

1 In my lectures notes, given equations 49.1 and 50.3, show that 51.1 and 51.2 are valid

2 Consider a complex (and free) scalar field:

(Peskin 2.2)

$$S = \int d^4x (\partial_\mu \phi^* \partial^\mu \phi - m^2 \phi^* \phi)$$

2 a Obtain the Hamiltonian:

$$H = \int d^3x (\pi^* \pi + \nabla \phi^* \cdot \nabla \phi + m^2 \phi^* \phi)$$

2 b Obtain the equations of motion (EOM) for ϕ and ϕ^* . Do they both satisfy the Klein-Gordon equation?

2 c In terms of the "Field Theoretical" jargon, how many degrees of freedom does this model have?

2 d Write H in terms of creation and annihilation operators.