

# Wave operator and propagator

## Quadratic (free) action

$$\mathcal{S} \equiv$$

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

Diagram illustrating the construction of the 2x2 matrix for the second step of the algorithm, showing the combination of results from the first step (left) and the second step (right).

**Left Matrix (Step 1 Results):**

$$\begin{matrix} h_0^{\#1} & h_0^{\#2} \\ h_0^{\#1} \vdash & \begin{bmatrix} -2\beta + \alpha k^2 & -\sqrt{3}\beta \\ -\sqrt{3}\beta & 0 \end{bmatrix} \\ h_0^{\#2} \vdash & \end{matrix}$$

**Right Matrix (Step 2 Results):**

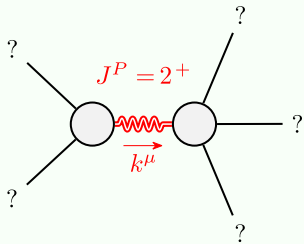
$$\begin{matrix} h_1^{\#1} & h_1^{\#2} \\ h_1^{\#1} \vdash & \begin{bmatrix} \frac{1}{\beta - \frac{\alpha k^2}{2}} & \beta - \frac{\alpha k^2}{2} \\ \beta & \frac{1}{\beta} \end{bmatrix} \\ h_1^{\#2} \vdash & \end{matrix}$$

**Combined Matrix (Step 2 Results):**

$$\begin{matrix} h_1^{\#1} & h_1^{\#2} \\ h_1^{\#1} \vdash & \begin{bmatrix} -\frac{1}{\sqrt{3}\beta} & 0 \\ \frac{2\beta - \alpha k^2}{3\beta^2} & -\frac{1}{\sqrt{3}\beta} \end{bmatrix} \\ h_1^{\#2} \vdash & \end{matrix}$$

(No source constraints)

# Massive and massless spectra



Massive particle	
Pole residue:	$-\frac{2}{\alpha} > 0$
Polarisations:	5
Square mass:	$\frac{2\beta}{\alpha} > 0$
Spin:	2
Parity:	Even

(No massless particles)

## Unitarity conditions

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