Particle spectrograph

Wave operator and propagator

$\tau_{1}^{\#2}{}_{\alpha}$	0	0	0	$-\frac{6ik}{(3+2k^2)^2t_3}$	$\frac{3i\sqrt{2}k}{(3+2k^2)^2t_3}$	0	$\frac{6k^2}{(3+2k^2)^2t_3}$
$\tau_{1}^{\#1}{}_{\alpha}$	0	0	0	0	0	0	0
$\sigma_{1}^{\#2}{}_{lpha}$	0	0	0	$-\frac{3\sqrt{2}}{(3+2k^2)^2t_3}$	$\frac{3}{(3+2k^2)^2t_3}$	0	$-\frac{3i\sqrt{2}k}{(3+2k^2)^2t_3}$
$\sigma_{1^{-}}^{\#1}{}_{\alpha}$	0	0	0	$\frac{6}{(3+2k^2)^2t_3}$	$-\frac{3\sqrt{2}}{(3+2k^2)^2t_3}$	0	$\frac{6ik}{(3+2k^2)^2t_3}$
$\tau_{1}^{\#1}_{\alpha\beta}$	$-\frac{2i\sqrt{2}}{3kr_3+3k^3r_3}$	$\frac{i(9k^2r_3+4t_2)}{3k(1+k^2)^2r_3t_2}$	$\frac{9k^2r_3+4t_2}{3(1+k^2)^2r_3t_2}$	0	0	0	0
$\sigma_{1}^{\#2}{}_{\alpha\beta}$	$-\frac{2\sqrt{2}}{3k^2r_3+3k^4r_3}$	$\frac{9k^2r_3+4t_2}{3(k+k^3)^2r_3t_2}$	$-\frac{i(9k^2r_3+4t_2)}{3k(1+k^2)^2r_3t_2}$	0	0	0	0
$\sigma_{1}^{\#1}{}_{+}\alpha\beta$	$\frac{2}{3k^2r_3}$	$-\frac{2\sqrt{2}}{3k^2r_3+3k^4r_3}$	$\frac{2i\sqrt{2}}{3kr_3+3k^3r_3}$	0	0	0	0
	$_{1}^{#1}+^{\alpha\beta}$	$_{1}^{#2}$ $+^{\alpha\beta}$	$_{1}^{#1}+^{\alpha eta}$	$\sigma_{1}^{\#1} + \alpha$	$\sigma_{1}^{\#2} + \alpha$	$\tau_{1}^{\#_{1}} + \alpha$	$ au_1^{\#2} +^{lpha}$

Quadratic (free) Lagrangian density
$\frac{2}{3}t_{3}\ \omega_{i}^{\ \alpha'}\ \omega_{\kappa\alpha}^{\ \ \kappa} + \frac{2}{3}t_{2}\ \omega_{i}^{\ \kappa\lambda}\ \omega_{\kappa\lambda}^{\ \prime} + \frac{1}{3}t_{2}\ \omega_{\kappa\lambda}^{\ \prime}\ \omega_{\kappa\lambda}^{\ \prime} + f^{\alpha\beta}\ \tau_{\alpha\beta} + \omega^{\alpha\beta\chi}\ \sigma_{\alpha\beta\chi} +$
$\frac{2}{3} r_2 \partial^\beta \omega^{\theta \alpha}_{ \alpha}{}_{ \beta}^{ \beta} - \frac{1}{3} r_2 \partial_\theta \omega^{ \beta}_{ \beta} \partial_\kappa \omega^{\alpha \beta \theta} - \frac{2}{3} r_2 \partial_\theta \omega^{ \beta}_{ \beta} \partial_\kappa \omega^{\theta \alpha \beta} +$
$r_3\partial_{lpha}\omega_{\lambda}^{lpha}_{}\partial_{\kappa}\omega^{ heta\kappa\lambda}_{}$ - $r_3\partial_{ heta}\omega_{\lambda}^{lpha}_{}\partial_{\kappa}\omega^{ heta\kappa\lambda}_{}+rac{1}{6}t_2\partial^{lpha}f_{\kappa}^{}\partial^{\kappa}f_{}^{}$ -
$\frac{1}{6}t_2\partial^{\alpha}f_{\kappa\theta}\partial^{\kappa}f_{\alpha}^{\ \theta}+\frac{1}{6}t_2\partial^{\alpha}f^{\lambda}_{\ \kappa}\partial^{\kappa}f_{\alpha\lambda}-\frac{2}{3}t_3\omega_{\kappa\alpha}^{\ \alpha}\partial^{\kappa}f'_{\ \prime}-\frac{2}{3}t_3\omega_{\kappa\lambda}^{\ \lambda}\partial^{\kappa}f'_{\ \prime}-$
$rac{4}{3} t_3 \partial^{lpha} f_{\kappa lpha} \partial^{\kappa} f'_{\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $
$\frac{1}{3}t_{2}\ \omega_{\theta IK}\ \partial^{\kappa}f^{'\theta} + \frac{2}{3}t_{2}\ \omega_{\theta KI}\ \partial^{\kappa}f^{'\theta} + \frac{2}{3}t_{3}\ \omega_{I\alpha}^{\ \alpha}\ \partial^{\kappa}f^{'}_{\ \ K} + \frac{2}{3}t_{3}\ \omega_{I\lambda}^{\ \lambda}\ \partial^{\kappa}f^{'}_{\ \ K} -$
$\frac{1}{6}t_2\partial^{\alpha}f^{\lambda}_{\kappa}\partial^{\kappa}f_{\lambda\alpha}-\frac{1}{6}t_2\partial_{\kappa}f_{\lambda}^{}\partial^{\kappa}f_{\lambda}^{}+\frac{1}{6}t_2\partial_{\kappa}f^{\lambda}_{\beta}\partial^{\kappa}f_{\lambda}^{\beta}+\frac{2}{3}t_3\partial^{\alpha}f^{\lambda}_{\alpha}\partial^{\kappa}f_{\lambda\kappa}+$
$\frac{1}{3}r_2\partial_\kappa\omega^{\alpha\beta\theta}\partial^\kappa\omega_{\alpha\beta\theta}+\frac{2}{3}r_2\partial_\kappa\omega^{\theta\alpha\beta}\partial^\kappa\omega_{\alpha\beta\theta}-\frac{2}{3}r_2\partial^\beta\omega_{}^{lpha\lambda}\partial_\lambda\omega_{\alpha\beta}^{\prime}+$
$\frac{2}{3} r_2 \partial^\beta \omega_{_{_{_{_{_{_{_{_{_{_{_{_{_{_{_{_{_{_{$

$f_{1}^{\#2}$	0	0	0	$-\frac{2}{3}$ ikt $_3$	$\frac{1}{3}\bar{l}\sqrt{2}kt_3$	0	$\frac{2k^2t_3}{3}$
$f_{1^-}^{\#1} \alpha$	0	0	0	0	0	0	0
$\omega_{1}^{\#2}{}_{\alpha}$	0	0	0	$-\frac{\sqrt{2}t_3}{3}$	[1 3]	0	$-\frac{1}{3}$ i $\sqrt{2}$ kt ₃
$\omega_{1^{\text{-}}}^{\#1}{}_{\alpha}$	0	0	0	$\frac{2t_3}{3}$	$-\frac{\sqrt{2}t_3}{3}$	0	2 i k t 3 3
$f_{1}^{\#1}$	$\frac{1}{3}$ \bar{l} $\sqrt{2}$ kt_2	<u>i kt2</u> 3	$\frac{k^2 t_2}{3}$	0	0	0	0
$\omega_1^{\#2}{}_+$	$\frac{\sqrt{2} t_2}{3}$	$\frac{t_2}{3}$	$-\frac{1}{3}$ $i k t_2$	0	0	0	0
$\omega_{1}^{\#1}_{\alpha\beta}$	$\frac{1}{6} (9 k^2 r_3 + 4 t_2)$	$\frac{\sqrt{2} t_2}{3}$	$-\frac{1}{3}$ i $\sqrt{2}$ kt ₂	0	0	0	0
	$\omega_1^{\#1} + \alpha^{\beta}$	$\omega_1^{\#2} + ^{\alpha \beta}$	$f_{1+}^{\#1} +^{\alpha\beta}$	$\omega_{1}^{\#_{1}} +^{\alpha}$	$\omega_1^{\#2} +^{lpha}$	$f_{1^{\bar{-}}}^{\#1} +^{\alpha}$	$f_{1}^{\#2} + ^{lpha}$

	$\sigma_{0^{+}}^{\#1}$	$\tau_{0}^{\#1}$	τ ₀ ^{#2}	$\sigma_0^{\#1}$
$\sigma_{0}^{\#1}$ †	$\frac{1}{(1+2k^2)^2t_3}$	$-\frac{i\sqrt{2} k}{(1+2k^2)^2 t_3}$	0	0
$\tau_{0}^{\#1}$ †	$\frac{i\sqrt{2} k}{(1+2k^2)^2 t_3}$	$\frac{2k^2}{(1+2k^2)^2t_3}$	0	0
$ au_{0^{+}}^{\#2} \dagger$	0	0	0	0
$\sigma_{0}^{\#1}$ †	0	0	0	$\frac{1}{k^2 r_2 + t_2}$

 $\tau_{1}^{\#1}\alpha\beta + ik \ \sigma_{1}^{\#2}\alpha\beta == 0$

 $\sigma_{1}^{\#1}{}^{\alpha} + 2 \ \sigma_{1}^{\#2}{}^{\alpha} = 0$

 $\tau_{1}^{\#2}{}^{\alpha} - ik \ \sigma_{1}^{\#1}{}^{\alpha} = 0$

 $\tau_{1}^{\#_{1}\alpha} == 0$

 $\tau_0^{\#1} - 2ik\sigma_0^{\#1} = 0$

 $t_2^{\#1}\alpha\beta$ == 0 Total constraints:

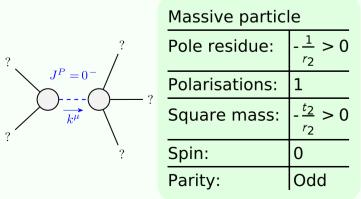
Source constraints/gauge generators SO(3) irreps Multiplicities $t_0^{\#2} == 0$ 1

$\sigma_{2^{+}\alpha\beta}^{\#1} \ \tau_{2^{+}\alpha\beta}^{\#1} \ \sigma_{2^{-}\alpha\beta\chi}^{\#1}$						
$\sigma_{2}^{\#1} \dagger^{\alpha\beta}$	$-\frac{2}{3k^2r_3}$	0	0			
$\tau_2^{\#1} \dagger^{\alpha\beta}$	0	0	0			
$\sigma_2^{\#1} \dagger^{\alpha\beta\chi}$	0	0	0			

	$\omega_{2}^{+} \alpha \beta$	$f_{2}^{\pi_{+}}\alpha\beta$	$\omega_{2^{-}\alpha\beta\chi}^{\#1}$
$\omega_{2}^{\sharp 1} \dagger^{\alpha \beta}$	$\frac{3k^2r_3}{2}$	0	0
$f_{2+}^{#1} \dagger^{\alpha\beta}$	0	0	0
$\omega_{2}^{\#1} \dagger^{\alpha\beta\chi}$	0	0	0

$\omega_{0}^{\#1}$	0	0	0	$k^2 r_2 + t_2$	
$f_{0}^{\#2}$	0	0	0	0	
$f_0^{\#1}$	$-i\sqrt{2}kt_3$	$2 k^2 t_3$	0	0	
$\omega_{0}^{\#1}$	£3	$i\sqrt{2}kt_3$	0	0	
·	$\omega_{0}^{\#1}\dagger$	$f_{0}^{#1}$ †	$f_0^{#2} +$	$\omega_{0^-}^{\#1} \dagger$	

Massive and massless spectra



sidue: $-\frac{1}{r_2} > 0$ ations: 1 mass: $-\frac{t_2}{r_2} > 0$ 0 partic	e particl	(No	
111ass: 1- = > 0	sidue:		mas
111ass: 1- = > 0	tions:	1	isle
0 1:0	mass:	$-\frac{t_2}{r_2} > 0$	
_		0	<u>∓</u> .
Odd &&		Odd	les)

Unitarity conditions

 $r_2 < 0 \&\& t_2 > 0$