

The massless limit for massive amplitudes and the contraction of the little group

Content

In this work, we are interested in studying the spin-spinor formalism to deal with amplitudes for massive particles. After presenting the basic formulae and conventions, we evaluate the amplitudes for two specific examples, namely the decay $W \rightarrow l\nu_l$ and the reaction $e^+e^- \rightarrow \mu^+\mu^-$. For each case, we display the amplitudes for all possible spin configurations for the initial and final states. We find it convenient to represent the flow of spin/helicities from the initial to the final particles in terms of graphs that resemble trees with branches. This simplifies the calculation of the total squared amplitude as the sum of the squares of the amplitudes for each branch; one can also verify the symmetries of the process by comparing different branches related by symmetries. Finally, we want to study the massless limit of the massive theory, and for this, we turn to the concept of Little Group Contraction (LGC), which was used by Inonu and Wigner to obtain the algebra of the Little Group (LG) for the massless case by taking the correct limit of the massive one.

Summary

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