Particle spectrograph

Wave operator and propagator

	$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$-\frac{i\sqrt{2}\,k}{t_1+k^2 t_1}$	0	0	0	0
$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	$-\frac{\sqrt{2}}{t_1+k^2 t_1}$	$\frac{1}{\sqrt{2}\,(k^2+2k^4)(r_1+r_5)}$	$-\frac{6k^2(r_1+r_5)+t_1}{\sqrt{2}\,(k+2k^3)^2(r_1+r_5)t_1}$	0	$\frac{i(6k^2(r_1+r_5)+t_1)}{\sqrt{2}\,k(1+2k^2)^2(r_1+r_5)t_1}$
$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	$\frac{i\sqrt{2}\,k}{t_1+k^2 t_1}$	$\frac{1}{\sqrt{2}\,(k^2+2k^4)(r_1+r_5)}$	$-\frac{6k^2(r_1+r_5)+t_1}{2(k+2k^3)^2(r_1+r_5)t_1}$	0	$-\frac{i(6k^2(r_1+r_5)+t_1)}{\sqrt{2}\,k(1+2k^2)^2(r_1+r_5)t_1}$
$\sigma_{1^-}^{\#1}{}_{\alpha}$	0	$\frac{1}{k^2(r_1+r_5)}$	$-\frac{1}{\sqrt{2}\,(k^2+2k^4)(r_1+r_5)}$	0	$-\frac{i}{k(1+2k^2)(r_1+r_5)}$
$\sigma_{1^-}^{\#2}{}_{\alpha}$	0	0	0	0	0
$\tau_{1^-}^{\#1}{}_{\alpha}$	0	0	0	0	0
$\tau_{1^-}^{\#2}{}_{\alpha}$	0	$\frac{i}{k(1+2k^2)(r_1+r_5)}$	$-\frac{i(6k^2(r_1+r_5)+t_1)}{\sqrt{2}\,k(1+2k^2)^2(r_1+r_5)t_1}$	0	$\frac{6k^2(r_1+r_5)+t_1}{(1+2k^2)^2(r_1+r_5)t_1}$

	$\sigma_{2^+}^{\#1}{}_{\alpha\beta}$	$\tau_{2^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{2^-}^{\#1}{}_{\alpha\beta\chi}$
$\sigma_{2^+}^{\#1\,\alpha\beta}$	$\frac{2}{(1+2k^2)^2 t_1}$	$-\frac{2i\sqrt{2}\,k}{(1+2k^2)^2 t_1}$	0
$\tau_{2^+}^{\#1\,\alpha\beta}$	$\frac{2i\sqrt{2}\,k}{(1+2k^2)^2 t_1}$	$\frac{4k^2}{(1+2k^2)^2 t_1}$	0
$\sigma_{2^-}^{\#1\,\alpha\beta\chi}$	0	0	$\frac{2}{2k^2 r_1+t_1}$

	$\omega_{2^+}^{\#1\,\alpha\beta}$	$f_{2^+}^{\#1\,\alpha\beta}$	$\omega_{2^-}^{\#1\,\alpha\beta\chi}$
$\omega_{2^+}^{\#1\,\alpha\beta}$	$\frac{t_1}{2}$	$\frac{ikt_1}{\sqrt{2}}$	0
$f_{2^+}^{\#1\,\alpha\beta}$	$-\frac{ikt_1}{\sqrt{2}}$	$k^2 t_1$	0
$\omega_{2^-}^{\#1\,\alpha\beta\chi}$	0	0	$k^2 r_1+\frac{t_1}{2}$

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\sigma_{0^+}^{\#1} == 0$	1
$\tau_{0^+}^{\#1} == 0$	1
$\tau_{0^+}^{\#2} == 0$	1
$\tau_{1^-}^{\#2\,\alpha} + 2ik\,\sigma_{1^-}^{\#2\,\alpha} == 0$	3
$\tau_{1^-}^{\#1\,\alpha} == 0$	3
$\tau_{1^+}^{\#1\,\alpha\beta} + ik\,\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	3
$\tau_{2^+}^{\#1\,\alpha\beta} - 2ik\,\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	5
Total constraints:	17

Quadratic (free) action

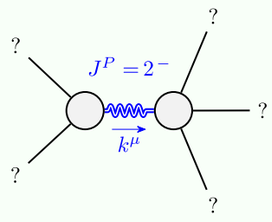
$$S_F == \iiint\Big(\tfrac{1}{6}(-2t_1\,\omega_\iota^{\alpha\prime}{}_\kappa\,\omega_{\kappa\alpha}^{\prime}{}^\kappa - 6t_1\,\omega_\iota^{\kappa}{}_\alpha\,\omega_{\kappa\lambda}^{\prime}{}^\lambda{}_\theta\,\omega_\kappa^{\prime}{}^{\alpha\theta} + 6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - 6r_5\,\partial_\iota\omega^{\kappa\lambda}{}_\kappa + 6\,f^{\alpha\beta}\,\tau_{\alpha\beta} + 6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - 6r_5\,\partial_\iota\omega^{\kappa\lambda}{}_\kappa + 4r_1\,\partial^\alpha\omega^{\kappa\beta\theta}\,\partial_\kappa\omega_{\alpha\beta\theta} - \partial^\prime\omega_\lambda{}^\alpha{}_\alpha - 4r_1\,\partial^\beta\omega^{\theta\alpha}{}_\kappa\,\partial_\theta\omega_{\alpha\beta}{}^\kappa - 4r_1\,\partial_\theta\omega_{\alpha\beta}{}^\kappa\,\partial_\kappa\omega^{\theta\alpha\beta} + 6r_5\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial_\kappa\omega^{\theta\kappa\lambda} + 6r_5\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial_\kappa\omega^{\kappa\lambda\theta} + 12r_5\,\partial_\theta\omega_\lambda{}^\alpha{}_\alpha\,\partial_\kappa\omega^{\kappa\lambda\theta} - 3t_1\,\partial^\alpha f_{\theta\kappa}\,\partial^\kappa f_\alpha{}^\theta - 3t_1\,\partial^\alpha f_\kappa{}^\theta\,\partial^\kappa f_\alpha{}^\lambda + 2t_1\,\omega_{\kappa\alpha}{}^\alpha\,\partial^\kappa f_\iota^{\prime} + 2t_1\,\omega_{\kappa\lambda}{}^\lambda\,\partial^\kappa f_\iota^{\prime} + 4t_1\,\partial^\alpha f_{\kappa\alpha}\,\partial^\kappa f_\iota^{\prime} - 2t_1\,\partial_\kappa f_\lambda{}^\lambda\,\partial^\kappa f_\iota^{\prime} + 12t_1\,\omega_{\iota\kappa\theta}\,\partial^\kappa f^{\prime\theta} - 2t_1\,\omega_{\iota\lambda}{}^\lambda\,\partial^\kappa f_\kappa^{\prime} + 3t_1\,\partial^\alpha f^\kappa{}_\lambda\,\partial^\lambda f_{\kappa\alpha} + 3t_1\,\partial_\kappa f_\theta{}^\lambda\,\partial^\kappa f_\lambda{}^\theta + 3t_1\,\partial_\kappa f^\lambda{}_\theta\,\partial^\kappa f_\lambda{}^\theta - 2t_1\,\partial^\alpha f^\kappa{}_\lambda\,\partial^\lambda f_{\kappa\alpha} + 4r_1\,\partial^\alpha f^\lambda{}_\alpha\,\partial^\kappa f_{\lambda\kappa} + 4r_1\,\partial_\kappa\omega^{\alpha\beta\theta}\,\partial^\kappa\omega_{\alpha\beta\theta} - 16r_1\,\partial^\beta\omega_\iota^{\lambda\alpha}\,\partial_\lambda\omega_{\alpha\beta}^{\prime} + 4r_1\,\partial_\kappa\omega^{\theta\alpha\beta}\,\partial^\kappa\omega_{\alpha\beta\theta} + 4r_1\,\partial^\alpha\omega^{\theta\kappa}{}_\kappa\,\partial^\lambda\omega_{\lambda\alpha}{}^\theta - 6r_5\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial^\lambda\omega^{\theta\kappa}{}_\kappa)\big)[t,x,y,z]\,dz\,dy\,dx\,dt$$

	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1\,\dagger}$	0	0	0	$-\frac{1}{t_1}$
$\tau_{0^+}^{\#1\,\dagger}$	0	0	0	0
$\tau_{0^+}^{\#2\,\dagger}$	0	0	0	0
$\sigma_{0^-}^{\#1\,\dagger}$	0	0	0	0

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

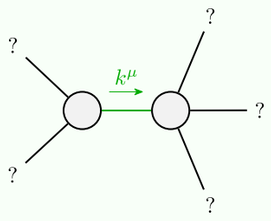
	$\omega_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^+}^{\#2}{}_{\alpha\beta}$	$f_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^-}^{\#1}{}_{\alpha}$	$\omega_{1^-}^{\#2}{}_{\alpha}$	$f_{1^-}^{\#1}{}_{\alpha}$	$f_{1^-}^{\#2}{}_{\alpha}$
$\omega_{1^+}^{\#1\,\alpha\beta\,\dagger}$	$k^2(2r_1+r_5)-\frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$-\frac{ikt_1}{\sqrt{2}}$	0	0	0	0
$\omega_{1^+}^{\#2\,\alpha\beta\,\dagger}$	$-\frac{t_1}{\sqrt{2}}$	0	0	0	0	0	0
$f_{1^+}^{\#1\,\alpha\beta\,\dagger}$	$\frac{ikt_1}{\sqrt{2}}$	0	0	0	0	0	0
$\omega_{1^-}^{\#1\,\alpha\,\dagger}$	0	0	0	$k^2(r_1+r_5)+\frac{t_1}{6}$	$\frac{t_1}{3\sqrt{2}}$	0	$\frac{ikt_1}{3}$
$\omega_{1^-}^{\#2\,\alpha\,\dagger}$	0	0	0	$\frac{t_1}{3\sqrt{2}}$	$\frac{t_1}{3}$	0	$\frac{1}{3}i\sqrt{2}\,kt_1$
$f_{1^-}^{\#1\,\alpha\,\dagger}$	0	0	0	0	0	0	0
$f_{1^-}^{\#2\,\alpha\,\dagger}$	0	0	0	$-\frac{1}{3}ikt_1$	$-\frac{1}{3}i\sqrt{2}\,kt_1$	0	$\frac{2k^2t_1}{3}$

Massive and massless spectra



Massive particle

Pole residue:	$-\frac{1}{r_1} > 0$
Polarisations:	5
Square mass:	$-\frac{t_1}{2r_1} > 0$
Spin:	2
Parity:	Odd



Quadratic pole

Pole residue:	$-\frac{1}{(r_1+r_5)t_1^2} > 0$
Polarisations:	2

Unitarity conditions

$r_1 < 0 \;\&\&\; r_5 < -r_1 \;\&\&\; t_1 > 0$