Particle spectrograph

Wave operator and propagator

Quadratic (free) action

$$S = \iiint\int \left(\tfrac{1}{6}\left(6\,f^{\alpha\beta}\,\tau_{\alpha\beta} + 6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} + 12\,r_1\,\partial_\beta\omega_{\ \ \theta}^{\ \theta}\,\partial'\omega^{\alpha\beta}{}_{\alpha} - 24\,r_3\,\partial_\beta\omega_{\ \ \theta}^{\ \theta}\,\partial'\omega^{\alpha\beta}{}_{\alpha} + 12\,r_1\,\partial_\alpha\omega^{\alpha\beta\iota}\,\partial_\theta\omega_{\ \ \iota}^{\theta}\,\partial'\omega^{\alpha\beta}{}_{\beta} - 24\,r_1\,\partial'\omega^{\alpha\beta}{}_{\alpha}\,\partial_\theta\omega_{\ \ \beta}^{\theta} + 12\,r_1\,\partial_\alpha\omega^{\alpha\beta\iota}\,\partial_\theta\omega_{\ \ \iota}^{\theta}\,\partial_\theta\omega_{\ \ \beta}^{\theta} - 24\,r_1\,\partial'\omega^{\alpha\beta}{}_{\alpha}\,\partial_\theta\omega_{\ \ \beta}^{\theta} + 48\,r_3\,\partial'\omega^{\alpha\beta}{}_{\alpha}\,\partial_\theta\omega_{\ \ \beta}^{\theta} + 4\,t_2\,\omega_{\iota\theta\alpha}\,\partial^\theta f^{\alpha\iota} + 2\,t_2\,\partial_\alpha f_{\iota\theta}\,\partial^\theta f^{\alpha\iota} - t_2\,\partial_\alpha f_{\theta\iota}\,\partial^\theta f^{\alpha\iota} - t_2\,\partial_\theta f_{\ \alpha\iota}\,\partial^\theta f^{\alpha\iota} - 4\,t_2\,\omega_{\alpha\theta\iota}\,(\omega^{\alpha\iota\theta} + \partial^\theta f^{\alpha\iota}) + 2\,t_2\,\omega_{\alpha\iota\theta}\,(\omega^{\alpha\iota\theta} + 2\,\partial^\theta f^{\alpha\iota}) - 8\,r_1\,\partial_\beta\omega_{\alpha\iota\theta}\,\partial^\theta\omega^{\alpha\beta\iota} + 8\,r_2\,\partial_\beta\omega_{\alpha\iota\theta}\,\partial^\theta\omega^{\alpha\beta\iota} + 4\,r_1\,\partial_\beta\omega_{\alpha\theta\iota}\,\partial^\theta\omega^{\alpha\beta\iota} - 4\,r_2\,\partial_\beta\omega_{\alpha\theta\iota}\,\partial^\theta\omega^{\alpha\beta\iota} + 8\,r_1\,\partial_\beta\omega_{\iota\theta\alpha}\,\partial^\theta\omega^{\alpha\beta\iota} + 4\,r_2\,\partial_\beta\omega_{\iota\theta\alpha}\,\partial^\theta\omega^{\alpha\beta\iota} - 24\,r_3\,\partial_\beta\omega_{\iota\theta\alpha}\,\partial^\theta\omega^{\alpha\beta\iota} - 4\,r_1\,\partial_\iota\omega_{\alpha\beta\theta}\,\partial^\theta\omega^{\alpha\beta\iota} + 4\,r_1\,\partial_\theta\omega_{\alpha\beta\iota}\,\partial^\theta\omega^{\alpha\beta\iota} + 2\,r_2\,\partial_\theta\omega_{\alpha\beta\iota}\,\partial^\theta\omega^{\alpha\beta\iota} + 4\,r_1\,\partial_\theta\omega_{\alpha\iota\beta}\,\partial^\theta\omega^{\alpha\beta\iota} - 4\,r_2\,\partial_\theta\omega_{\alpha\iota\beta}\,\partial^\theta\omega^{\alpha\beta\iota}\right)\right)[t,\,x,\,y,\,z]\,dt\,dx\,dy\,dz$$

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\,\dagger$	$6\,k^2\,(-r_1+r_3)$	0	0	0
$f_{0^+}^{\#1}\,\dagger$	0	0	0	0
$f_{0^+}^{\#2}\,\dagger$	0	0	0	0
$\omega_{0^-}^{\#1}\,\dagger$	0	0	0	$k^2\,r_2 + t_2$

	$\omega_{2^+}^{\#1\,\alpha\beta}$	$f_{2^+}^{\#1\,\alpha\beta}$	$\omega_{2^-}^{\#1\,\alpha\beta\chi}$
$\omega_{2^+}^{\#1}\,\dagger^{\alpha\beta}$	0	0	0
$f_{2^+}^{\#1}\,\dagger^{\alpha\beta}$	0	0	0
$\omega_{2^-}^{\#1}\,\dagger^{\alpha\beta\chi}$	0	0	$k^2\,r_1$

	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}\,\dagger$	$\frac{1}{6\,k^2\,(-r_1+r_3)}$	0	0	0
$\tau_{0^+}^{\#1}\,\dagger$	0	0	0	0
$\tau_{0^+}^{\#2}\,\dagger$	0	0	0	0
$\sigma_{0^-}^{\#1}\,\dagger$	0	0	0	$\frac{1}{k^2\,r_2+t_2}$

	$\omega_{1^+}^{\#1\,\alpha\beta}$	$\omega_{1^+}^{\#2\,\alpha\beta}$	$f_{1^+}^{\#1\,\alpha\beta}$	$\omega_{1^-}^{\#1\,\alpha}$	$\omega_{1^-}^{\#2\,\alpha}$	$f_{1^-}^{\#1\,\alpha}$	$f_{1^-}^{\#2\,\alpha}$
$\omega_{1^+}^{\#1\,\alpha\beta}$	$\frac{2\,t_2}{3}$	$\frac{\sqrt{2}\,t_2}{3}$	$-\frac{1}{3}\,i\,\sqrt{2}\,k\,t_2$	0	0	0	0
$\omega_{1^+}^{\#2\,\alpha\beta}$	$\frac{\sqrt{2}\,t_2}{3}$	$\frac{t_2}{3}$	$-\frac{1}{3}\,i\,k\,t_2$	0	0	0	0
$f_{1^+}^{\#1\,\alpha\beta}$	$-\frac{1}{3}\,i\,\sqrt{2}\,k\,t_2$	$-\frac{i\,k\,t_2}{3}$	$\frac{k^2\,t_2}{3}$	0	0	0	0
$\omega_{1^-}^{\#1\,\alpha}$	0	0	0	$-k^2\,r_1$	0	0	0
$\omega_{1^-}^{\#2\,\alpha}$	0	0	0	0	0	0	0
$f_{1^-}^{\#1\,\alpha}$	0	0	0	0	0	0	0
$f_{1^-}^{\#2\,\alpha}$	0	0	0	0	0	0	0

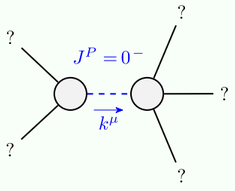
	$\sigma_{1^+}^{\#1\,\alpha\beta}$	$\sigma_{1^+}^{\#2\,\alpha\beta}$	$\tau_{1^+}^{\#1\,\alpha\beta}$	$\sigma_{1^-}^{\#1\,\alpha}$	$\tau_{1^-}^{\#1\,\alpha}$	$\tau_{1^-}^{\#2\,\alpha}$
$\sigma_{1^+}^{\#1\,\alpha\beta}$	$\frac{6}{(3+k^2)^2\,t_2}$	$\frac{3\,\sqrt{2}}{(3+k^2)^2\,t_2}$	$-\frac{3\,i\,\sqrt{2}\,k}{(3+k^2)^2\,t_2}$	0	0	0
$\sigma_{1^+}^{\#2\,\alpha\beta}$	$\frac{3\,\sqrt{2}}{(3+k^2)^2\,t_2}$	$\frac{3}{(3+k^2)^2\,t_2}$	$-\frac{3\,i\,k}{(3+k^2)^2\,t_2}$	0	0	0
$\tau_{1^+}^{\#1\,\alpha\beta}$	$-\frac{3\,i\,\sqrt{2}\,k}{(3+k^2)^2\,t_2}$	$-\frac{3\,i\,k}{(3+k^2)^2\,t_2}$	$\frac{3\,k^2}{(3+k^2)^2\,t_2}$	0	0	0
$\sigma_{1^-}^{\#1\,\alpha}$	0	0	0	$-\frac{1}{k^2\,r_1}$	0	0
$\tau_{1^-}^{\#1\,\alpha}$	0	0	0	0	0	0
$\tau_{1^-}^{\#2\,\alpha}$	0	0	0	0	0	0

	$\sigma_{2^+}^{\#1\,\alpha\beta}$	$\tau_{2^+}^{\#1\,\alpha\beta}$	$\sigma_{2^-}^{\#1\,\alpha\beta\chi}$
$\sigma_{2^+}^{\#1\,\alpha\beta}$	0	0	$\frac{1}{k^2\,r_1}$
$\tau_{2^+}^{\#1\,\alpha\beta}$	0	0	0
$\sigma_{2^-}^{\#1\,\alpha\beta\chi}$	0	0	0

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\tau_{0^+}^{\#2} == 0$	1
$\tau_{0^+}^{\#1} == 0$	1
$\tau_{1^-}^{\#2\,\alpha} == 0$	3
$\tau_{1^-}^{\#1\,\alpha} == 0$	3
$\sigma_{1^-}^{\#2\,\alpha} == 0$	3
$\tau_{1^+}^{\#1\,\alpha\beta} + i\,i\,k\,\sigma_{1^+}^{\#1\,\alpha\beta} == 0$	3
$\sigma_{1^+}^{\#1\,\alpha\beta} == \sigma_{1^+}^{\#2\,\alpha\beta}$	3
$\tau_{2^+}^{\#1\,\alpha\beta} == 0$	5
$\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	5
Total constraints:	27

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

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