Particle spectrograph

Wave operator and propagator

+	$\tau_{1}^{\#2}{}_{\alpha}$	0	0	0	$\frac{4i}{k(1+2k^2)(r_3+2r_5)}$	$\frac{i\sqrt{2}(3k^2(r_3+2r_5)+4t_3)}{k(1+2k^2)^2(r_3+2r_5)t_3}$	0	$\frac{6k^2(r_3+2r_5)+8t_3}{(1+2k^2)^2(r_3+2r_5)t_3}$
$\lambda \alpha$ $\lambda \alpha$ $\lambda \alpha$	$\mathfrak{r}_{1^{-}}^{\#1}\alpha$	0	0	0	0	0	0	0
Quadratic (free) action $\int_{\mathbb{R}^{2}} \frac{1}{\epsilon} (4t_{3} \omega_{\alpha}^{\alpha l} \omega_{\kappa}^{\kappa} + 6 f^{\alpha \beta} \tau_{\alpha\beta} + 6 \omega^{\alpha\beta\chi} \sigma_{\alpha\beta\chi} - 3 r_{3} \partial_{l}\omega^{\kappa\lambda}_{\kappa} \partial^{l}\omega_{\lambda}^{\alpha}_{\alpha} - 6 r_{5} \partial_{l}\omega^{\kappa\lambda}_{\kappa} \partial^{l}\omega_{\lambda}^{\alpha}_{\alpha} + 4 r_{2} \partial^{\beta}\omega^{\beta}_{\alpha} \partial^{\beta}\omega^{\beta}_{\alpha} + 2 r_{2} \partial^{\beta}\omega^{\beta}_{\alpha} \partial^{\beta}\omega^{\beta}_{\alpha} + 2 r_{2} \partial^{\beta}\omega^{\beta}_{\alpha} \partial^{\beta}\omega^{\beta}_{\alpha} + 4 r_{2} \partial^{\beta}\omega^{\beta}_{\alpha} \partial^{\beta}\omega^{\beta}_{\alpha} + 2 r_{2} \partial^{\beta}\omega^{\beta}_{\alpha} \partial^{\beta}\omega^{\beta}_{\alpha} + 4 r_{2} \partial^{\beta}\omega^{\beta}_{\alpha} \partial^{\beta}\omega^{\beta}_{\alpha} + 6 r_{3} \partial^{\beta}\omega^{\lambda}_{\alpha} \partial^{\beta}\omega^{\lambda}_{\alpha} + 6 r_{3} \partial^{\beta}\omega^{\lambda}_{\alpha} \partial^{\beta}\omega^{\lambda}_{\alpha} + 4 r_{3} \partial^{\beta}\omega^{\lambda}_{\alpha} \partial^{\beta}\omega^{\lambda}_{\alpha} \partial^{\beta}\omega^{\lambda}_{\alpha} + 4 r_{3} \omega^{\beta}\omega^{\lambda}_{\alpha} \partial^{\beta}\omega^{\lambda}_{\alpha} \partial^{\beta}\omega^{\lambda}_{\alpha} + 4 r_{3} \omega^{\beta}\omega^{\lambda}_{\alpha} \partial^{\beta}\omega^{\lambda}_{\alpha} \partial^{\beta}\omega^{$	$\sigma_{1^{+}\alpha}^{\#2}$	0	0	0	$\frac{2\sqrt{2}}{k^2(1+2k^2)(r_3+2r_5)}$	$\frac{3k^2(r_3+2r_5)+4t_3}{(k+2k^3)^2(r_3+2r_5)t_3}$	0	$-\frac{i\sqrt{2}(3k^2(r_3+2r_5)+4t_3)}{k(1+2k^2)^2(r_3+2r_5)t_3}$
Quadratic (free) action $\int_{\exists F} = \int_{\exists J} (At_3 \omega_{\mu}^{\alpha l} \omega_{\kappa \alpha}^{\alpha l} + 6 f^{\alpha \beta} t_{\alpha \beta} + 6 \omega^{\alpha \beta \chi} \sigma_{\alpha \beta \chi} - 3 r_3 \partial_{\mu} \omega^{\kappa \lambda} \partial_{\nu} \omega^{\kappa \lambda} $	$\sigma_{1^{-}\alpha}^{\#1}$	0	0	0	$\frac{2}{k^2 (r_3 + 2 r_5)}$	$\frac{2\sqrt{2}}{k^2(1+2k^2)(r_3+2r_5)}$	0	$-\frac{4i}{k(1+2k^2)(r_3+2r_5)}$
$\begin{array}{c} 6 f^{\alpha\beta} \\ 6 f^{\alpha\beta} \\ \beta^{\alpha} \omega_{\lambda}^{\alpha} \\ \beta^{\alpha} \omega_{\lambda}^{\alpha} \\ \beta^{\alpha} \omega_{\lambda}^{\alpha} \\ \beta^{\alpha} \omega^{\beta} \\ \beta^{\alpha} \omega^{\beta} \\ \beta^{\alpha} \omega^{\beta} \\ \beta^{\alpha} \omega^{\beta} \\ \end{array}$	$ au_1^{\#1}$	0	0	0	0	0	0	0
action $\omega_{\kappa\alpha}^{\kappa} + (\omega_{\kappa\alpha}^{\kappa} + (\omega_{\kappa\alpha}^{\kappa} + (\omega_{\kappa}^{\kappa} - 6r_5)^2)$ $\omega_{\kappa}^{\kappa} + (\omega_{\kappa}^{\kappa} - 6r_5)^2$ $\omega_{\kappa}^{\kappa} + (\omega_{\kappa}^{\kappa} - 4r_5)^2$ $\omega_{\kappa}^{\kappa} + (\omega_{\kappa}^{\kappa} - 6r_5)^2$ $\omega_{\kappa}^{\kappa} - 6r_5)^2$	$\sigma_{1}^{\#2}{}_{\alpha\beta}\ \tau_{1}^{\#1}{}_{\alpha\beta}$	0	0	0	0	0	0	0
Quadratic (free) $S_{F} == \begin{cases} S_{F} == \\ \int \int \int \int (\frac{1}{6} (4t_{3} \omega_{\alpha}^{\alpha t}) \\ \partial_{i} \omega^{\kappa \lambda} \partial_{\alpha} \omega_{\alpha}^{\alpha} \partial_{\alpha} \omega_{\alpha}^{\alpha t} \\ \partial_{k} \omega^{\theta \kappa \lambda} \partial_{\alpha} \omega_{\alpha}^{\alpha} \partial_{\alpha} \omega_{\alpha}^{\beta t} \\ \partial_{k} \omega^{\theta \kappa \lambda} - 3r_{3} \partial_{\alpha} \omega_{\alpha}^{\beta t} \\ 12r_{5} \partial_{\theta} \omega_{\alpha}^{\alpha} \partial_{\alpha} \omega_{\alpha}^{\beta t} \\ 4t_{3} \partial_{k} f^{\lambda} \partial^{k} f'_{i} + i \\ 2r_{2} \partial_{\kappa} \omega^{\alpha \beta \theta} \partial^{k} \omega_{\alpha t}^{\beta t} \\ \partial_{\lambda} \omega_{\alpha \beta}^{i} - 24r_{3} \partial^{\beta} \omega_{\alpha}^{\beta t} \\ \partial_{\lambda} \omega_{\alpha \beta}^{i} - 24r_{3} \partial^{\beta} \omega_{\alpha}^{\beta t} \\ 3r_{3} \partial_{\theta} \omega_{\lambda}^{\alpha} \partial^{\lambda} \omega^{\theta t} \end{cases}$	$\sigma_{1}^{\#1}{}_{\alpha\beta}$	$\frac{1}{k^2(2r_3+r_5)}$	0	0	0	0	0	0
Quadra $S_F = \int \int \int \int \int \int (\frac{1}{6})^{\frac{1}{6}}$ $\partial_r \omega^{k\lambda}$ $\partial_k \omega^{\theta k'}$ $\partial_k \omega^{\theta k'}$ $\partial_k \omega_{\alpha\beta}$ $\partial_\lambda \omega_{\alpha\beta}$ $\partial_\lambda \omega_{\alpha\beta}$,	$r_1^{\#1} + \alpha \beta$	$r_1^{\#2} + \alpha \beta$	$^{\#1}_{1+} \dagger^{\alpha\beta}$	$\sigma_{1}^{\#1} +^{lpha}$	$\sigma_{1}^{\#2} +^{lpha}$	$\tau_{1}^{\#1} +^{\alpha}$	$\tau_{1}^{\#2} +^{\alpha}$

$f_{1^-}^{\#2}{}_{lpha}$	0	0	0	$-\frac{2}{3}$ ikt ₃	$\frac{1}{3}\vec{l}\sqrt{2}kt_3$	0	$\frac{2k^2t_3}{3}$	
$f_{1^{ ext{-}}}^{\#1}{}_{lpha}$	0	0	0	0	0	0	0	
$\omega_{1^{\bar{-}}\alpha}^{\#2}$	0	0	0	$-\frac{\sqrt{2}t_3}{3}$	<u>t3</u> 3	0	$-\frac{1}{3}\bar{l}\sqrt{2}kt_3$	
$\omega_{1^{-}\alpha}^{\#1}$	0	0	0	$k^2 \left(\frac{r_3}{2} + r_5 \right) + \frac{2t_3}{3}$	$-\frac{\sqrt{2}t_3}{3}$	0	2 <i>ikt</i> 3 3	
$f_{1}^{\#1}{}_{\alpha\beta}$	0	0	0	0	0	0	0	
$\omega_{1}^{\#2}_{+\alpha\beta}\ f_{1}^{\#1}_{+\alpha\beta}$	0	0	0	0	0	0	0	
$\omega_{1}^{\#1}{}_{\alpha\beta}$	$v_1^{#1} + \alpha \beta \left(2 r_3 + r_5 \right)$	0	0	0	0	0	0	
	$_{1}^{\#1}+^{lphaeta}$	$\sigma_1^{\#2} + \alpha \beta$	$f_1^{#1} + \alpha \beta$	$\omega_{1}^{\#1} +^{lpha}$	$\omega_{1}^{\#2} +^{lpha}$	$f_{1}^{\#1} \dagger^{\alpha}$	$f_{1}^{#2} + \alpha$	

$ \tau_{0}^{+1} + $		$\frac{(2)^2 t_3}{\sqrt{2} k}$						$\sigma_{2+\alpha\beta}^{\#1}$	$-\frac{\sigma_2^{"+}\alpha\beta}{3k^2r_3} 0$		$ \begin{array}{c c} \sigma_2^{\#1}_{\alpha\beta\chi} \\ \hline 0 \end{array} $			
$\tau_{0}^{\#2}$ †		0	0		0	0		$ au_{2^{+}}^{\#1}$ †		0	0		0	
$\sigma_0^{\#1}$ †		0		0	0	$\frac{1}{k^2}$	_ (2	σ ₂ -1 † '	αβχ	0	0 0		0	
										$\omega_{2^{-}}^{\#1}\alpha\beta\chi$	0	C	>	0
	$\omega_2^{\#1}$ $\beta_2^{\#1}$ $\beta_2^{\#1}$												0	0
	-											2	>	0
)	$\omega_{2}^{\#1} + \alpha \beta = \frac{3k^2 r_3}{2}$	$1 + \alpha \beta$	72+ 1	$\omega_2^{*-1} + ^{\sim_F \wedge}$
tors	(0										$\omega_{2}^{\#}$, # ,	, 2+	ω_2^{*}
enera	Multiplicities 1									$\omega_{0^{\text{-}}}^{\#1}$	0	0	0	$k^2 r_2$
uge g	lultip								24	$f_{0}^{#2}$	9	0	0	0
aints/ga	2 -	== 0 1	$\sigma_1^{\#2\alpha} == 0 \ 3$	3	3	3	72	5	aints: 2	$f_{0}^{\#1}$	$-i\sqrt{2}kt_3$	$2k^2t_3$	0	0
Source constraints/gauge generators	$SO(3)$ irreps $r^{\#_2^2} = 0$	$ik \sigma_{0}^{\#1}$	+ 2 ī k	0 ==	3 == 0	θ == 0	0 == χ _θ	3 == 0	Total constrai	$\omega_{0}^{\#1}$	<i>t</i> ₃	$i \sqrt{2} kt_3$	0	0
Sour	$\frac{\text{SO(3)}}{r^{\#_2}}$	r#1 - 2	$t_1^{\#2\alpha}$	$\tau_{1}^{\#1\alpha}$	$\tau_1^{\#1}\alpha\beta$:	$\sigma_{1}^{\#2}{}^{\alpha\beta}$:	$\sigma_2^{\#1}\alpha\beta\chi$	$\tau_2^{\#1\alpha\beta}$:	Total		$\omega_{0}^{\#1}$ †	$f_{0}^{#1}$ †	$f_{0}^{#2} \uparrow$	$\omega_{0}^{\#1}$ \pm

Massive and massless spectra

Quadratic pole

Pole residue:
$$-\frac{1}{r_3(2r_3+r_5)(r_3+2r_5)p^2} > 0$$

Polarisations: 2

(No massive particles)

Unitarity conditions

$$r_3 < 0 \&\& (r_5 < -\frac{r_3}{2} || r_5 > -2 r_3) || r_3 > 0 \&\& -2 r_3 < r_5 < -\frac{r_3}{2}$$