

$$\hat{\alpha}^\dagger_{\boldsymbol{p}} = \int_{\Sigma} \frac{d^d \Sigma^\mu}{(2\pi)^d} \frac{d^d \boldsymbol{P}}{2E_P} \left(2i \frac{\partial}{\partial X_\mu} \langle\langle X, \boldsymbol{P} | \boldsymbol{p} \rangle\rangle \right) A^\dagger_{X, \boldsymbol{P}}$$