

QFT

Chapter 48: Spin-Averaged Cross-Sections

Overview

- All the pieces are in place.
 - In chapter 45, we wrote down the amplitudes using the Feynman rules
 - In chapter 46, we discussed how to sum over the final states and average over the initial states. This leads to taking traces of gamma matrices
 - In chapter 47, we discussed how to take the trace of gamma matrices
- All that's left is to simplify the squared amplitudes
 - We could then plug this into the decay rate/cross-section formulas in chapter 11
 - In some sense, it's strange that this gets its own section; there's no new information here.

Form of the Answer

- For decay rates, our answer should have constants only
 - The decay rate should be the same in every reference frame; we can always choose the rest frame of the decaying particle
- For cross-sections, our answer should have constants and Mandelstam variables
 - There is no unique rest frame, but the Mandelstam variables are frame-invariant

Tedium

- Solving these equations is very tedious, and easy to make a mistake. Some students wonder why it is necessary to do this kind of calculation more than once – they're not very enlightening.
- But, it's important to remember that this is not a toy model or an approximation. This is the real deal, the best model that physics has to offer for evaluating these cross-sections or decay rates.
 - In some sense, all your physics training ever has been leading up to doing these calculations. I hope you enjoy it.