Zusammenfassung 17.12.

11.5. Eichboson-Massen

Higgsfeld $\Phi = \begin{pmatrix} \phi^+ \\ \phi^0 \end{pmatrix}$ $\boxed{\tau = \frac{1}{2}, Y = 1}$

Lagrangian:

$$\mathcal{L}_{Higgs} = (\partial^\mu \Phi)^+ (\partial_\mu \Phi) + \mu^2 \Phi^+ \Phi - \lambda^2 (\Phi^+ \Phi)^2$$

und $\mathcal{L}_{gauge} = -\frac{1}{4} F^i_{\mu\nu} F^{\mu\nu\, i} - \frac{1}{4} f_{\mu\nu} f^{\mu\nu}$

mit $f_{\mu\nu} = \partial_\mu B_\nu - \partial_\nu B_\mu$

und $\vec{F}_{\mu\nu} = \partial_\mu \vec{W}_\nu - \partial_\nu \vec{W}_\mu - \underbrace{g \vec{W}_\mu \times \vec{W}_\nu}$

aus nicht-Kommutativität SU(

Wechselwirkung von Higgs- und Eichfeldern:

$$\partial^\mu \to D^\mu = \partial^\mu + i\frac{g}{2}\vec{\tau}\vec{W}^\mu + i\frac{g'}{2} B^\mu$$

- Vakuum-Erwartungswert:

$$\boxed{\Phi_0 = \frac{1}{\sqrt{2}}\begin{pmatrix} 0 \\ v \end{pmatrix}} \qquad v = \mu/\lambda$$

$$\Phi(x) = \frac{1}{\sqrt{2}}\begin{pmatrix} 0 \\ v+\eta(x) \end{pmatrix}$$

$$\Rightarrow \mathcal{L} = \underbrace{\left[\frac{1}{2}(\partial^\mu \eta)(\partial_\mu \eta) - \mu^2 \eta^2\right]}_{①} - \frac{1}{4} F^i_{\mu\nu} F^{\mu\nu i} - \frac{1}{4} f_{\mu\nu} f^{\mu\nu}$$

$$+ \underbrace{\frac{1}{2}\frac{g^2 v^2}{4}\left(|W^+_\mu|^2 + |W^-_\mu|^2\right)}_{②} + \underbrace{\frac{1}{2}\frac{v^2 g^2}{4\cos^2\Theta_W}|Z_\mu|^2}_{③}$$

① Massives Higgs-Boson $m_H = \sqrt{2}\mu$

② Massive W-Bosonen $m_W = \frac{gv}{2}$

③ Massives Z-Boson $m_Z = \frac{gv}{2\cos\Theta_W} = \frac{m_W}{\cos\Theta_W}$

④ Kein Masseterm f. Photo