

11/8/06

Results from QFT 1 :-

In a QFT with scalar fields  $\phi$ , the physical information is contained in:-

$$\langle \Omega | T \left( \prod_{i=1}^N \hat{\phi}(\vec{x}_i, t_i) \right) | \Omega \rangle / \langle \Omega | \Omega \rangle$$

time ordering
field operator
vacuum / ground state

$$\hat{\phi}(\vec{x}_i, t_i) = e^{i\hat{H}t_i} \hat{\phi}(\vec{x}_i, 0) e^{-i\hat{H}t_i}$$

↓  
Hamiltonian

This contains information about

- ① Mass spectrum → poles in 2-pt. fun. in mom. space
- ② S-matrix → LSZ formalism

LSZ prescription

Similar formula holds for other QFT's.

Perturbation theory :-

Split  $H$  into  $H_0 + H_{int}$

Quadratic in fields & their conjugate momentum → involves cubic & higher order terms

Feynman rules  $\rightarrow$  a procedure for computing Green's fns to arbitrary order in power series expansion in  $\hbar$ .

---

Our goal: Rederive the Feynman rules using a different approach.

$\rightarrow$  Path integrals

---

# Why should we do this?

$\rightarrow$  ① The earlier method was not manifestly Lorentz invariant although the final result is Lorentz invariant.

Reason: - We treat space & Time coordinates differently.

[While taking the  $\mathcal{H}$ , we treat 't' diff. bcs we define canonically conjugate mom. (although the 'L' was Lor. inv.)]

② If the interaction term in the Lagrangian 'L' contains derivatives then the defn. of conjugate momentum ~~is~~ involves interaction terms  $\xrightarrow[\text{result}]{\text{as a}}$   $\mathcal{H}$  can get complicated.

