

Particle spectrograph

Wave operator and propagator

$\sigma_1^{\#1} + \alpha\beta$	$\frac{6}{(3+k^2)^2 t_2}$	$\frac{3\sqrt{2}}{(3+k^2)^2 t_2}$	$\frac{3i\sqrt{2}k}{(3+k^2)^2 t_2}$	0	0	0	0
$\sigma_1^{\#2} + \alpha\beta$	$\frac{3\sqrt{2}}{(3+k^2)^2 t_2}$	$\frac{3}{(3+k^2)^2 t_2}$	$\frac{3ik}{(3+k^2)^2 t_2}$	0	0	0	0
$\tau_1^{\#1} + \alpha\beta$	$-\frac{3i\sqrt{2}k}{(3+k^2)^2 t_2}$	$-\frac{3ik}{(3+k^2)^2 t_2}$	$\frac{3k^2}{(3+k^2)^2 t_2}$	0	0	0	0
$\sigma_1^{\#1} + \alpha$	0	0	0	$\frac{6}{(3+2k^2)^2 t_3}$	$-\frac{3\sqrt{2}}{(3+2k^2)^2 t_3}$	0	$-\frac{6ik}{(3+2k^2)^2 t_3}$
$\sigma_1^{\#2} + \alpha$	0	0	0	$-\frac{3\sqrt{2}}{(3+2k^2)^2 t_3}$	$\frac{3}{(3+2k^2)^2 t_3}$	0	$\frac{3i\sqrt{2}k}{(3+2k^2)^2 t_3}$
$\tau_1^{\#1} + \alpha$	0	0	0	0	0	0	0
$\tau_1^{\#2} + \alpha$	0	0	0	$\frac{6ik}{(3+2k^2)^2 t_3}$	$-\frac{3i\sqrt{2}k}{(3+2k^2)^2 t_3}$	0	$\frac{6k^2}{(3+2k^2)^2 t_3}$

$\omega_1^{\#1} + \alpha\beta$	$\frac{2t_2}{3}$	$\frac{\sqrt{2}t_2}{3}$	$\frac{1}{3}i\sqrt{2}kt_2$	0	0	0	0
$\omega_1^{\#2} + \alpha\beta$	$\frac{\sqrt{2}t_2}{3}$	$\frac{t_2}{3}$	$\frac{ikt_2}{3}$	0	0	0	0
$f_1^{\#1} + \alpha\beta$	$-\frac{1}{3}i\sqrt{2}kt_2$	$-\frac{1}{3}ikt_2$	$\frac{k^2t_2}{3}$	0	0	0	0
$\omega_1^{\#1} + \alpha$	0	0	0	$\frac{2t_3}{3}$	$-\frac{\sqrt{2}t_3}{3}$	0	$-\frac{2}{3}ikt_3$
$\omega_1^{\#2} + \alpha$	0	0	0	$-\frac{\sqrt{2}t_3}{3}$	$\frac{t_3}{3}$	0	$\frac{1}{3}i\sqrt{2}kt_3$
$f_1^{\#1} + \alpha$	0	0	0	0	0	0	0
$f_1^{\#2} + \alpha$	0	0	0	$\frac{2ikt_3}{3}$	$-\frac{1}{3}i\sqrt{2}kt_3$	0	$\frac{2k^2t_3}{3}$

Quadratic (free) action

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$$\begin{aligned} & \iiint \left(\frac{1}{6} (-4t_3 \omega_{\alpha}^{\alpha\iota} \omega_{\iota}^{\kappa} \omega_{\kappa}^{\alpha\beta} \tau_{\alpha\beta} + 6 \omega^{\alpha\beta\chi} \sigma_{\alpha\beta\chi} + 8t_3 \omega_{\alpha}^{\kappa} \partial_{\iota} f^{\alpha\iota} - 8t_3 \omega_{\iota}^{\kappa} \partial_{\alpha} f^{\alpha\iota} - \right. \\ & \quad \partial_{\alpha}^{\iota} f^{\alpha} + 4t_3 \partial_{\iota} f_{\kappa}^{\kappa} \partial_{\alpha}^{\iota} f_{\alpha}^{\alpha} + 4t_2 \omega_{\iota\theta\alpha} \partial^{\theta} f^{\alpha\iota} + 2t_2 \partial_{\alpha} f_{\theta} \partial^{\theta} f^{\alpha\iota} - t_2 \partial_{\alpha} f_{\theta\iota} \partial^{\theta} f^{\alpha\iota} - \\ & \quad t_2 \partial_{\iota} f_{\alpha\theta} \partial^{\theta} f^{\alpha\iota} + t_2 \partial_{\theta} f_{\alpha\iota} \partial^{\theta} f^{\alpha\iota} - t_2 \partial_{\theta} f_{\iota\alpha} \partial^{\theta} f^{\alpha\iota} - 4t_2 \omega_{\alpha\theta\iota} (\omega^{\alpha\iota\theta} + \partial^{\theta} f^{\alpha\iota}) + \\ & \quad 2t_2 \omega_{\alpha\iota\theta} (\omega^{\alpha\iota\theta} + 2 \partial^{\theta} f^{\alpha\iota}) + 8r_2 \partial_{\beta} \omega_{\alpha\iota\theta} \partial^{\theta} \omega_{\alpha\beta\iota} - 4r_2 \partial_{\beta} \omega_{\alpha\theta\iota} \partial^{\theta} \omega_{\alpha\beta\iota} + \\ & \quad 4r_2 \partial_{\beta} \omega_{\iota\theta\alpha} \partial^{\theta} \omega_{\alpha\beta\iota} - 2r_2 \partial_{\iota} \omega_{\alpha\beta\theta} \partial^{\theta} \omega^{\alpha\beta\iota} + 2r_2 \partial_{\theta} \omega_{\alpha\beta\iota} \partial^{\theta} \omega^{\alpha\beta\iota} - \\ & \quad \left. 4r_2 \partial_{\theta} \omega_{\alpha\iota\beta} \partial^{\theta} \omega_{\alpha\beta\iota} + 4t_3 \partial_{\iota} f^{\alpha\iota} \partial_{\kappa} f_{\alpha}^{\kappa} - 8t_3 \partial_{\iota} f_{\alpha}^{\alpha} \partial_{\kappa} f_{\iota}^{\kappa} \right) [t, x, y, z] dz dy dx dt \end{aligned}$$

	$\omega_{0+}^{\#1}$	$f_{0+}^{\#1}$	$f_{0+}^{\#2}$	$\omega_0^{\#1}$
$\omega_{0+}^{\#1} \dagger$	t_3	$-i \sqrt{2} k t_3$	0	0
$f_{0+}^{\#1} \dagger$	$i \sqrt{2} k t_3$	$2 k^2 t_3$	0	0
$f_{0+}^{\#2} \dagger$	0	0	0	0
$\omega_0^{\#1} \dagger$	0	0	0	$k^2 r_2 + t_2$

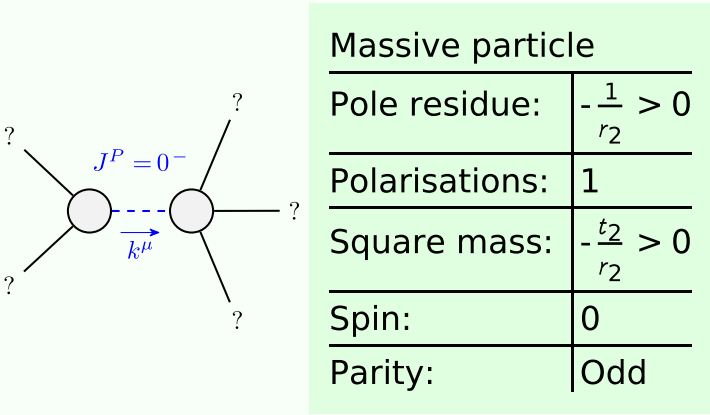
Source constraints/gauge generators	
SO(3) irreps	Multiplicities
$\tau_{0+}^{\#2} == 0$	1
$\tau_{0+}^{\#1} - 2 \, i \, k \, \sigma_{0+}^{\#1} == 0$	1
$\tau_{1-}^{\#2\alpha} - i \, k \, \sigma_{1-}^{\#1\alpha} == 0$	3
$\tau_{1-}^{\#1\alpha} == 0$	3
$\sigma_{1-}^{\#1\alpha} + 2 \, \sigma_{1-}^{\#2\alpha} == 0$	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
$\sigma_{2+}^{\#1\alpha\beta} == 0$	5
Total constraints:	32

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

	$\sigma_0^{\#1}$	$\tau_0^{\#1}$	$\tau_0^{\#2}$	$\sigma_0^{\#1}$
$\sigma_0^{\#1} \dagger$	$\frac{1}{(1+2k^2)^2 t_3}$	$-\frac{i\sqrt{2}k}{(1+2k^2)^2 t_3}$	0	0
$\tau_0^{\#1} \dagger$	$\frac{i\sqrt{2}k}{(1+2k^2)^2 t_3}$	$\frac{2k^2}{(1+2k^2)^2 t_3}$	0	0
$\tau_0^{\#2} \dagger$	0	0	0	0
$\sigma_0^{\#1} \dagger$	0	0	0	$\frac{1}{k^2 r_2 + t_2}$

$\sigma_2^{\#1} + \alpha\beta$	$\sigma_2^{\#1} + \alpha\beta$	$\tau_2^{\#1} + \alpha\beta$	$\sigma_2^{\#1} + \alpha\beta\chi$
0	0	0	0
$\tau_2^{\#1} + \alpha\beta$	0	0	0
$\sigma_2^{\#1} + \alpha\beta\chi$	0	0	0

Massive and massless spectra



(No massless particles)

Unitarity conditions

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