

# Particle spectrograph

## Wave operator and propagator

Quadratic (free) action

$S_F ==$

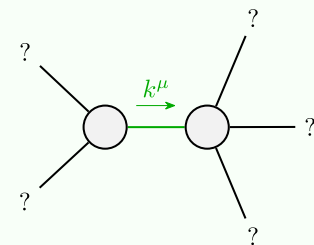
$$\iiint (h^{\alpha\beta} \mathcal{T}_{\alpha\beta} + \alpha \partial_\beta h^\chi_\chi \partial^\beta h^\alpha_\alpha + \alpha (-2 \partial_\beta h_{\alpha\chi} + \partial_\chi h_{\alpha\beta}) \partial^\chi h^{\alpha\beta}) [t, x, y, z] dz dy dx dt$$

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\mathcal{T}_1^{\#1\alpha} == 0$	3
Total constraints:	3

$$\begin{array}{c} \mathcal{T}_{2^+}^{\#1\alpha\beta} \left[ \frac{1}{\alpha k^2} \right] h_{2^+}^{\#1\alpha\beta} \left[ \alpha k^2 \right] \mathcal{T}_{1^+}^{\#1\alpha} \left[ 0 \right] h_{1^+}^{\#1\alpha} \left[ 0 \right] \end{array} \quad \begin{array}{c} \mathcal{T}_{0^+}^{\#1} \left[ 0 \right] \mathcal{T}_{0^+}^{\#2} \left[ \frac{1}{\sqrt{3} \alpha k^2} \right] \\ \mathcal{T}_{0^+}^{\#2} \left[ \frac{1}{\sqrt{3} \alpha k^2} \right] \mathcal{T}_{0^+}^{\#1} \left[ -\frac{4}{3 \alpha k^2} \right] \end{array} \quad \begin{array}{c} h_{0^+}^{\#2} \left[ \sqrt{3} \alpha k^2 \right] h_{0^+}^{\#1} \left[ 4 \alpha k^2 \right] \\ h_{0^+}^{\#1} \left[ \sqrt{3} \alpha k^2 \right] h_{0^+}^{\#2} \left[ 0 \right] \end{array}$$

## Massive and massless spectra



Quadratic pole

Pole residue:	$\frac{1}{\alpha} > 0$
Polarisations:	3

(No massive particles)

## Unitarity conditions

$$\alpha > 0$$