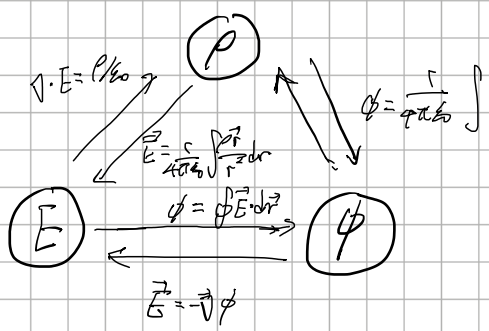

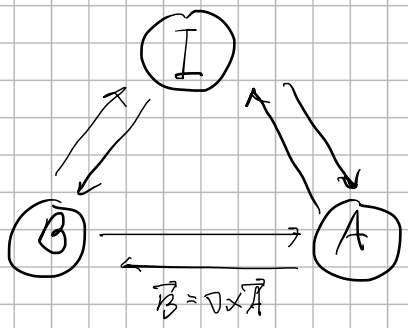

I. Electrostatics

$$\nabla \cdot \vec{E} = 4\pi\rho$$
$$\nabla \cdot \vec{B} = 0$$
$$\nabla \times \vec{E} = \frac{1}{c}\frac{\partial \vec{B}}{\partial t}$$
$$\nabla \times \vec{B} = \frac{4\pi}{c}\vec{J} + \frac{1}{c}\frac{\partial \vec{E}}{\partial t}$$

Coulomb's law 1770 ~ 1784 Cavendish Coulomb

no magnetic dipole

Faraday's induction law 1831 Faraday

Ampere's law 1820 ~ 1830 Oersted, Biot-Savart Ampere

1864 Maxwell

(cf. 1675 Römer, 1st measurement of the speed of light)

1888 Hert. demonstration of EM wave

1900 Max Plank. quantization of EM wave

1920 Einstein photoelectric effect,

Spatial quantization of EM wave ⇒ photon

de Broglie, Bohr, Schrödinger

→ Quantum mechanics

Schrödinger's equation:

particle is described by a field (wavefunction)

Maxwell's equation

photon is described by field, EM

1930-1960 QED (Quantum Electro dynamics)

Feynmann, Schrödinger Tomonaga

field quantizes theory of interacting electron & photons

In, statics, $\frac{\partial}{\partial t} = 0$

$\nabla \cdot \vec{E} = 4\pi\rho$ $\quad \nabla \cdot \vec{B} = 0$ $\quad \rho \rightarrow \vec{E}$

$\nabla \times \vec{E} = 0$ $\quad \nabla \times \vec{B} = \frac{4\pi}{c}\vec{J}$ $\quad J \rightarrow \vec{B}$

cf. Units

Electrostatic system of unit (ESu)

mechanic unit: c.g.s

unit of charge: stat coulomb, esu

$F = k\frac{q_1 q_2}{r^2}$, $k = 1$

1 dyne $= \frac{(1\,esu)(1\,esu)}{(1\,cm)^2}$ $\quad [esu] = [\text{stat coulomb}] = M^{1/2} L^{3/2} / T$

- e-charge: 4.8×10^{-10} esu
- field 1 gauss: 1 dyne / 1 esu

potential: stat volt

1 stat volt = 300 Volt

1 stat coulomb = $\frac{1}{3\times 10^9}$ coulomb

1 gauss $= 3\times 10^4$ Gc $= 3\times 10^4$ Vlm.