Particle spectrograph

Wave operator and propagator

Source constraints/g	auge generators
SO(3) irreps	Multiplicities
$\tau_{0^{+}}^{\#2} == 0$	1
$\tau_{0+}^{\#1} == 0$	1
$\sigma_{0^{+}}^{\#1} == 0$	1
$\tau_1^{\#2\alpha} == 0$	3
$\tau_1^{\#1\alpha} == 0$	3
$\sigma_{1}^{\#2\alpha} == 0$	3
$\sigma_{1}^{\#1\alpha} == 0$	3
$\tau_{1+}^{\#1\alpha\beta} + i k \sigma_{1+}^{\#1\alpha\beta} == 0$	3
$\sigma_{1+}^{\#1}{}^{\alpha\beta} = \sigma_{1+}^{\#2}{}^{\alpha\beta}$	3
$\sigma_2^{\#1\alpha\beta\chi} == 0$	5
$\tau_{2+}^{\#1\alpha\beta} == 0$	5
$\sigma_{2+}^{\sharp 1 \alpha \beta} == 0$	5
Total constraints:	36

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$f_{1}^{\#2}$	0	0	0	0	0	0	0
$f_{1}^{\#1}$ α	0	0	0	0	0	0	0
$\omega_{1^{-}}^{\#1}{}_{lpha}\;\omega_{1^{-}}^{\#2}{}_{lpha}\;f_{1^{-}}^{\#1}{}_{lpha}\;f_{1^{-}}^{\#2},$	0	0	0	0	0	0	0
$\omega_{1^{\bar{-}}}^{\#1}{}_{\alpha}$	0	0	0	0	0	0	0
$f_{1}^{\#1}_{\alpha\beta}$	$\frac{1}{3}\bar{l}\sqrt{2}kt_2$	<u>ikt2</u> 3	$\frac{k^2 t_2}{3}$	0	0	0	0
$\omega_1^{\#2}{}_+ \alpha eta$	$\frac{\sqrt{2}\ t_2}{3}$	t 2 3	$-\frac{1}{3}$ \bar{I} kt_2	0	0	0	0
$\omega_1^{\#1}{}_+\alpha\beta$	$\frac{2t_2}{3}$	$\frac{\sqrt{2} t_2}{3}$	$-\frac{1}{3}\bar{l}\sqrt{2}kt_2$	0	0	0	0
	$\omega_1^{\#1} + ^{lphaeta}$	$\omega_1^{\#_2^2} + ^{\alpha \beta}$	$f_1^{#1} + \alpha \beta$	$\omega_{1^{\text{-}}}^{\#1} \dagger^{\alpha}$	$\omega_1^{\#2} +^{lpha}$	$f_1^{\#1} + ^{lpha}$	$f_1^{\#2} + \alpha$

			$\sigma_{2}^{\#1}{}_{\alpha\beta}$ $\tau_{2}^{\#1}$	‡1 ! ⁺ αβ	$\sigma_{2}^{\#1}{}_{\alpha\beta\chi}$						
	, o	$\sigma_{2^{+}}^{\sharp 1}\dagger^{lphaeta}$	0	0	0						
	$t_2\partial_{lpha j}$	$\tau_{2^{+}}^{\#1}\dagger^{\alpha\beta}$	0	0	0						
	$^{g}f^{\alpha_{l}}$ = $^{g}a_{l}\theta_{l}$	$\sigma_{2}^{\#1}\dagger^{lphaeta\chi}$	0	0	0		#1 #	£1 #2	ш.	1	
	$\partial_{eta}\omega^{\prime}$				•	-	$\sigma_{0}^{\#1}$ $\tau_{0}^{\#}$	τ_{0}^{+1}	$\sigma_0^{\#}$		
	$\partial_{\alpha}f$ $3r_{2}d$ dx					$\sigma_{0^{+}}^{\#1}$ †	0 0	0	0		.
	$2t_2$ $\theta \omega^{\alpha}$					$\tau_{0}^{\#1}$ †	0 0	0	0		‡
	$f^{\alpha\prime} + \frac{1}{2} g^{\alpha\prime} + \frac{1}{2} g^{\alpha$					$\tau_{0^{+}}^{#2}$ †	0 0	0	0		#1
	$ \theta_{\alpha} \partial^{\theta} f $ $ \beta_{\alpha} \partial^{\theta} f $ $ \beta_{\alpha} + 2 \beta_{\alpha} $ $ \beta_{\alpha} \partial^{\theta} f $ $ \beta_{\alpha} \partial$					$\sigma_{0}^{\!\#1}$ †	0 0	0	$\frac{1}{k^2 r_2}$	<u></u> +t ₂	
	$egin{aligned} & L t_2 \ \omega_i, \ & L t_2 \ \partial_{\theta} f \ & (\omega^{lpha l} \epsilon \ & (\omega^{lph$		$\sigma_{1}^{\#1}{}_{lphaeta}$	($\sigma_{1}^{\#2}_{\alpha\beta}$	$ au_{1}^{\#1}{}_{lphaeta}$	$\sigma_{1}^{\#1}{}_{\alpha}$	$\sigma_{1}^{\#2}\alpha$			#
	$a \beta_X + 2 \beta_{\beta} f^{\alpha l}$ $ \partial^{\theta} f^{\alpha l} - 2 \omega_{\alpha l} \theta_{\beta} \partial^{\theta} \omega_{\beta}^{(l)} \partial^{\theta} \omega_{\alpha l}^{(l)} \partial^{\theta} \omega$	$\sigma_{1}^{\sharp 1}$ † lphaeta	$\frac{6}{(3+k^2)^2 t_2}$	(3	$\frac{3\sqrt{2}}{(1+k^2)^2t_2}$	$\frac{3i\sqrt{2}k}{(3+k^2)^2t_2}$	0	0	0	0	
_	$S == \begin{cases} \int_{0}^{\infty} \left(\int_{0}^{\infty} \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \left(\int_{0}^{\infty} f^{\alpha \beta} \right) \left(\int_{0}^{\infty} f^{\alpha \beta} \left(\int_{0}^{\infty} f$	$\sigma_{1^+}^{\#2}\dagger^{lphaeta}$	$\frac{3\sqrt{2}}{(3+k^2)^2t_2}$	(3	$\frac{3}{(1+k^2)^2t_2}$	$\frac{3ik}{(3+k^2)^2t_2}$		0	0	0] .
Quadratic (free) action	$3+6 \omega$ $f^{\alpha\prime}+t$ $+\partial^{\theta}f^{\alpha\prime}$ $3^{\prime}+4 \Gamma$ $3^{\prime}-4 \Gamma_{2}$	$ au_{1}^{\#1} \dagger^{lphaeta}$	$-\frac{3i\sqrt{2}k}{(3+k^2)^2t}$	(3	$\frac{3ik}{3+k^2)^2t_2}$	$\frac{3k^2}{(3+k^2)^2t_2}$	0	0	0	0	*
ree)	$\beta t_{\alpha\beta}$ $\alpha\theta \partial^{\theta}$ $\beta \omega^{\alpha\beta}$ $\beta \omega^{\alpha\beta}$	$\sigma_1^{\!\scriptscriptstyle\# 1}\dagger^lpha$	0		0	0	0	0	0	0	C#2
itic (f	$(6 \ f^{lpha} \ t_{2} \ \partial_{i} f \ \omega_{lpha eta_{i}} \ \omega_{lpha} \ \omega_$	$\sigma_1^{\#2} \dagger^{\alpha}$	0		0	0	0	0	0	0	#,
adra	$\int_{f} \int_{g} \left(\frac{1}{6} \right)^{\frac{1}{2}} f^{\alpha l} $ $\int_{f} \int_{g} \frac{1}{2} \int_{g} \int_{$	$ au_1^{\#_1} \dagger^{lpha}$	0		0	0	0	0	0	0	#
Qu	$S == S$ $\iiint O^{\theta} f$ $4 t_2$ $4 r_2$ $2 r_2$	$ au_1^{\#2} \dagger^{lpha}$	0		0	0	0	0	0	0	

$\omega_{2}^{\#1}$	0	0		0	
$f_{2}^{\#1}$	0	0		0	
$\omega_2^{\#1}{}_+\alpha\beta$	0	0		0	
	$\omega_{2}^{\#1} + ^{lphaeta}$	$f_{2}^{#1} + \alpha \beta$	7	$\omega_{2^{-}}^{\#1} +^{lphaeta\chi}$	
$\omega_{0}^{\#1}$	0	0	0		$k^{-} r_{2} + t_{2}$
+5					
$f_{0}^{\#2}$	0	0	0		0
$f_{0}^{\#1} f_{0}^{\#}$	0 0	0 0	0 0		0 0
	0 0 0	0 0 0	0 0 0		0 0 0

Massive and massless spectra

Massive particle
Pole residue:
$$-\frac{1}{r_2} > 0$$
Polarisations: 1
Square mass: $-\frac{t_2}{r_2} > 0$
Spin: 0
Parity: Odd

massless particles)

Unitarity conditions

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