**Interacting Fields**

In real world, fields interact!

We will require that:

1. Interactions are local: products of fields at same space-time point.

\[ H_{int} = \int d^3x \left[ \mathcal{L}(\phi) \right] = -\int d^3x \, \mathcal{L}_{int} + O(\phi^4) \]

(Otherwise violate causality.)

2. Here we will focus on \( H_{int} = -\mathcal{L}_{int} \) that are functions of fields only, not derivatives.

(i.e. unit system, don’t scale this...)

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**Example 1**

\[ Y = \frac{1}{2} \left( \frac{\partial \phi}{\partial x} \right)^2 - \frac{1}{2} m^2 \phi^2 - \frac{1}{4!} \phi^4 \]

(should give fourth theory)

Consider dimensional analysis...