GREEN'S FUNCTION CONVENTIONS → APPEL

$$\partial^2 = \frac{1}{c^2}\frac{\partial^2}{\partial t^2} - \frac{\partial^2}{\partial \underline{x}^2}$$

$$\delta^4(x) = \delta(t)\,\delta^3(\underline{x}) \quad \leftarrow \quad \underline{\underline{\text{not}}} \quad \delta(ct)\,\delta^3(\underline{x})$$

$$d^4k = dE\, d^3\underline{k}\,(2\pi)^{-4} \quad \leftarrow \quad \underline{\underline{\text{not}}} \quad (dE/c)\, d^3\underline{k}$$

$$\int_{-\infty}^{\infty} \frac{1}{k^2-(E/c)^2}\, e^{-iEu}\, dE = \int_{-\infty}^{\infty} \frac{-1}{\mathcal{E}^2-k^2}\, e^{-i\mathcal{E}cu}\, c\, d\mathcal{E}$$

$$\mathcal{E} \equiv E/c$$

$$\xrightarrow[\text{PUSH}]{\text{POLE}} \int_{-\infty}^{\infty} \frac{-e^{-i\mathcal{E}cu}}{(\mathcal{E}-(k-i\epsilon))(\mathcal{E}+(k+i\epsilon))}\, c\, d\mathcal{E}$$

$$= \oint_{\bar{C}_-} \frac{-e^{-i\mathcal{E}cu}}{[\mathcal{E}-(k-i\epsilon)][\mathcal{E}-(-k-i\epsilon)]}\, c\, d\mathcal{E}$$

w/o ORIENTATION

$\mathcal{E}=k$ $\qquad\qquad$ $\mathcal{E}=-k$

$$= -2\pi i \sum \text{Res}$$

$$= -2\pi i \cdot \left[ \frac{-ce^{-ikcu}}{+2k} + \frac{-ce^{+ikcu}}{-2k} \right]$$

$$= \frac{-i\pi c}{k}\left(e^{ikcu} - e^{-ikcu}\right)$$

thanks to Wei-Xiang Feng for pointing this out