Homework Set #4.

Due Date - Oral Presentation: Wednesday October 28, 2015
Due Date - Written Solutions: Wednesday November 4, 2015

1. n**-body final states**

Indicate with $d\Phi^{(n)}$ the n-body Lorentz-invariant phase space $d\Pi_{\rm LIPS}$.

(i) Using an appropriate version of the identity, show that you can write

$$d\Phi^{(3)} = \int \frac{d\mu^2}{2\pi}(2\pi)^4\delta^4(P_i-p_1-q)\frac{d^3\vec{p}_1}{2p_1^0(2\pi)^3}\frac{d^3\vec{q}}{2q^0(2\pi)^3}(2\pi)^4\delta^4(q-p_2-p_3)\frac{d^3\vec{p}_2}{2p_2^0(2\pi)^3}\frac{d^3\vec{p}_3}{2p_3^0(2\pi)^3} =$$

$$= \int \frac{d\mu^2}{2\pi}d\Phi^{(2)}(P_i;m_1,\mu;\vec{p}_1,\vec{q})d\Phi^{(2)}(\mu;m_2,m_3;\vec{p}_2,\vec{p}_3),$$

where of course P_i is the total initial 4-momentum.

(ii) Show that similarly you can write

$$d\Phi^{(4)} = \int \frac{d\mu^2}{2\pi}\int \frac{d\mu'^2}{2\pi}d\Phi^{(2)}(P_i;\mu,\mu';\vec{q},\vec{q}')d\Phi^{(2)}(\mu;m_1,m_2;\vec{p}_1,\vec{p}_2)d\Phi^{(2)}(\mu';m_3,m_4;\vec{p}_3,\vec{p}_4).$$

(iii) Generalize and show that

$$d\Phi^{(n)} = \int \frac{d\mu^2}{2\pi}d\Phi^{(2)}(P_i;\mu,m_1;\vec{q},\vec{p}_1)d\Phi^{(n-1)}(\mu;m_2,\ldots,m_n;\vec{p}_2,\ldots,\vec{p}_n).$$