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1. Standard Model +2

spin 1 ○ 1/2

spin 1/2: e μ τ ν_e ν_e ν_e (×2 particle/antiparticle)

u c t d s b (×3 colors)

W, Z, h, g +1

2. The force carriers for them are different +1

↳ in what ways?

3. $WZ \to e\nu\nu\nu$

$\frac{e\nu\nu\nu + u\nu\nu\nu}{6\times2 + 6\times3} = \frac{2}{30} = \frac{1}{15}$ +2

?

4. $WW \to l\nu l'\nu'$ +2

$e\nu_e e^+\nu_e^+$ | four combinations / 1 → $\frac{4}{30}$ $\frac{4}{15}$

$e\nu_e\mu\nu_\mu$ |

$ZZ \to$ eight combinations → $\frac{8}{30} = \frac{4}{15}$

~~eeee~~ eeuu, ... uuuu

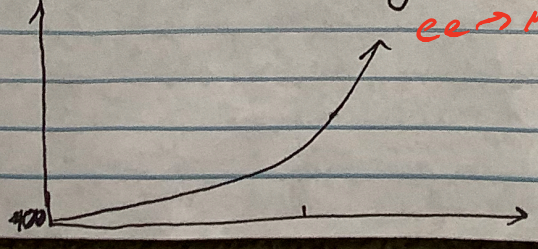
WW is the best discovery channel, then ZZ than $\gamma\gamma$

5 a) protons ~~will decay~~ into quarks at high energy +0

b) ~~electrons~~

6 $R(E_{CM}) \equiv \frac{\sigma(ee \to jets)}{\sigma(\mu\mu \to jets)}$ increases +0

$\sigma(ee \to \mu\mu)$



+3

7 → ~~data~~ electrons and muons both are curved by the magnetic field but muons are not stopped by the calorimeter

→ electrons and photons are both stopped by the calorimeter, but photons don't have ~~mass~~ charge so aren't curved by the magnetic field

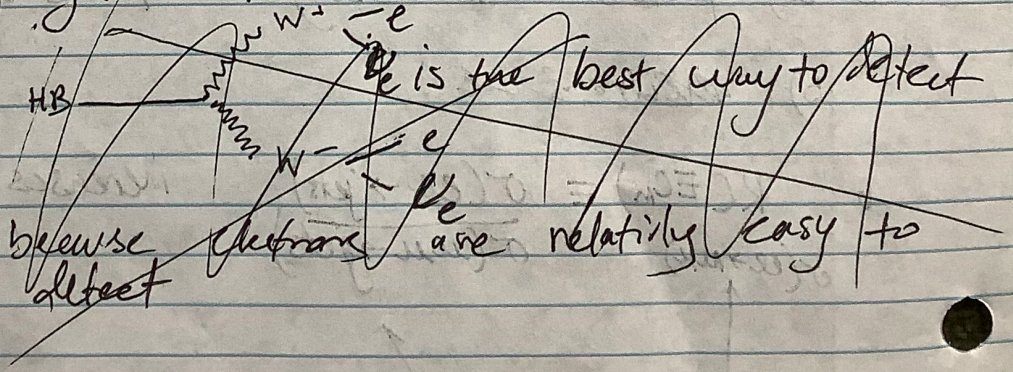
8 Hadronic showers are harder to measure because ~~electro~~ magnetic showers will show up as ~~curved or the electro~~ energy from the magnetic field but hadronic showers will only show on the calorimeter.

+2

10 ~~muons are detected because~~ neutrinos are detected because based on conservation of momentum there should have been stuff coming out, but wasn't detected so must be a neutrino. +2

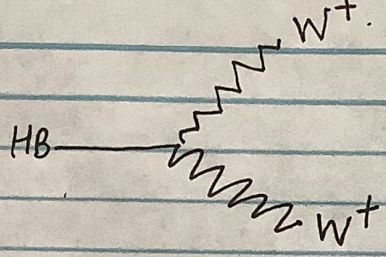
9 ~~the~~ electrons are stopped in by the first stage of the detector muons only in the last stage

+3 I would expect EC to give a more accurate measurement because you can use the curvature of the 2 electrons and also measure their energy going into the calorimeter



11 e is the best way to detect because electrons are relatively easy to detect

11

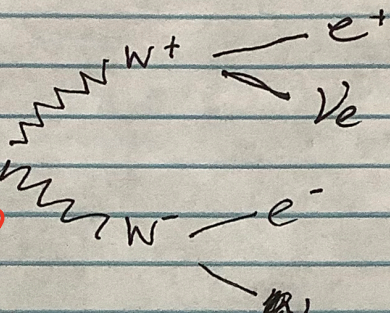


+1

Production?

5) ?

12



+0

Not leptons

the HB → WW decay mode is the best because of the high branching ratio and because electrons are relatily easier to dectect in particle colliders

13. a) The group symetry descrises which patices are allowed. +2

b)

c) the electron and ~~neutrono~~ are produced in pairs as well as ~~the~~ μ/ν_μ and τ/ν_τ

14

+0

b) ~~particles across the three generations of particles have different ratios of masses~~

c)