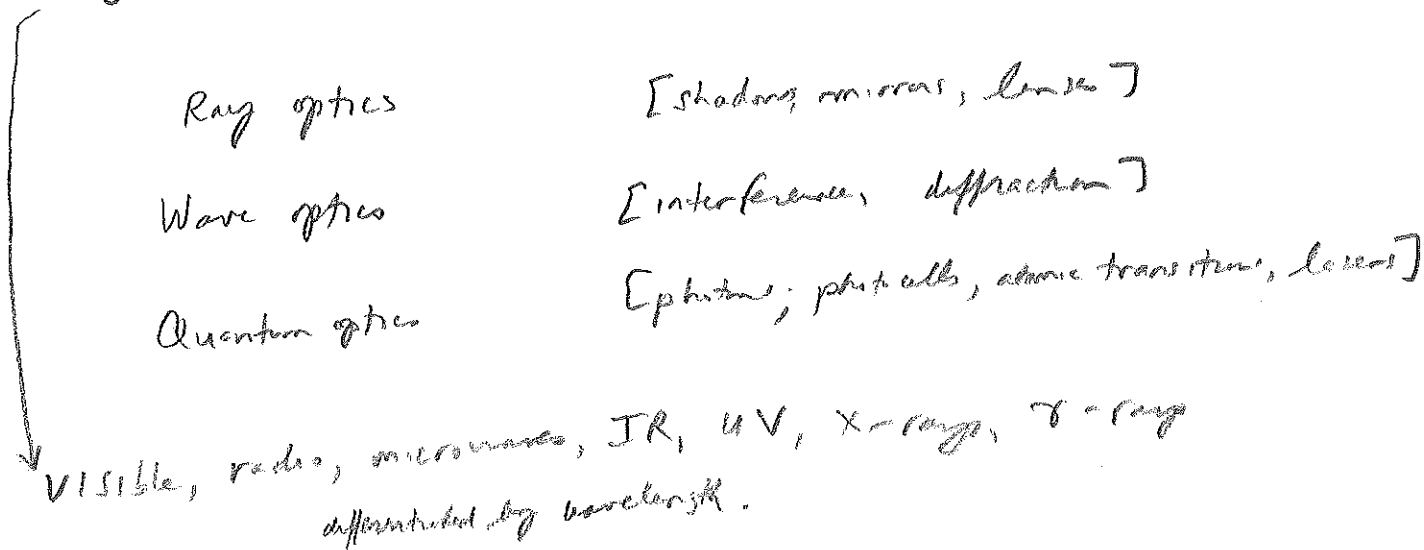


[Course is about]

Light



Interaction of light w/ matter

[see things, also in IR
X-rays;
structure of molecules, DNA]

Matter: wave-particle duality

Light = electromagnetic waves

→ electric & magnetic fields

which are produced by electric charges

[need to know abt
electric charges & fields]

Electric charge, q

• Scalar quantity (+ or -)

[lots of charge in the world,
but comes in two varieties, + & -
which mostly cancels out, so
objects are usually electrically neutral,
x 'on dry winter days']

• conserved (neither created nor destroyed)

[originally thought to be a
kind of fluid, flowing
from here to there,
infinitely divisible.]

• quantized in units of $e = 1.609 \times 10^{-19} \text{ C}$ (coulombs)

$$q_{\text{proton}} = +e$$

$$q_{\text{electron}} = -e$$

$$q_{\text{neutron}} = 0$$

[atoms neutral because
equal #s of protons & electrons]

Quarks: $q_{\text{up}} = +\frac{2}{3}e$
 $q_{\text{down}} = -\frac{1}{3}e$

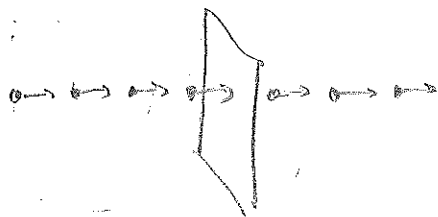
[but not isolatable]



Current, i = flow of charge

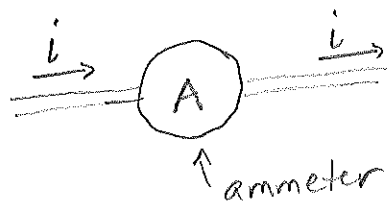
A3

$i =$ charge per unit time flowing through a surface (unit: A)



$$i = \frac{\Delta q}{\Delta t}$$

units: 1 ampere (A) = 1 $\frac{\text{Coulomb}}{\text{sec}}$

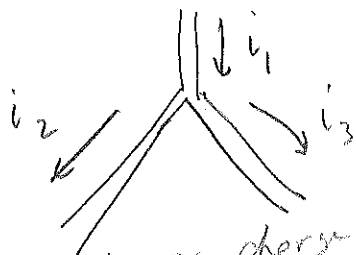


arrow indicates direction that a positive charge would flow (electrons actually flow in the opposite direction)

[We always describe current as flowing thru a circuit, so to measure it we need to put something into the circuit

+ measure how many coulombs pass thru it per second]

[Cons. of chg means same amt flows into or element as flows out, in steady state (else charge build-up)]



Conservation of charge implies $i_1 = i_2 + i_3$ (node rule)
(Kirchhoff's current law)
KCL