Toy Standard Model using FeynCalc

Raj Patil (Analysis Note)

August 9, 2022

Project done under the guidance of
Dr. Arnab Rudra

 raj.patil.physics@gmail.com

1 Single Scalar (Phi34)

1.1 Lagrangian

$$\mathcal{L} = (Z_P)\frac{1}{2}(\partial\phi)^2 - (Z_P Z m_P^2)\frac{1}{2}m_P^2\ \phi^2 - (Z_P^2 Z g_3)\frac{1}{3!}g_3\ \phi^3 - (Z_P^2 Z g_4)\frac{1}{4!}g_4\ \phi^4 - \delta_{\texttt{vev}} m_P^2\ \phi - \frac{1}{2}\delta_{\texttt{vev}} g_3\ \phi^2 - \frac{1}{3!}\delta_{\texttt{vev}} g_4 \phi^3 \tag{1}$$

1.2 Answers

$$\delta_{\texttt{vev}} = \frac{1}{\epsilon}\frac{g_3}{16\pi^2} \tag{2}$$

$$\delta P = 0 \qquad \delta m_P = \frac{1}{\epsilon}\frac{g_4}{32\pi^2} \tag{3}$$

$$\delta g_3 = \frac{1}{\epsilon}\frac{g_4}{8\pi^2} \qquad \delta g_4 = \frac{1}{\epsilon}\frac{3g_4}{16\pi^2} \tag{4}$$