

Title: Quantum Field Theory - Lecture 10B

Date: Oct 22, 2012 10:30 AM

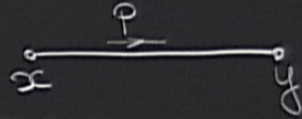
URL: <http://pirsa.org/12100071>

Abstract:

Feynman rules in momentum space

$$D_C \int \frac{d^4 p}{(2\pi)^4} \frac{i}{p^2 - m^2} e^{-ipx} \cdot e^{+ipy}$$

Feynman rules in momentum space

$$(x-y) = \int \frac{d^4 p}{(2\pi)^4} \frac{i}{p^2 - m^2} e^{-ipx} e^{ipy} = \text{diagram}$$
A Feynman diagram representing a propagator. It consists of a horizontal line with an arrow pointing from left to right. The left end is labeled 'x' and the right end is labeled 'y'. Above the line, the letter 'p' is written, indicating the momentum of the particle.

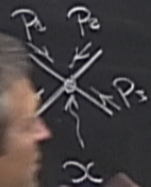
Feynman rules in momentum space

$$D(x-y) = \int \frac{d^4 p}{(2\pi)^4} \frac{i}{p^2 - m^2} e^{-ipx} \cdot e^{ipy} = \begin{array}{c} \begin{array}{ccc} e^{-ipx} & p & e^{ipy} \\ \circ & \xrightarrow{\quad} & \circ \\ x & & y \end{array} \\ \frac{i}{p^2 - m^2} \end{array}$$



Feynman rules in momentum space

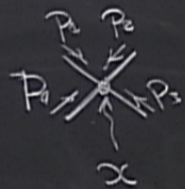
$$D(x-y) = \int \frac{d^4 p}{(2\pi)^4} \frac{i}{p^2 - m^2} e^{-ipx} e^{ipy} = \begin{array}{c} e^{-ipx} \quad p \quad e^{ipy} \\ x \quad \text{---} \quad y \\ \quad \quad \quad \frac{i}{p^2 - m^2} \end{array}$$



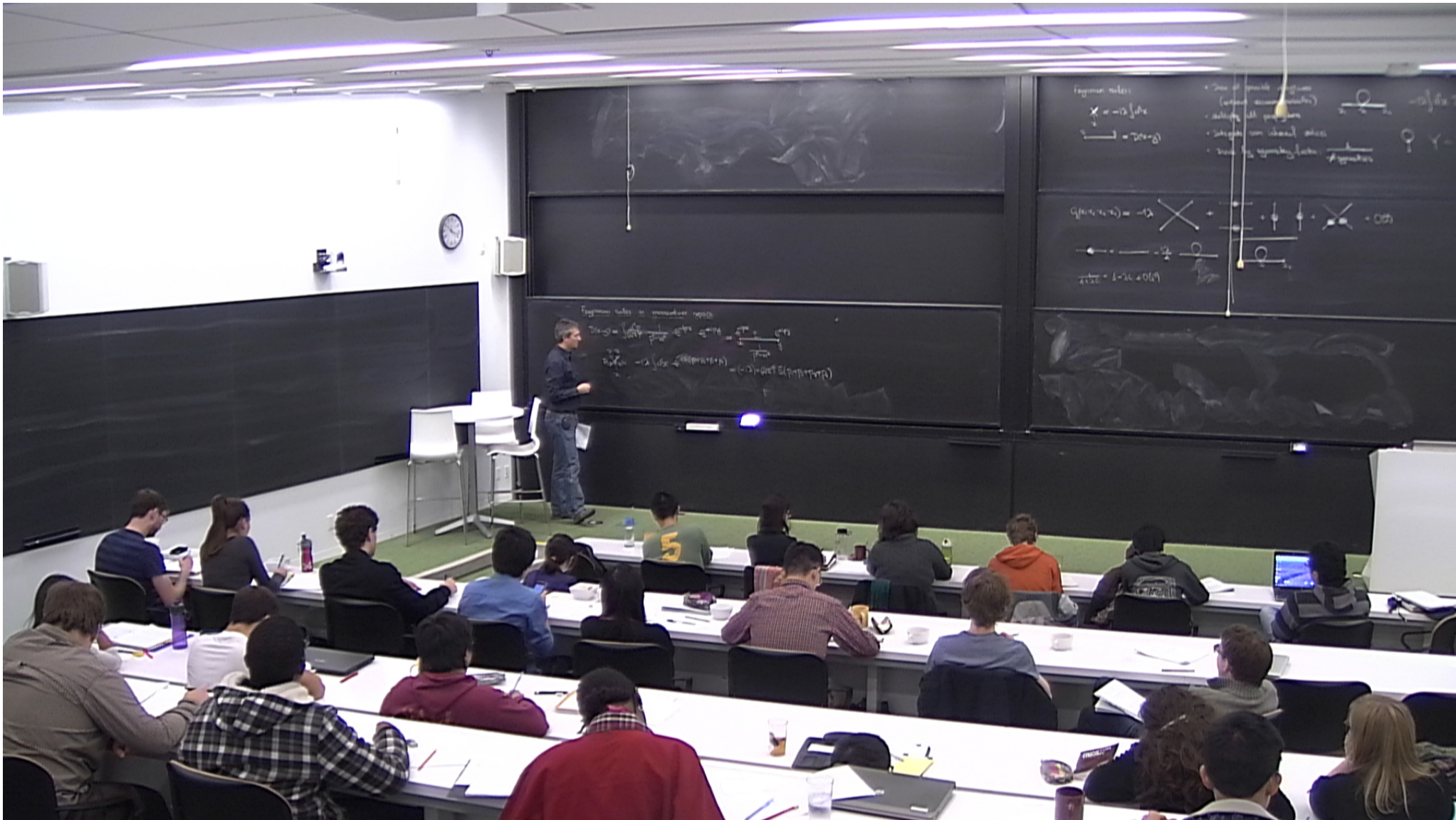
$$-i\lambda \int d^4 x e^{ix(p_1 + p_2 + p_3 + p_4)}$$

Feynman rules in momentum space

$$D(x-y) = \int \frac{d^4 p}{(2\pi)^4} \frac{i}{p^2 - m^2} e^{-ipx} e^{ipy} = \begin{array}{c} e^{-ipx} \quad p \quad e^{ipy} \\ x \quad \text{---} \quad y \\ \quad \quad \quad \frac{i}{p^2 - m^2} \end{array}$$



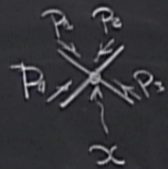
$$-i\lambda \int d^4 x e^{ix(p_1 + p_2 + p_3 + p_4)} = (-i\lambda) \times (2\pi)^4 \delta(p_1 + p_2 + p_3 + p_4)$$



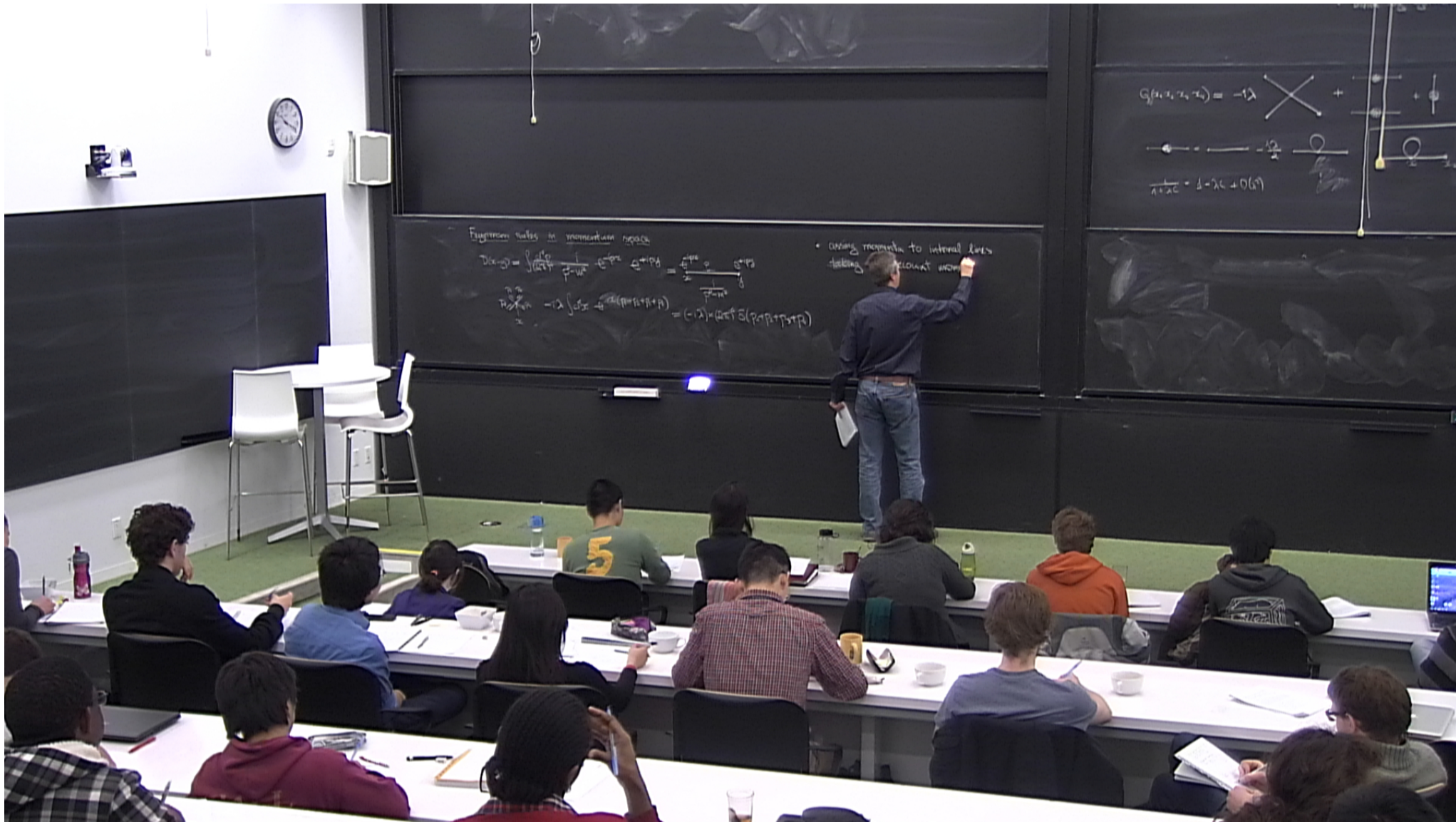
Feynman rules in momentum space

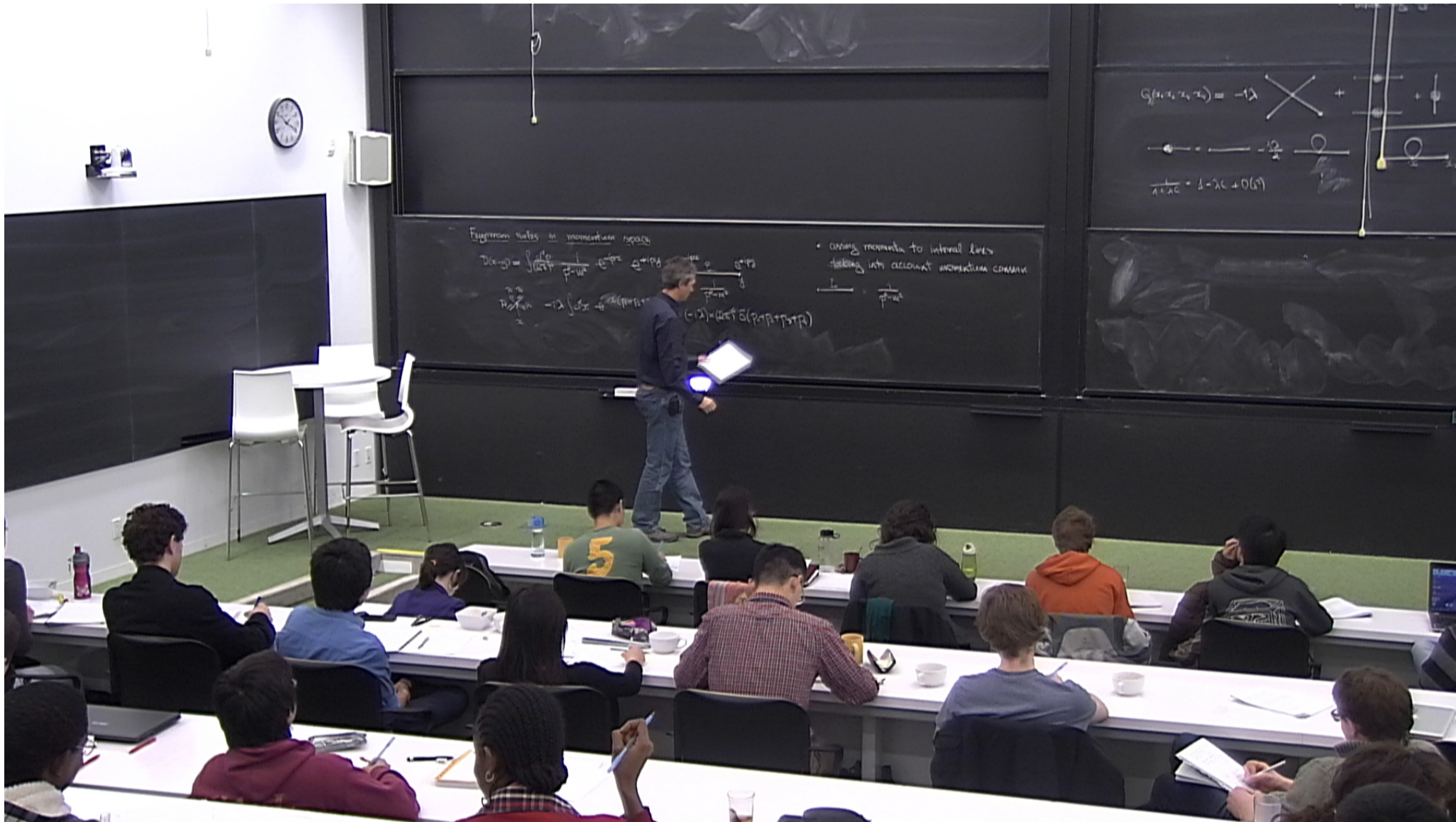
• assigning momenta

$$D(x-y) = \int \frac{d^4 p}{(2\pi)^4} \frac{i}{p^2 - m^2} e^{-ipx} e^{ipy} = \begin{array}{c} x \xrightarrow{p} y \\ \frac{i}{p^2 - m^2} \end{array}$$



$$-i\lambda \int d^4 x e^{i\lambda(p_1 + p_2 + p_3 + p_4)} = (-i\lambda) \times (2\pi)^4 \delta(p_1 + p_2 + p_3 + p_4)$$

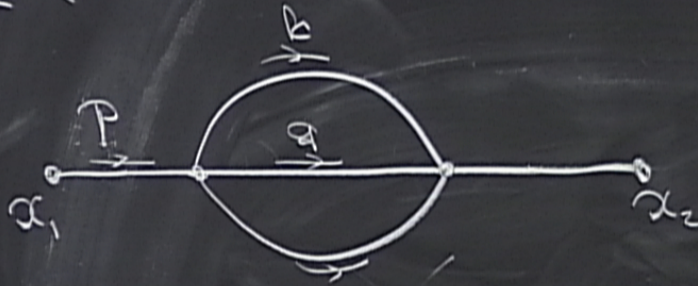




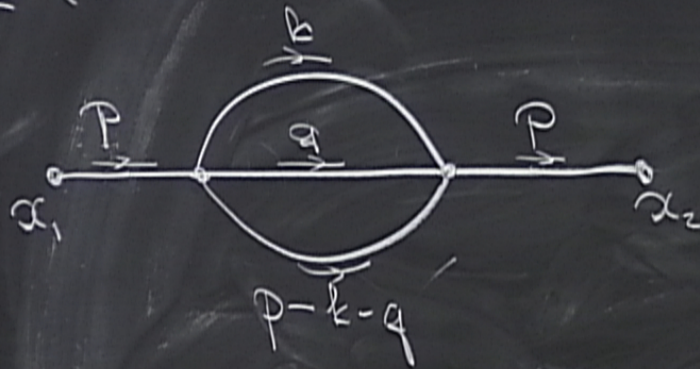
Ex (second-order correction to 2pt function)



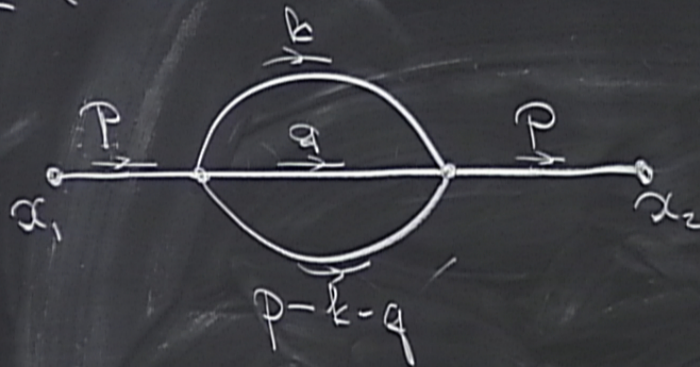
Ex (second-order correction to 2pt function)



Ex (second-order correction to 2pt function)

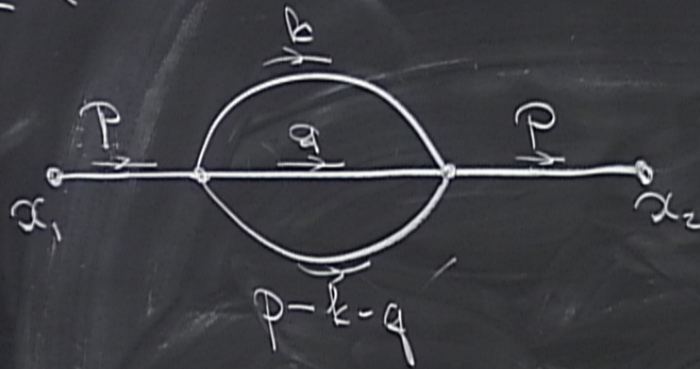


Ex (second-order correction to 2pt function)



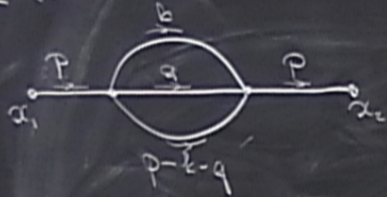
$$\frac{(-i\lambda)^2}{6}$$

Ex (second-order correction to 2pt function)



$$\frac{(-i\lambda)^2}{6} \int \frac{d^4 p}{(2\pi)^4} e^{-ip(x_1 - x_2)}$$

Ex (second-order correction to 2pt function)



$$\frac{(-i\lambda)^2}{6} \int \frac{d^4 p}{(2\pi)^4} e^{-ip(x_1 - x_2)} \left(\frac{i}{p^2 - m^2} \right)^2 \int \frac{d^4 k}{(2\pi)^4} \frac{d^4 q}{(2\pi)^4} \frac{i}{k^2 - m^2} \frac{i}{(p-k-q)^2 - m^2}$$