

QFT: A Brief Summary

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1 Classical Field Theory

Equation 1.1

(Euler-Lagrange Equations)

$$\partial_\mu \left(\frac{\partial \mathcal{L}}{\partial (\partial_\mu \varphi_a)} \right) - \frac{\partial \mathcal{L}}{\partial \varphi_a} = 0. \quad (1.1)$$

Equation 1.2

(Noether's Theorem)

An infinitesimal transformation $\delta \varphi_a$ is a symmetry of a field theory if $\delta \mathcal{L} = \partial_\mu \chi^\mu$, then

$$\partial_\mu \left(\frac{\partial \mathcal{L}}{\partial (\partial_\mu \varphi_a)} \delta \varphi_a - \chi^\mu \right) = 0. \quad (1.2)$$

Equation 1.3

(Stress-Energy Tensor)

A special case of the above. If the variation is obtained by $x^\mu \rightarrow x^\mu + \epsilon^\mu$, then

$$\partial_\mu \left(\frac{\partial \mathcal{L}}{\partial (\partial_\mu \varphi_a)} \epsilon^\nu \partial_\nu \varphi_a - \epsilon^\mu \mathcal{L} \right) = \epsilon^\nu \partial_\mu T^\mu{}_\nu = 0. \quad (1.3)$$

asdfasdf “Hi”