Particle spectrograph

Wave operator and propagator

Quadratic (free) action

$\mathcal{S}$ ==

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

Source constraints

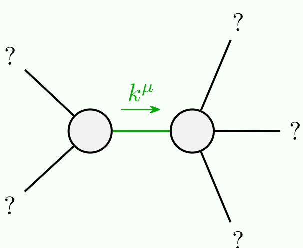
SO(3) irreps	Fundamental fields	Multiplicities
$\mathcal{T}^{\#2}_{0^+} == 0$	$\partial_{\beta}\partial_{\alpha}\mathcal{T}^{\alpha\beta} == 0$	1
$\mathcal{T}^{\#1\,\alpha}_{1^-} == 0$	$\partial_{\chi}\partial_{\beta}\partial^{\alpha}\mathcal{T}^{\beta\chi} == \partial_{\chi}\partial^{\chi}\partial_{\beta}\mathcal{T}^{\alpha\beta}$	3
Total constraints/gauge generators:	4	

$$\begin{array}{c|ccc} & \mathcal{T}^{\#1}_{0^+} & \mathcal{T}^{\#2}_{0^+} & \rho^{\#1}_{0^+} \\ \hline \mathcal{T}^{\#1}_{0^+}\dagger & \frac{1}{\alpha k^2} & 0 & 0 \\ \mathcal{T}^{\#2}_{0^+}\dagger & 0 & 0 & 0 \\ \rho^{\#1}_{0^+}\dagger & 0 & 0 & \frac{1}{\beta k^2} \end{array}$$

$$\begin{array}{c|c} & \mathcal{T}^{\#1}_{2^+\,\alpha\beta} \\ \hline \mathcal{T}^{\#1}_{2^+}\dagger^{\alpha\beta} & -\frac{2}{\alpha k^2} \end{array} \qquad \begin{array}{c|c} & h^{\#1}_{2^+\,\alpha\beta} \\ \hline h^{\#1}_{2^+}\dagger^{\alpha\beta} & -\frac{\alpha k^2}{2} \end{array} \qquad \begin{array}{c|c} & \mathcal{T}^{\#1}_{1^-\,\alpha} \\ \hline \mathcal{T}^{\#1}_{1^-}\dagger^{\alpha} & 0 \end{array} \qquad \begin{array}{c|c} & h^{\#1}_{1^-\,\alpha} \\ \hline h^{\#1}_{1^-}\dagger^{\alpha} & 0 \end{array}$$

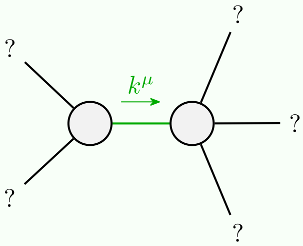
$$\begin{array}{c|ccc} & h^{\#1}_{0^+} & h^{\#2}_{0^+} & \phi^{\#1}_{0^+} \\ \hline h^{\#1}_{0^+}\dagger & \alpha k^2 & 0 & 0 \\ h^{\#2}_{0^+}\dagger & 0 & 0 & 0 \\ \phi^{\#1}_{0^+}\dagger & 0 & 0 & \beta k^2 \end{array}$$

Massive and massless spectra



Quadratic pole

Pole residue:	$-\frac{1}{\alpha} > 0$
Polarisations:	2



Quadratic pole

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

(No massive particles)

Unitarity conditions

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