

Particle spectrograph

Wave operator and propagator

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

$\omega_{1+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1+}^{\#2} \dagger^{\alpha\beta}$	$f_{1+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1-}^{\#1} \alpha$	$\omega_{1-}^{\#2} \alpha$	$f_{1-}^{\#1} \alpha$	$f_{1-}^{\#2} \alpha$
$\frac{2 t_2}{3}$	$\frac{\sqrt{2} t_2}{3}$	$\frac{1}{3} i \sqrt{2} k t_2$	0	0	0	0
$\frac{\sqrt{2} t_2}{3}$	$\frac{t_2}{3}$	$\frac{i k t_2}{3}$	0	0	0	0
$-\frac{1}{3} i \sqrt{2} k t_2$	$-\frac{1}{3} i k t_2$	$\frac{k^2 t_2}{3}$	0	0	0	0
$\omega_1^{\#1} \dagger^{\alpha}$	0	0	$\frac{2 t_3}{3}$	$-\frac{\sqrt{2} t_3}{3}$	0	$-\frac{2}{3} i k t_3$
$\omega_1^{\#2} \dagger^{\alpha}$	0	0	$-\frac{\sqrt{2} t_3}{3}$	$\frac{t_3}{3}$	0	$\frac{1}{3} i \sqrt{2} k t_3$
$f_1^{\#1} \dagger^{\alpha}$	0	0	0	0	0	0
$f_1^{\#2} \dagger^{\alpha}$	0	0	$\frac{2 i k t_3}{3}$	$-\frac{1}{3} i \sqrt{2} k t_3$	0	$\frac{2 k^2 t_3}{3}$

Quadratic (free) action

S ==

$$\iiint [(\frac{1}{6} (-4 t_3 \omega_{\alpha}^{\alpha i} \omega_{i \kappa}^{\kappa} + 6 f^{\alpha \beta} \tau_{\alpha \beta} + 6 \omega^{\alpha \beta \chi} \sigma_{\alpha \beta \chi} + 8 t_3 \omega_{\alpha \kappa}^{\kappa} \partial_i f^{\alpha i} - 8 t_3 \omega_{i \kappa}^{\kappa} \partial^i f^{\alpha}_{\alpha} + 4 t_3 \partial_i f_{\kappa}^{\kappa} \partial^i f^{\alpha}_{\alpha} + 4 t_2 \omega_{i \theta \alpha} \partial^{\theta} f^{\alpha i} + 2 t_2 \partial_{\alpha} f_{i \theta} \partial^{\theta} f^{\alpha i} - t_2 \partial_{\alpha} f_{i \theta} \partial^{\theta} f^{\alpha i} - t_2 \partial_{\alpha} f_{\theta i} \partial^{\theta} f^{\alpha i}) + t_2 \partial_i f_{\alpha \theta} \partial^{\theta} f^{\alpha i} + t_2 \partial_{\theta} f_{\alpha i} \partial^{\theta} f^{\alpha i} - t_2 \partial_{\theta} f_{i \alpha} \partial^{\theta} f^{\alpha i} - 4 t_2 \omega_{\alpha \theta i} (\omega^{\alpha i \theta} + \partial^{\theta} f^{\alpha i}) + 2 t_2 \omega_{\alpha i \theta} (\omega^{\alpha i \theta} + 2 \partial^{\theta} f^{\alpha i}) + 8 r_2 \partial_{\beta} \omega_{\alpha i \theta} \partial^{\theta} \omega^{\alpha \beta i} - 4 r_2 \partial_{\beta} \omega_{\alpha \beta i} \partial^{\theta} \omega^{\alpha \beta i} + 4 r_2 \partial_{\theta} \omega_{\alpha i \beta} \partial^{\theta} \omega^{\alpha \beta i} - 2 r_2 \partial_i \omega_{\alpha \beta \theta} \partial^{\theta} \omega^{\alpha \beta i} + 2 r_2 \partial_{\theta} \omega_{\alpha \beta i} \partial^{\theta} \omega^{\alpha \beta i} - 4 r_2 \partial_{\theta} \omega_{\alpha i \beta} \partial^{\theta} \omega^{\alpha \beta i} + 4 t_3 \partial_i f^{\alpha i} \partial_{\kappa} f^{\kappa}_{\alpha} - 8 t_3 \partial^i f^{\alpha}_{\alpha} \partial_{\kappa} f^{\kappa}_i)] [t, x, y, z] d z d y d x d t$$

Source constraints/gauge generators

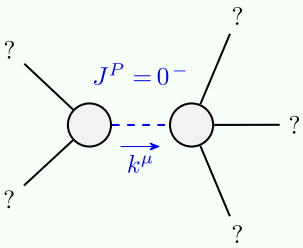
SO(3) irreps	Multiplicities
$\tau_{0+}^{\#2} == 0$	1
$\tau_{0+}^{\#1} - 2 i k \sigma_{0+}^{\#1} == 0$	1
$\tau_1^{\#2 \alpha} - i k \sigma_1^{\#1 \alpha} == 0$	3
$\tau_1^{\#1 \alpha} == 0$	3
$\sigma_1^{\#1 \alpha} + 2 \sigma_1^{\#2 \alpha} == 0$	3
$\tau_{1+}^{\#1 \alpha \beta} + i k \sigma_{1+}^{\#1 \alpha \beta} == 0$	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

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

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

	$\sigma_{2+}^{\#1} \dagger^{\alpha\beta}$	$\tau_{2+}^{\#1} \dagger^{\alpha\beta}$	$\sigma_{2-}^{\#1} \dagger^{\alpha\beta\chi}$
$\sigma_{2+}^{\#1} \dagger^{\alpha\beta}$	0	0	0
$\tau_{2+}^{\#1} \dagger^{\alpha\beta}$	0	0	0
$\sigma_{2-}^{\#1} \dagger^{\alpha\beta\chi}$	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

(No massless particles)

Unitarity conditions

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