Particle spectrograph

Wave operator and propagator

	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}\dagger$	$\frac{1}{(1+2k^2)^2 t_3}$	$-\frac{i\sqrt{2}\,k}{(1+2k^2)^2 t_3}$	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	$-\frac{1}{t_1}$

	$\sigma_{2^+\,\alpha\beta}^{\#1}$	$\tau_{2^+\,\alpha\beta}^{\#1}$	$\sigma_{2^-\,\alpha\beta\chi}^{\#1}$
$\sigma_{2^+}^{\#1}\dagger^{\alpha\beta}$	$\frac{2}{(1+2k^2)^2 t_1}$	$-\frac{2i\sqrt{2}\,k}{(1+2k^2)^2 t_1}$	0
$\tau_{2^+}^{\#1}\dagger^{\alpha\beta}$	$\frac{2i\sqrt{2}\,k}{(1+2k^2)^2 t_1}$	$\frac{4k^2}{(1+2k^2)^2 t_1}$	0
$\sigma_{2^-}^{\#1}\dagger^{\alpha\beta\chi}$	0	0	$\frac{2}{t_1}$

Source constraints/gauge generators	Multiplicities
SO(3) irreps	
$\tau_{0^+}^{\#2} == 0$	1
$\tau_{0^+}^{\#1} - 2i k\,\sigma_{0^+}^{\#1} == 0$	1
$\tau_{1^-}^{\#2\,\alpha} + 2i k\,\sigma_{1^-}^{\#2\,\alpha} == 0$	3
$\tau_{1^-}^{\#1\,\alpha} == 0$	3
$\tau_{1^+}^{\#1\,\alpha\beta} + i k\,\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	3
$\tau_{2^+}^{\#1\,\alpha\beta} - 2i k\,\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	5
Total constraints:	16

	$\sigma_{1^+\,\alpha\beta}^{\#1}$	$\sigma_{1^+\,\alpha\beta}^{\#2}$	$\tau_{1^+\,\alpha\beta}^{\#1}$	$\sigma_{1^-\,\alpha}^{\#1}$	$\tau_{1^-\,\alpha}^{\#2}$	$\sigma_{1^-\,\alpha}^{\#2}$	$\tau_{1^-\,\alpha}^{\#1}$
$\sigma_{1^+}^{\#1}\dagger^{\alpha\beta}$	0	$-\frac{\sqrt{2}}{t_1+k^2 t_1}$	$-\frac{i\sqrt{2}\,k}{t_1+k^2 t_1}$	0	0	$\frac{\sqrt{2}\,(t_1-2t_3)}{(1+2k^2)(3t_1 t_3+2k^2 r_5 (t_1+t_3))}$	0
$\sigma_{1^+}^{\#2}\dagger^{\alpha\beta}$	$-\frac{\sqrt{2}}{t_1+k^2 t_1}$	$-\frac{2k^2 r_5+t_1}{(1+k^2)^2 t_1^2}$	$-\frac{i(2k^3 r_5-k t_1)}{(1+k^2)^2 t_1^2}$	0	0	$\frac{6k^2 r_5+t_1+4t_3}{(1+2k^2)^2 (3t_1 t_3+2k^2 r_5 (t_1+t_3))}$	0
$\tau_{1^+}^{\#1}\dagger^{\alpha\beta}$	$\frac{i\sqrt{2}\,k}{t_1+k^2 t_1}$	$\frac{i(2k^3 r_5-k t_1)}{(1+k^2)^2 t_1^2}$	$-\frac{2k^4 r_5+k^2 t_1}{(1+k^2)^2 t_1^2}$	0	0	$\frac{i\sqrt{2}\,k(6k^2 r_5+t_1+4t_3)}{(1+2k^2)^2 (3t_1 t_3+2k^2 r_5 (t_1+t_3))}$	0
$\sigma_{1^-}^{\#1}\dagger^{\alpha}$	0	0	0	$\frac{2(t_1+t_3)}{3t_1 t_3+2k^2 r_5 (t_1+t_3)}$	0	$\frac{\sqrt{2}\,(t_1-2t_3)}{(1+2k^2)(3t_1 t_3+2k^2 r_5 (t_1+t_3))}$	0
$\sigma_{1^-}^{\#2}\dagger^{\alpha}$	0	0	0	0	0	$\frac{6k^2 r_5+t_1+4t_3}{(1+2k^2)^2 (3t_1 t_3+2k^2 r_5 (t_1+t_3))}$	0
$\tau_{1^-}^{\#1}\dagger^{\alpha}$	0	0	0	$\frac{2i k(t_1-2t_3)}{(1+2k^2)(3t_1 t_3+2k^2 r_5 (t_1+t_3))}$	0	$-\frac{i\sqrt{2}\,k(6k^2 r_5+t_1+4t_3)}{(1+2k^2)^2 (3t_1 t_3+2k^2 r_5 (t_1+t_3))}$	0
$\tau_{1^-}^{\#2}\dagger^{\alpha}$	0	0	0	0	0	$-\frac{2k^2 (6k^2 r_5+t_1+4t_3)}{(1+2k^2)^2 (3t_1 t_3+2k^2 r_5 (t_1+t_3))}$	0

	$\omega_{1^+\,\alpha\beta}^{\#1}$	$\omega_{1^+\,\alpha\beta}^{\#2}$	$f_{1^+\,\alpha\beta}^{\#1}$	$\omega_{1^-\,\alpha}^{\#1}$	$\omega_{1^-\,\alpha}^{\#2}$	$f_{1^-\,\alpha}^{\#2}$	$f_{1^-\,\alpha}^{\#1}$
$\omega_{1^+}^{\#1}\dagger^{\alpha\beta}$	$k^2 r_5-\frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$-\frac{i k t_1}{\sqrt{2}}$	0	0	0	0
$\omega_{1^+}^{\#2}\dagger^{\alpha\beta}$	$-\frac{t_1}{\sqrt{2}}$	0	0	0	0	0	0
$f_{1^+}^{\#1}\dagger^{\alpha\beta}$	$\frac{i k t_1}{\sqrt{2}}$	0	0	0	0	0	0
$\omega_{1^-}^{\#1}\dagger^{\alpha}$	0	0	0	$\frac{1}{6}(6k^2 r_5+t_1+4t_3)$	$\frac{t_1-2t_3}{3\sqrt{2}}$	$\frac{1}{3}i k (t_1-2t_3)$	0
$\omega_{1^-}^{\#2}\dagger^{\alpha}$	0	0	0	$\frac{t_1-2t_3}{3\sqrt{2}}$	$\frac{t_1+t_3}{3}$	$\frac{2}{3}k^2 (t_1+t_3)$	0
$f_{1^-}^{\#1}\dagger^{\alpha}$	0	0	0	0	0	$-\frac{1}{3}i\sqrt{2}\,k (t_1+t_3)$	0
$f_{1^-}^{\#2}\dagger^{\alpha}$	0	0	0	$-\frac{1}{3}i k (t_1-2t_3)$	$-\frac{1}{3}i\sqrt{2}\,k (t_1+t_3)$	0	0

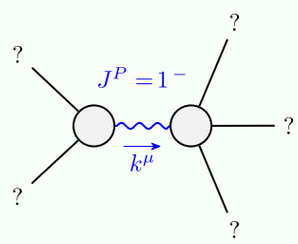
	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\dagger$	t_3	$-i\sqrt{2}\,k t_3$	0	0
$f_{0^+}^{\#1}\dagger$	$i\sqrt{2}\,k t_3$	$2k^2 t_3$	0	0
$f_{0^+}^{\#2}\dagger$	0	0	0	0
$\omega_{0^-}^{\#1}\dagger$	0	0	0	$-t_1$

	$\omega_{2^+\,\alpha\beta}^{\#1}$	$f_{2^+\,\alpha\beta}^{\#1}$	$\omega_{2^-\,\alpha\beta\chi}^{\#1}$
$\omega_{2^+}^{\#1}\dagger^{\alpha\beta}$	$\frac{t_1}{2}$	$-\frac{i k t_1}{\sqrt{2}}$	0
$f_{2^+}^{\#1}\dagger^{\alpha\beta}$	$\frac{i k t_1}{\sqrt{2}}$	$k^2 t_1$	0
$\omega_{2^-}^{\#1}\dagger^{\alpha\beta\chi}$	0	0	$\frac{t_1}{2}$

Quadratic (free) action

$$S == \int\int\int (\tfrac{1}{6}(2\,\omega^{\alpha\prime}{}_{\alpha}\,(t_1\,\omega_{\prime}{}^{\theta}{}_{\theta} - 2\,t_3\,\omega_{\prime}{}^{\kappa}{}_{\kappa}) + 6\,f^{\alpha\beta}\,\tau_{\alpha\beta} + 6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - 4\,t_1\,\omega_{\alpha\theta\prime}\,(\omega^{\alpha\prime\theta} + 2\,\partial^{\theta} f^{\alpha\prime}) + 6\,r_5\,\partial_{\prime}\omega^{\kappa}{}_{\theta}\,\partial^{\theta}\omega^{\alpha\prime}{}_{\alpha} - 6\,r_5\,\partial_{\theta}\omega^{\kappa}{}_{\prime}\,\partial^{\theta}\omega^{\alpha\prime}{}_{\alpha} + \partial_{\prime} f^{\alpha\prime} - 8\,t_3\,\omega^{\kappa}{}_{\alpha\,\kappa}\,\partial_{\prime} f^{\alpha\prime} + 4\,t_1\,\omega_{\prime}{}^{\theta}{}_{\theta}\,\partial^{\prime} f^{\alpha}{}_{\alpha} - 8\,t_3\,\omega_{\prime}{}^{\kappa}{}_{\kappa}\,\partial^{\prime} f^{\alpha}{}_{\alpha} - 2\,t_1\,\partial_{\prime} f^{\theta}{}_{\theta}\,\partial^{\prime} f^{\alpha}{}_{\alpha} + 4\,t_3\,\partial_{\prime} f^{\kappa}{}_{\kappa}\,\partial^{\prime} f^{\alpha}{}_{\alpha} - 2\,t_1\,\partial_{\prime} f^{\alpha\prime}\,\partial_{\theta} f^{\theta}{}_{\alpha} + 4\,t_1\,\partial^{\prime} f^{\alpha}{}_{\alpha}\,\partial_{\theta} f^{\theta}{}_{\prime} - 6\,t_1\,\partial_{\alpha} f_{\prime\theta}\,\partial^{\theta} f^{\alpha\prime} - 6\,t_1\,\partial_{\alpha} f_{\theta\prime}\,\partial^{\theta} f^{\alpha\prime} + 3\,t_1\,\partial_{\alpha\theta} f_{\prime}{}^{\theta}\,\partial^{\theta} f^{\alpha\prime} + 3\,t_1\,\partial_{\theta} f_{\alpha\prime}\,\partial^{\theta} f^{\alpha\prime} + 3\,t_1\,\partial_{\theta} f_{\prime\alpha}\,\partial^{\theta} f^{\alpha\prime} + 4\,t_3\,\partial_{\prime} f^{\alpha\prime}\,\partial_{\kappa} f_{\alpha}{}^{\kappa} - 8\,t_3\,\partial^{\prime} f^{\alpha}{}_{\alpha}\,\partial_{\kappa} f_{\prime}{}^{\kappa} - 6\,r_5\,\partial_{\alpha}\omega^{\alpha\theta}\,\partial_{\kappa}\omega_{\prime}{}^{\kappa}{}_{\theta} + 12\,r_5\,\partial^{\theta}\omega^{\alpha\prime}{}_{\alpha}\,\partial_{\kappa}\omega_{\prime}{}^{\kappa}{}_{\theta} + 6\,r_5\,\partial_{\alpha}\omega^{\alpha\theta}\,\partial_{\kappa}\omega_{\theta}{}^{\kappa}{}_{\prime} - 12\,r_5\,\partial^{\theta}\omega^{\alpha\prime}{}_{\alpha}\,\partial_{\kappa}\omega_{\theta}{}^{\kappa}{}_{\prime}))[t, x, y, z]\,dt\,dz\,dy\,dx\,dt$$

Massive and massless spectra



Massive particle	
Pole residue:	$\frac{6t_1 t_3 (t_1+t_3)-3r_5 (t_1^2+2t_3^2)}{2r_5 (t_1+t_3)(-3t_1 t_3+r_5 (t_1+t_3))} > 0$
Polarisations:	3
Square mass:	$-\frac{3t_1 t_3}{2r_5 t_1+2r_5 t_3} > 0$
Spin:	1
Parity:	Odd

(No massless particles)

Unitarity conditions

$r_5 < 0 \;\&\&\; (t_1 < 0 \;\&\&\; 0 < t_3 < -t_1) \,||\, (t_1 > 0 \;\&\&\; (t_3 < -t_1 \,||\, t_3 > 0))$