$$\mathcal{L}_{\text{light}} = \frac{1}{2}(\partial\phi)^2 - \frac{1}{2}m^2\phi^2 - \frac{1}{4!}\lambda\phi^4$$

Z_2 symmetry + Lor. invariance

$\mathcal{O} \sim \partial^{2n}\phi^{2k}$; dim $= n+k$

smallest dim : $n+k = 3$

$\mathcal{O} = \phi^6,\ \phi^3\Box\phi,\ (\Box\phi)^2$

eom: $\Box\phi + m^2\phi + \frac{1}{6}\lambda\phi^3 = 0$

$\rightarrow \phi^3\Box\phi = -\phi^3(m^2\phi + \frac{1}{6}\lambda\phi^3) + \text{eom}$

$\rightarrow -\frac{\lambda}{6}\phi^6 + \text{eom} + \text{ren (of } \lambda)$

$(\Box\phi)^2 \rightarrow \frac{\lambda^2}{36}\phi^6 + \text{eom} + \text{ren (of } \lambda \text{ \& } m^2)$

$\Rightarrow \mathcal{L}_{\text{eff}} = \mathcal{L}_{\text{light}} + \frac{c}{\Lambda^2}\phi^6 + \cdots$

If $\mathcal{O} = \phi^3\left(\Box\phi + m^2\phi + \frac{1}{6}\lambda\phi^3\right)$

 $= -\frac{6i}{\Lambda^2}\sum\left(k_i^2 - m^2\right)$

 $= +i\,\frac{5!\,c}{\Lambda^2}\,\lambda$

1 $\mathcal{O}$ insertion, 6 ext. legs, $O(\lambda)$

$$-i\lambda\,\frac{i}{p^2-m^2}\cdot 20\cdot\left(-\frac{6i}{\Lambda^2}\right)\left(p^2-m^2\right)$$

$$-i\lambda\,\frac{i}{p^2-m^2}\left(-\frac{6i}{\Lambda^2}\right)\sum\left(k_i^2-m^2\right)$$

no single part. pole

cancel.

$$+i\,\frac{120\,c}{\Lambda^2}\,\lambda$$

· The factor of 20: let $\chi = (\Box + m^2)\phi$

$\Rightarrow$ need to contract $\phi^3\chi$ & $\frac{1}{4!}\phi^4$

There are 4 ways of getting $\phi^3\,\chi\,\phi\,\phi^3$ and the contraction gives 1; then

$$\rightarrow \frac{4}{4!}\phi^3\cdot 1\cdot\phi^3 = \frac{1}{6}\phi^6 = \frac{120}{6!}\phi^6$$

which cancels the $c\lambda\phi^6$ term contribution