Subatomic Physics II

Problem Set 7

Due on November 25, 2021, 23:59

Problem 7.1: Feynman rules

Based on the tree-level Feynman rules of the Standard Model of particle physics, indicate whether the following tree-level vertices exist or not*. In case the vertex does not exist, give at least one reason.

- $Ze\mu$
- Wtb
- $H\gamma\gamma$
- $\gamma\tau\tau$
- HWW
- $Z\nu_e\nu_e$
- $gggg$

For each existing vertex, give two minimal but complete Feynman diagrams describing observable processes, each containing the allowed vertex; if possible both a collision process and a single-particle decay. For each diagram, specify the relevant kinematic condition on the centre-of-mass energy, given the measured masses of observed particles as listed by the PDG, and/or limits on the masses of so far unobserved particles. Also, specify which of the particles in each diagram need to be real (on-shell) or virtual (off-shell).
(10pt)

*The order of particles in this notation is arbitrary, and a particle symbol also stands for its antiparticle or the corresponding virtual particle.