R^2} + \frac{(\vec{a}\cdot\hat{R})(\vec{\beta}\times\hat{R})}{c^2\kappa^3 R^2} + \frac{(\vec{a}\times\hat{R})}{c^2\kappa^2 R}\right]$$

$$= \frac{1}{c}\left(\hat{R}\times\vec{E}(\vec{r},t)\right)$$

$\vec{B} \perp \vec{E} \perp \hat{R}$

line of sight

$\vec{E}$ & $\vec{B}$ $\rightarrow$ $\vec{E}_v$, $\vec{E}_a$ & $\vec{B}_v$, $\vec{B}_a$

$\vec{E}^{full} \xrightarrow{\beta \ll 1} \vec{E}^{static} \propto 1/R^2$

$\vec{E}_a, \vec{B}_a \propto 1/R$

$E_v, B_v \propto 1/R^2 \longrightarrow S_{vv} \sim E_v^2 \cdot B_v^2 \propto 1/R^4$

$E_a, B_a \propto 1/R \longrightarrow S_{aa} \sim E_a^2 \cdot B_a^2 \propto 1/R^2$

$\longrightarrow S_{av} \sim E_a^2 \cdot B_v^2 \propto 1/R^5$

Field Course

Newton's cross

prim & sec mirror
support. diffraction points
disruption → new waves

double slit → sources of waves

6 veins, not 4

low level

1 in 40 in residual

can see my psf fit

optimize residual w/ components

① isolate small region → fit

② hella initial components