

# Wave operator and propagator

$$\begin{aligned} & \iiint [(\omega^{\alpha\beta\chi} \sigma_{\alpha\beta\chi} - \frac{2}{3} r_1 (2 \partial_\beta \omega_{\alpha i \theta} - \partial_\beta \omega_{\alpha \theta i} + 4 \partial_\beta \omega_{i \theta \alpha} + \partial_i \omega_{\alpha \beta \theta} - \partial_\theta \omega_{\alpha \beta i} - \partial_\theta \omega_{\alpha i \beta}) \\ & \partial^\theta \omega^{\alpha\beta i} + r_5 (\partial_i \omega_{\theta}^{\kappa} \partial^\theta \omega_{\kappa}^{\alpha i} - \partial_\theta \omega_{i}^{\kappa} \partial^\theta \omega_{\kappa}^{\alpha i} - \\ & (\partial_\alpha \omega^{\alpha i \theta} - 2 \partial^\theta \omega_{\alpha}^{\alpha i}) (\partial_\kappa \omega_{i \theta}^{\kappa} - \partial_\kappa \omega_{\theta i}^{\kappa}))) [t, x, y, z] d^3 y d^3 x dt \end{aligned}$$

$$\begin{array}{cc}
& \sigma_{2^+ \alpha \beta}^{\#1} & \sigma_{2^- \alpha \beta \chi}^{\#1} \\
\sigma_{2^+}^{\#1} \dagger^{\alpha \beta} & 0 & 0 \\
\sigma_{2^-}^{\#1} \dagger^{\alpha \beta \chi} & 0 & \frac{1}{k^2 r_1}
\end{array}$$

	$\omega_{0+}^{\#1}$	$\omega_{0-}^{\#1}$
$\omega_{0+}^{\#1} \vdash$	0	0
$\omega_{0-}^{\#1} \vdash$	0	0

A diagram showing a 2x2 matrix with colored cells and labels. The columns are labeled  $\sigma_0^{\#1+}$  and  $\sigma_0^{\#1-}$  at the bottom. The rows are labeled  $\sigma_0^{\#1+}$  and  $\sigma_0^{\#1-}$  on the left. The cells contain the following values:

$\sigma_0^{\#1+}$	0 (pink cell)	0 (light blue cell)
$\sigma_0^{\#1-}$	0 (light red cell)	0 (pink cell)

	$\sigma_{1^+}^{\#1} \alpha \beta$	$\sigma_{1^+}^{\#2} \alpha \beta$	$\sigma_{1^-}^{\#1} \alpha$	$\sigma_{1^-}^{\#2} \alpha$
$\sigma_{1^+}^{\#1} \dagger \alpha \beta$	$\frac{1}{k^2 (2r_1 + r_5)}$	0	0	0
$\sigma_{1^+}^{\#2} \dagger \alpha \beta$	0	0	0	0
$\sigma_{1^-}^{\#1} \dagger \alpha$	0	0	$\frac{1}{k^2 (r_1 + r_5)}$	0
$\sigma_{1^-}^{\#2} \dagger \alpha$	0	0	0	0

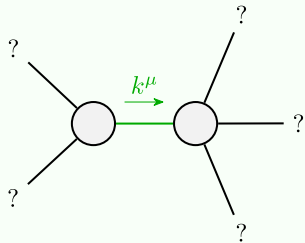
	$\omega_{2^+ \alpha \beta}^{\#1}$	$\omega_{2^- \alpha \beta \chi}^{\#1}$
$\omega_{2^+ \dagger}^{\#1 \alpha \beta}$	0	0
$\omega_{2^- \dagger}^{\#1 \alpha \beta \chi}$	0	$k^2 r_1$

$\omega_1^{\#1} + \alpha\beta$	$\omega_1^{\#2} + \alpha\beta$	$\omega_1^{\#1} - \alpha$	$\omega_1^{\#2} - \alpha$
$k^2 (2r_1 + r_5)$	0	0	0
0	0	0	0
0	0	$k^2 (r_1 + r_5)$	0
0	0	0	0

## Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\sigma_0^{-1} \Rightarrow 0$	1
$\sigma_0^{+1} \Rightarrow 0$	1
$\sigma_1^{+2\alpha} \Rightarrow 0$	3
$\sigma_1^{+2\alpha\beta} \Rightarrow 0$	3
$\sigma_2^{+1\alpha\beta} \Rightarrow 0$	5
Total constraints:	13

# Massive and massless spectra



Quadratic pole	
Pole residue:	$-\frac{1}{r_1(r_1+r_5)(2r_1+r_5)} > 0$
Polarisations:	2

(No massive particles)

# Unitarity conditions

$$r_1 < 0 \&\& (r_5 < -r_1 \parallel r_5 > -2r_1) \parallel r_1 > 0 \&\& -2r_1 < r_5 < -r_1$$