Cross section will be our main subject of interest.

\[ F = \frac{L \cdot \mu}{b^2} \]

Event Rate, Luminescence, Cross Section.

\[ (\frac{1}{E_0}) \rightarrow \Phi \neq 1.0 \cdot 10^{-7} \]

Cross sections are smaller if 

For example, \( \frac{4\pi}{\sigma} \) \( \Phi \approx 5 \times 10^{-7} \) \( \Phi \approx 5 \times 10^{-7} \) or \( \Phi \approx 5 \times 10^{-7} \)

Cross Sections: Rough Estimate
\[
\frac{1}{\sqrt{2m}} \frac{\partial}{\partial z} \left( \frac{z}{\sqrt{m}} \right)
\]

\[
= \frac{1}{\sqrt{2m^2}} \frac{z}{\sqrt{m}} \frac{1}{\sqrt{2m}} \frac{\partial}{\partial z} \left( \frac{z}{\sqrt{m}} \right)
\]

Integrate over \(d\phi^2\)

\[
\int_0^{2\pi} \int_0^{2\pi} \frac{1}{\sqrt{2m^2}} \frac{z}{\sqrt{m}} \frac{1}{\sqrt{2m}} \frac{\partial}{\partial z} \left( \frac{z}{\sqrt{m}} \right) \sin \phi \, d\phi \, d\phi
\]

Most common case: \( Z = 2 \), \( L = 2 \), \( S = 0 \)

Along the \( Z \) axis.

\( \xi \) is Lorentz invariant. \( \phi \) is invariant under boosts.
If \( m = m_0, \quad t = \frac{1}{2}, \quad u = \frac{1}{2} (v + u_0) \),
\[ s + t + u = m + m_0. \]

Modelling variables:
\[ s = (u + v)^2 = 2. \]
\[ t = (v - u)^2. \]

By Energy conservation:
\[ \mu (t + u_0^2) = m_0 (u + v)^2, \]
but this is \( \geq 0 \) so \( m \geq m_0 \).

If \( m = m_0, \quad E = E_0, \quad \frac{dE}{dt} = \frac{1}{2} m \frac{d^2 \phi}{dt^2} \),
\[ \frac{dE}{dt} = \frac{1}{2} \left( \frac{m}{m_0} \right)^2 \frac{d^2 \phi}{dt^2} \]
\( \text{velocity of } \phi \text{ is } \frac{\phi}{L}. \]

\[ \text{Example: } \phi = \gamma \left( e^{-\gamma t} \right), \quad s = \frac{e^{-\gamma t}}{1 + \gamma s}. \]

\[ \text{energy} \quad A = e^{\gamma t} + A_1 e^{\frac{t}{2}}, \quad A_1 = \frac{1}{2} (1 + \gamma s). \]

\[ \text{energy} \quad B = \frac{1}{2} m_0 \left( \frac{e^{-\gamma t}}{1 + \gamma s} \right)^2. \]

\[ \text{energy} \quad C = \frac{e^{-\gamma t}}{1 + \gamma s}. \]
In the final state, \( S = 0 \), must have \( E = \pm 1 \). But if

\[ E = -1 \]

This difference is a complete set of solutions of original


\[ \frac{1}{2} M \omega^2 \theta = e \sin \theta \]

Problem: Write \( f(s) = \int \left( C \mu e^{[e]} + M \right) \cdot \frac{1}{2} \omega^2 \theta \) when it is a scalar.

As an exercise, we can replace the prior with a scalar


\[ \text{scalar part of } \mu \text{ is } e^{[e]} \text{ and } 

\text{vector part of } M = e \]

Not to forget:

\[ \text{let's include } 2 \text{. The completely interesting point...} \]
Fig. 2. Measured cross sections of muon-pair production compared with the fit results. The ALEPH measurements below 60 GeV correspond to the exclusive hard ISR selection that are not used in the fit. For comparison the measurements at lower energies from PEP, PETRA and TRISTAN are included.

Fig. 3. Measured forward-backward asymmetries of muon-pair production compared with the fit results. The ALEPH measurements below 60 GeV correspond to the exclusive hard ISR selection that are not used in the fit. For comparison the measurements at lower energies from PEP, PETRA and TRISTAN are included.

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