

## 1 Canonical Quantization

For the quantization of the electromagnetic field you just need to make a mode expansion of  $\vec{A}$ , which leads to

$$\hat{A}(x) = \sum_J \sum_{\lambda=1}^2 \frac{1}{\sqrt{\omega_J}} \vec{\varepsilon}_{J,\lambda} \left( e^{-i\omega_J t} \tilde{A}_{J,\lambda}(\vec{r}) \hat{a}_{J,\lambda} + e^{i\omega_J t} \tilde{A}_{J,\lambda}^*(\vec{r}) \hat{a}_{J,\lambda}^\dagger \right).$$

## 2 Integral Theorems

The *Gauß-Ostrogradski* and *Green* theorem are shown below:

$$\int_V \operatorname{div} \vec{F} \, d^n V = \oint_S \vec{F} \cdot \vec{n} \, d^{n-1} S, \quad (1)$$

$$\iint_D \left( \frac{\partial g}{\partial x}(x, y) - \frac{\partial f}{\partial y}(x, y) \right) dx \, dy = \oint_C (f(x, y) \, dx + g(x, y) \, dy) \quad (2)$$