

# Particle spectrograph

## Wave operator and propagator

Quadratic (free) action

$S_F ==$

$$\iiint (\beta \mathcal{B}_{\alpha\beta} \mathcal{B}^{\alpha\beta} + \mathcal{B}^{\alpha\beta} \mathcal{T}_{\alpha\beta} + \frac{1}{3} \alpha (-2 \partial_\beta \mathcal{B}_{\alpha\chi} + \partial_\chi \mathcal{B}_{\alpha\beta}) \partial^\chi \mathcal{B}^{\alpha\beta}) [t, x, y, z] dz dy dx dt$$

$\mathcal{T}_{1^+ \alpha\beta} \quad \mathcal{T}_{1^- \alpha}$

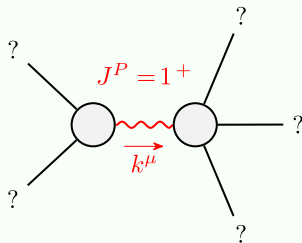
$\mathcal{T}_{1^+}^{\#1} \dagger^{\alpha\beta}$	$\frac{1}{\beta + \frac{\alpha k^2}{3}}$	0
$\mathcal{T}_{1^-}^{\#1} \dagger^\alpha$	0	$\frac{1}{\beta}$

$\mathcal{B}_{1^+ \alpha\beta}^{\#1} \quad \mathcal{B}_{1^- \alpha}^{\#1}$

$\mathcal{B}_{1^+}^{\#1} \dagger^{\alpha\beta}$	$\beta + \frac{\alpha k^2}{3}$	0
$\mathcal{B}_{1^-}^{\#1} \dagger^\alpha$	0	$\beta$

(No source constraints)

## Massive and massless spectra



Massive particle

Pole residue:	$\frac{3}{\alpha} > 0$
Polarisations:	3
Square mass:	$-\frac{3\beta}{\alpha} > 0$
Spin:	1
Parity:	Even

(No massless particles)

## Unitarity conditions

$$\alpha > 0 \ \&\& \ \beta < 0$$