

# Particle spectrograph

## Wave operator and propagator

Quadratic (free) action

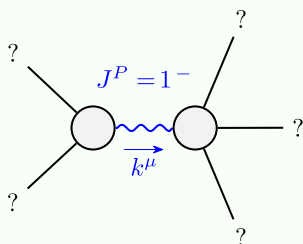
$$S_F = \iiint \int (\gamma \mathcal{B}_\alpha \mathcal{B}^\alpha + \mathcal{B}^\alpha \mathcal{J}_\alpha + 2\alpha (-\partial_\alpha \mathcal{B}_\beta + \partial_\beta \mathcal{B}_\alpha) \partial^\beta \mathcal{B}^\alpha) [t, x, y, z] dz dy dx dt$$

$$\mathcal{B}_{1-}^{\#1} \dagger^\alpha \boxed{\gamma + 2\alpha k^2}$$

(No source constraints)

$$\mathcal{J}_{1-}^{\#1} \dagger^\alpha \boxed{\frac{1}{\gamma + 2\alpha k^2}} \quad \mathcal{J}_{0+}^{\#1} \dagger \boxed{\frac{1}{\gamma}} \quad \mathcal{B}_{0+}^{\#1} \dagger \boxed{\gamma} \quad \mathcal{B}_{0+}^{\#1}$$

## Massive and massless spectra



Massive particle

Pole residue:	$-\frac{1}{2\alpha} > 0$
Polarisations:	3
Square mass:	$-\frac{\gamma}{2\alpha} > 0$
Spin:	1
Parity:	Odd

(No massless particles)

## Unitarity conditions

$$\alpha < 0 \ \&\& \ \gamma > 0$$