

# Small and Fast Physics

Calculations in relativistic quantum field theory require management of infinities (regularization and renormalization)

$$\left( \frac{d^2}{dt^2} - c^2 \nabla^2 \right) A^\mu = J^\mu \quad \xrightarrow[\text{choosing a gauge}]{\text{Invert by}} \quad A^\mu = e^{ikx} \dots$$

Field eqs.  Propagator

$\mathcal{L}$  = simple

+  $A^\mu$  ...perturbation

## History

1940s Developed by Feynman, Tomonaga, Schwinger  
Old masters uncomfortable (Feynman, Dirac)

## Current Efforts

Shut up and calculate the most precise calcs in physics

## My Efforts

Nature uses all well-formed terms.

Use a Lagrangian's neighbors.  $(\mathcal{L}, \vec{P}) = \frac{1}{2}(B^2 - E^2, 4 \vec{E} \times \vec{B})$

Using the complete set, field equations can be inverted  
without choosing a gauge

$B^2 - E^2$  unchanged by time reversal,  $E \times B$  does change