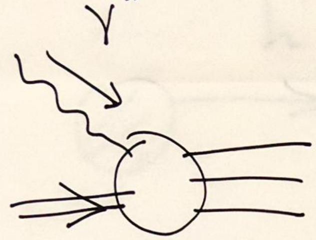
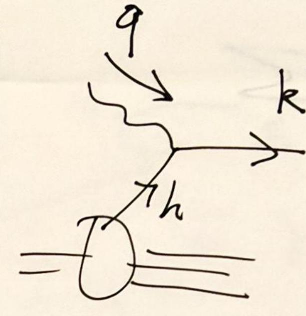
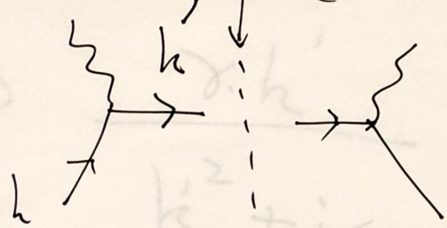
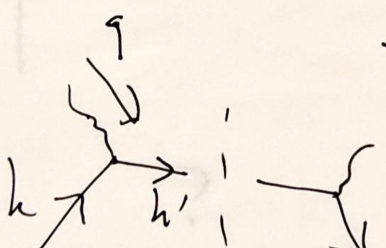
HUGS 2021

$\sigma \propto \Big|$  $\Big|^2 \longrightarrow \Big|$  $\Big|^2 \dfrac{d^3k'}{(2\pi)^3 2E'}$

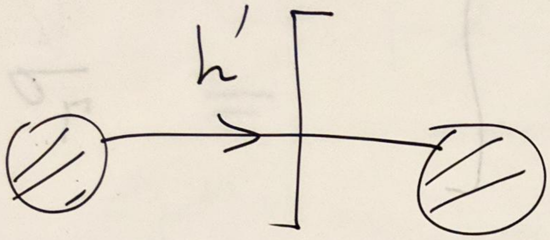
$$\frac{d^3k'}{(2\pi)^3 2E'} \longrightarrow \frac{d^4k'}{(2\pi)^4} 2\pi\, \delta_+(k'^2)$$



$$(2\pi)^4 \delta^4(q+k-k')$$



$$\sum_s \bar{u}_s(k')\, u_s(k')\, (2\pi)$$

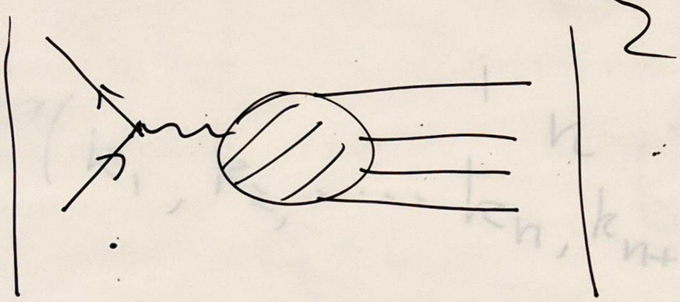


$\sum_s \bar{u}_s(k')\, u_s(k')$

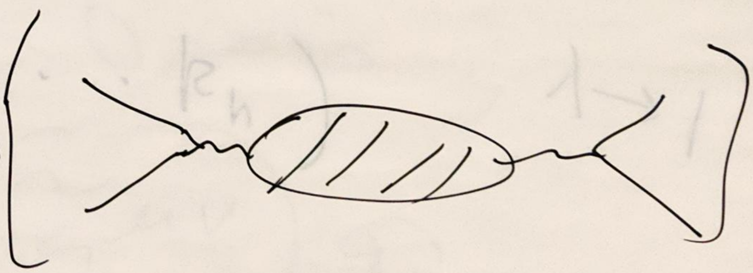
$= \gamma\cdot k'$

$(\gamma\cdot k')\; 2\pi\,\delta((k')^2)$

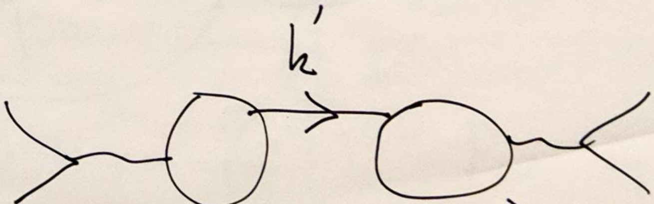
$\Longleftrightarrow \quad \dfrac{\gamma\cdot k'}{k'^2 \pm i\epsilon}$



$= 2\pi \cdot \mathrm{Im}$



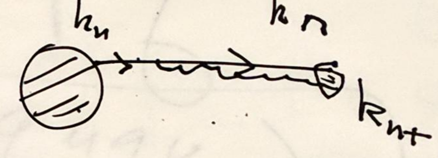
$\dfrac{\gamma\cdot k'}{k'^2 \pm i\epsilon}$



$\longrightarrow \mp\gamma\cdot k'\,(\pi\,\delta(k'^2))$

$$\sigma_\Gamma = \int d\Omega_2 \left(\frac{d\sigma}{d\Omega_2}\right) \Gamma(k_1, k_2)$$

$$+ \int d\Omega_3 \left(\frac{d\sigma}{d\Omega_3}\right) \Gamma(k_1, k_2, k_3)$$



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$$\Gamma(k_1, k_2, \ldots k_n, k_{n+1} = (1-\lambda) k_n)$$

$$= \Gamma(k_1, k_2, \ldots k_n) \qquad \lambda \to 1$$

$$W^{\mu\nu}(p,q)$$

$$g^{\mu\nu}, \quad p^\mu p^\nu, \quad q^\mu q^\nu$$

$$p^\mu q^\nu + p^\nu q^\mu$$

$$\boxed{\tilde{g}^{\mu\nu} \equiv \left(g^{\mu\nu} - \frac{q^\mu q^\nu}{q^2}\right)}$$

$$\tilde{g}^{\mu\nu} \cdot q_\mu = 0$$

$$\tilde{p}^\mu = \tilde{g}^{\mu\nu} p_\nu$$

$$= \left(p^\mu - \frac{q^\mu q^\nu p_\nu}{q^2}\right)$$

$$\tilde{g}^{\mu\nu} \,, \quad \tilde{p}^{\mu} \cdot \tilde{p}^{\nu}$$

$$\left(g^{\mu\nu} - \frac{q^{\mu} q}{q^2} \right) \qquad \left(p^{\mu} - \frac{p \cdot q \; q^{\mu}}{q} \right) * \left(p^{\nu} - \frac{p \cdot q \; q^{\nu}}{q^2} \right)$$

$$\cancel{q} \quad \tilde{g}^{\mu\nu} \cdot q_{\nu} = 0$$

$$\cancel{q}_{\rho} \, \epsilon^{\mu\nu\alpha\beta} \, q_{\alpha} \left[( ) p_{\beta} \,, \; s_{\beta} \right]$$