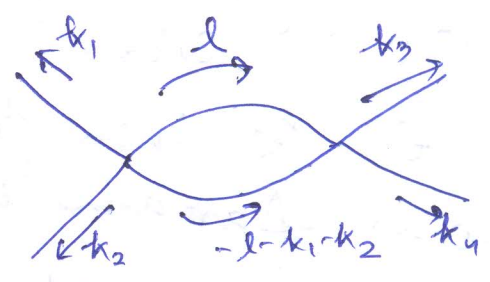


26/10/06

- ① Regularization
- ② Renormalization

(Instead of treating the original parameters as the input parameters, we take the renormalized parameters)

In  $\phi^4$  th., we have 2 parameters  $\rightarrow \lambda$  &  $m$ .  
 By adjusting finite no. of parameters we have to make infinite no. of quantities finite - remove a no. of div. - But we need to make a limited class of div. diag. conv.



$$\int \frac{d^4 l}{(2\pi)^4} \frac{1}{\{-l^2 - m^2 + i\epsilon\}} \frac{1}{\{-(k_1+k_2+l)^2 - m^2 + i\epsilon\}}$$

we get

$$\frac{(k_1+k_2+l)_\mu}{\{-(k_1+k_2+l)^2 - m^2 + i\epsilon\}^2}$$

$\frac{\partial}{\partial k_{1\mu}}$  act on this

this expression has the property that only the first term in the Taylor series expansion is finite; all other terms are divergent

6 powers of  $l$  in denominator & 5 powers of  $l$  in num - so it isn't div.

### Regularization

It's not that for every new  $k$  we have a new const. - you make it finite for one choice of ext. mom., it will be finite for any other choice - so div. are not unrelated - so adjustment of a finite quantities is needed, though apparently naively we would have thought there were infinite no. of const. to be satisfied

Make infinite integrals finite with the help of a cut-off  $\epsilon$ .  
 As  $\epsilon \rightarrow 0$ , initially divergent integrals become divergent.  
Consistency condition: - Initially finite integrals must approach their original values.  
 (otherwise you are changing the theory)

Adding more loops don't increase the div. prop. of renormalizable th. -



But non-renormalizable th. - adds of more loops  $\uparrow$  div.

