Particle Physics

matter is made up of 17 fundamental particles

these particles are categorized based on their properties

in the standard model there are hadrons and leptons

- Hadrons are made of quarks
  - Mesons have 2 quarks
  - Baryons have 3 quarks
- Leptons interact with the weak nuclear force ,
- gauge bosons - force carriers

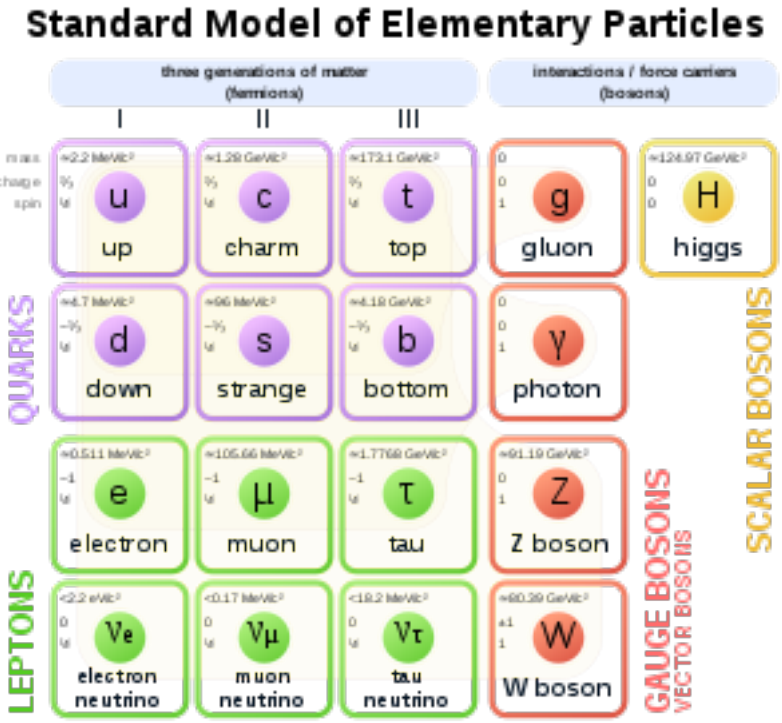

Figure 1: standard model

particles separated by three key properties

- spin - denotes intrinsic angular momentum of the particle
- charge - electrical charge
- strangeness - describes the decay of particles in strong nuclear and electromagnetic forces

all particles have antiparticles

antiparticles have all the same properties as their normal matter pair but have the opposite charge and strangeness

read 13.4 and 13.5

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How does the SNO lab detect neutrinos

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Light Quiz

- Diffraction
  - interference
- polarization
  - what it is
  - how it occurs (4 ways)
    - reflection
    - scattering
    - double diffraction
    - filtering (polarizing filters)
  - diagram what is happening
  - how can this show the quantum nature of light
    - light is both a wave and a particle
    - comes in distinct packets of energy
  - Single slit: calculate: explain
  - thin film: why does it result in diffraction?
    - calculate λ or thickness
  - General properties of light
    - Wien's law $\rightarrow$ find peak λ or temp of peak λ
  - Discussion Questions from lab
  - photoelectric effect
    - work function
      - determining E_k

10 multiple choice 2 explain questions 3 full answer questions

the light lab showed quantum nature of light as different colours of light require different voltages

Thin Film

when light contacts a thin clear film, some of the light will be refracted and some will be refracted. Some of that refracted light will hit the second boundary and will reflect back out.

$air \to n = 1$

$bubble \to n > 1$

when light reflects off a slow medium from a fast medium, it will invert. $\therefore$ the light that is bouncing off the top layer will be $\frac{\lambda}{2}$ out of phase from the light passing through the bottom medium.

Thus in order to cause constructive interference, the light passing through must pass total a $\frac{\lambda}{2}$, so the width of the medium must be $\frac{\lambda}{4}$. Some with destructive. In order for the light to totally delete itself, the light must maintain it's $\frac{\lambda}{2}$ wavelength phase shift, so the width of the medium must be λ

this all changes if the medium on the inside of the bubble is slower than the medium the bubble is made of, as in this means there would be a double reflection.

Example Find the min thickness of a bubble ($n = 1.4$) that can produce a maximum brightness for 540 nm light in air.

for bubble min thickness for constructive is found at $\frac{\lambda}{4}$

find λ in the bubble

$$\frac{n_1}{n_2} = \frac{\lambda_2}{\lambda_1}$$
$$\lambda_2 = \frac{\lambda_1 n_1}{n_2}$$
$$= 3.857.71nm$$

find thickness

$$t = \frac{\lambda_2}{4}$$
$$...$$

whats the angle to the 3rd maxima for a single slit diffraction pattern where the screen is 2.7 m from a 0.14 mm slit that has 350 nm light waves passing through it.

$L = 2.7$

$W = 0.15 \times 10^{-}3m$

$\lambda = 350 \times 10^{-}9m$

$m = 3$

$$wsin\theta = (m + 0.5)\lambda$$

$$theta = \sin^{-1}(\frac{(m+0.5)\lambda}{w})$$
$$0.47^o = \theta$$