

PHYS 704 - Field Theory Problem 1.

- 1. [10 points]

Consider the Lagrangian density

$$\mathcal{L} = (1/2)(\partial_\mu\phi)(\partial^\mu\phi) - m^2\phi^2$$

and its variations under the twin transformation

$$x^\mu \rightarrow \exp(\alpha)x^\mu, \quad \phi(x) \rightarrow \exp(-d\alpha)\phi(x)$$

- (a) If $m = 0$, for what values of d is the action invariant? What happens when $m \neq 0$?
- (b) If you replace ϕ^2 with ϕ^4 in the mass term, what are the required dimensions of m ?
- (c) For the ϕ^4 case with appropriate dimensions for m , what is the conserved Noether current?