Lecture 20 Summary

Spin 1 system:

gauge transformation:

$$A_\mu \to UAU^{-1} - (\partial_\mu U)U^{-1} \qquad \text{for} \quad U = e^{i\alpha(x)}.$$

given a scalar (ϕ) interacting with A, it must have $\phi \to U\phi$ under gauge transformation.

In a theory with. n # massless spin 1 ~~sp~~ fields interacting among themselves $\Rightarrow$ must furnish a 'n' dimensional real ~~representation~~ representation of the Lie group.

Ex, for $SU(N)$ Lie group ~~(...)~~ $n = N^2 - 1 \to$ adjoint representation.

$$U = e^{i\alpha_a t_a}$$

$\Phi \to$ say in the fundamental rep. of $SU(N)$

$\to U\Phi \to$

$$A^a \to UAU^{-1} - (\partial_\mu U)U^{-1}$$

$\hookrightarrow$ extra piece for masslessness of A.

$$F^a_{\mu\nu} \to UF^aU^{-1} \quad \Rightarrow \text{no homogeneous piece.}$$

where $F^a_{\mu\nu} = \partial_\mu A^a_\nu - \partial_\nu A^a_\mu + f^a_{bc} A^b_\mu A^c_\nu$

$$A \equiv A^a t^a$$

$\Rightarrow \mathcal{L} \supset -\frac{1}{4}(F_{\mu\nu})^2 \to$ gauge invariant.

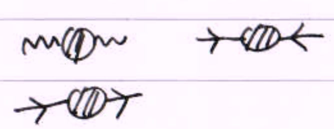
We constructed the Lagrangian of fermions ~~and~~ charged under ~~the scalar~~ a $U(1)$ gauge transformation $\to$

$\to$ introduced Feynman rules in 2-component notation.

Calculated

Green's function:

(a) 2 pt.



(b) 3 point.