- Electromagnetism

  $\vec{E}(\vec{r},t) \quad , \quad \vec{B}(\vec{r},t)$

- Maxwell's equation

  $$\oiint_s a\,\vec{E}\cdot d\vec{A} = \frac{Q}{\epsilon} = \iiint_\tau P(\vec{r})\,d\vec{r}$$ --- Gauss' law for electric field

  $$\oiint \vec{B}\cdot d\vec{A} = 0$$ --- Gauss' law for magnetic field

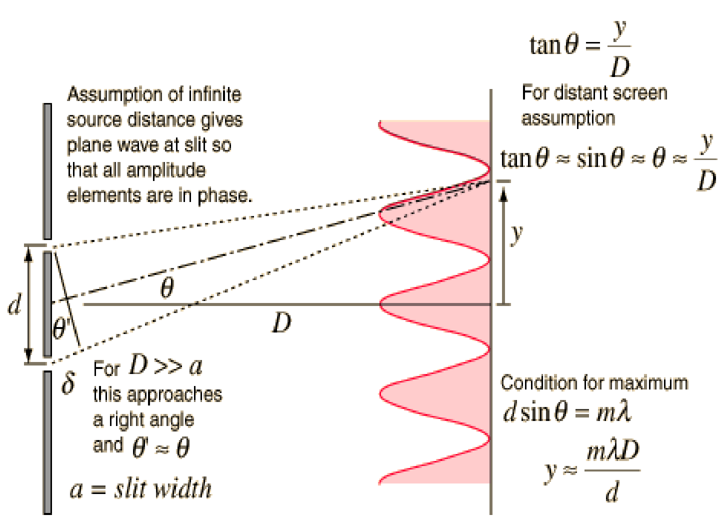
  $$\oint \vec{E}\cdot d\vec{l} = -\frac{d\phi_B}{dt}$$ --- Faraday's law

  $$\oint \vec{B}\cdot d\vec{l} = \mu_0 I = \mu_0 \oiint \vec{J}\cdot d\vec{A}$$ --- Ampère's law

- Continuity equation

  $$\int_V \vec{\nabla}\cdot\vec{J} = -\frac{d}{dt}\int_V \rho\, d\tau = -\int_V \frac{\partial\rho}{\partial t} d\tau \quad \Rightarrow \quad \vec{\nabla}\cdot\vec{J} = -\frac{\partial\rho}{\partial t}$$

- N-slit interference



$$I(\theta)=V(\mu_E+\mu_B)=\left(\frac{E}{\epsilon}\right)^{\frac{1}{2}}\frac{1}{2}|E|^2 \quad , \quad E(\theta)=E_1+E_2+\ldots+E_i+\ldots+E_N$$

$$E_i=\frac{A_0}{x_i N}\sin(\omega t-k x_i) = \frac{A_0}{x_i N}\sin\left[\omega t-k x_i-\frac{k b}{N}(i-1)\sin\theta\right]$$

$$A_3 \sin\theta_3 = A_1 \sin\theta_1 + A_2 \sin\theta_2$$

$$E(\theta) = \widehat{ab} = 2\mathrm{R}\sin\frac{A}{2}, \quad R = \frac{\widehat{ab}}{\Delta} = \frac{A_0}{\Delta}$$

$$\beta = \frac{\Delta}{2} \quad , \quad (\frac{\sin\beta}{\beta})^2 \rightarrow max \quad , \quad \frac{d\frac{\sin\beta}{\beta}}{d\sin\beta} = 0 \quad => \quad \tan\beta_i = \beta_i$$

$$\tilde{E}_i(x_i, t) = \frac{A_0}{N x_i} e^{i(\omega t - k x_i)}$$

$$\tilde{E}(\theta) = \sum_{i=1}^{N} \tilde{E}_i(x_i, t) = \frac{A_0}{N x_0} e^{i(\omega t - k x_i)} \underbrace{(1 + e^{-i\frac{A}{N}} + \ldots + e^{-i\frac{N-1}{N}A})}_{\frac{1-e^{-i\Delta}}{1-e^{-i\frac{\Delta}{N}}} = 1 - \cos\Delta = 2\sin^2\frac{\Delta}{2}}$$

- Field energy

electric field: $u_E = \frac{\epsilon E^2}{2}$

magnetic field: $u_B = \frac{B^2}{2\mu}$

Energy of EM-wave : U, momentum: p

$$=> \quad \frac{U}{p} = c$$

- Photoelectric effect

particle	wave
photon	EM wave
$U = N_\gamma h f$	$f, \lambda, h_{0,} B_0$
$p = \frac{h}{\lambda}$	$U = pc$

- Quantization condition

$$L=[l(l+1)]^{\frac{1}{2}}\hbar$$

- Schroedinger wave equation

$$i\hbar\frac{\partial}{\partial t}\psi(x,t)=-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi(x,t)+V(x)\psi(x,t)$$

(1) $|\psi(x,t)|^2$ is the *probability* of finding particle between $x \sim x+dx$

(2) Normalization condition: $\int_{-\infty}^{+\infty}|\psi(x,t)|^2 dx=1$