

Particle spectrograph

Wave operator and propagator

	$\sigma_{1^+}^{\#1} \alpha\beta$	$\sigma_{1^+}^{\#2} \alpha\beta$	$\tau_{1^+}^{\#1} \alpha\beta$	$\sigma_{1^+}^{\#1} \alpha$	$\sigma_{1^+}^{\#2} \alpha$	$\tau_{1^+}^{\#1} \alpha$	$\tau_{1^+}^{\#2} \alpha$
$\sigma_{1^+}^{\#1} \dagger^{\alpha\beta}$	$\frac{1}{k^2(2r_3+r_5)}$	0	0	0	0	0	0
$\sigma_{1^+}^{\#2} \dagger^{\alpha\beta}$	0	0	0	0	0	0	0
$\tau_{1^+}^{\#1} \dagger^{\alpha\beta}$	0	0	0	0	0	0	0
$\sigma_{1^+}^{\#1} \dagger^\alpha$	0	0	0	$\frac{2}{k^2(r_3+2r_5)}$	$\frac{2\sqrt{2}}{k^2(1+2k^2)(r_3+2r_5)}$	0	$\frac{4i}{k(1+2k^2)(r_3+2r_5)}$
$\sigma_{1^+}^{\#2} \dagger^\alpha$	0	0	0	$\frac{2\sqrt{2}}{k^2(1+2k^2)(r_3+2r_5)}$	$\frac{3k^2(r_3+2r_5)+4t_3}{(k+2k^3)^2(r_3+2r_5)t_3}$	0	$\frac{i\sqrt{2}(3k^2(r_3+2r_5)+4t_3)}{k(1+2k^2)^2(r_3+2r_5)t_3}$
$\tau_{1^+}^{\#1} \dagger^\alpha$	0	0	0	0	0	0	0
$\tau_{1^+}^{\#2} \dagger^\alpha$	0	0	0	$-\frac{4i}{k(1+2k^2)(r_3+2r_5)}$	$-\frac{i\sqrt{2}(3k^2(r_3+2r_5)+4t_3)}{k(1+2k^2)^2(r_3+2r_5)t_3}$	0	$\frac{6k^2(r_3+2r_5)+8t_3}{(1+2k^2)^2(r_3+2r_5)t_3}$

	$\omega_{1^+}^{\#1} \alpha\beta$	$\omega_{1^+}^{\#2} \alpha\beta$	$f_{1^+}^{\#1} \alpha\beta$	$\omega_{1^+}^{\#1} \alpha$	$\omega_{1^+}^{\#2} \alpha$	$f_{1^+}^{\#1} \alpha$	$f_{1^+}^{\#2} \alpha$
$\omega_{1^+}^{\#1} \dagger^{\alpha\beta}$	$k^2(2r_3+r_5)$	0	0	0	0	0	0
$\omega_{1^+}^{\#2} \dagger^{\alpha\beta}$	0	0	0	0	0	0	0
$f_{1^+}^{\#1} \dagger^{\alpha\beta}$	0	0	0	0	0	0	0
$\omega_{1^+}^{\#1} \dagger^\alpha$	0	0	0	$k^2(\frac{r_3}{2}+r_5)+\frac{2t_3}{3}$	$-\frac{\sqrt{2}t_3}{3}$	0	$-\frac{2}{3}i\sqrt{2}kt_3$
$\omega_{1^+}^{\#2} \dagger^\alpha$	0	0	0	$-\frac{\sqrt{2}t_3}{3}$	$\frac{t_3}{3}$	0	$\frac{1}{3}i\sqrt{2}kt_3$
$f_{1^+}^{\#1} \dagger^\alpha$	0	0	0	0	0	0	0
$f_{1^+}^{\#2} \dagger^\alpha$	0	0	0	$\frac{2ikt_3}{3}$	$-\frac{1}{3}i\sqrt{2}kt_3$	0	$\frac{2k^2t_3}{3}$

Quadratic (free) action

$S_F ==$

$$\iiint (\frac{1}{6}(4t_3\omega_{\lambda\alpha}^{\alpha'}\omega_{\kappa\alpha}^{\kappa'}+6f^{\alpha\beta}\tau_{\alpha\beta}+6\omega^{\alpha\beta\chi}\sigma_{\alpha\beta\chi}-3r_3\partial_{\lambda'}\omega_{\kappa}^{\kappa'}\partial'_{\lambda}\omega_{\alpha}^{\alpha'}-6r_5\partial_{\lambda'}\omega_{\kappa}^{\kappa'}\partial'_{\lambda}\omega_{\alpha}^{\alpha'}+3r_3\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega_{\theta}^{\theta\kappa\lambda}-6r_5\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega_{\theta}^{\theta\kappa\lambda}-3r_3\partial_{\theta}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega^{\theta\kappa\lambda}+6r_5\partial_{\theta}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega^{\theta\kappa\lambda}-3r_3\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega^{\kappa\lambda\theta}-6r_5\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega^{\kappa\lambda\theta}+6r_3\partial_{\theta}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega^{\kappa\lambda\theta}+12r_5\partial_{\theta}\omega_{\lambda}^{\alpha}\partial_{\kappa}\omega^{\kappa\lambda\theta}-4t_3\omega_{\kappa\alpha}^{\alpha}\partial^{\kappa}f_{\lambda}^{\lambda'}-4t_3\omega_{\kappa\lambda}^{\lambda}\partial^{\kappa}f_{\lambda'}^{\lambda'}-8t_3\partial^{\alpha}f_{\kappa\alpha}\partial^{\kappa}f_{\lambda}^{\lambda'}+4t_3\partial_{\kappa}f_{\lambda}^{\lambda}\partial^{\kappa}f_{\lambda'}^{\lambda'}+4t_3\omega_{\lambda\alpha}^{\alpha}\partial^{\kappa}f_{\kappa}^{\kappa'}+4t_3\omega_{\lambda\alpha}^{\alpha}\partial^{\kappa}f_{\lambda'}^{\lambda'}+4t_3\partial^{\alpha}f_{\lambda\kappa}\partial^{\kappa}f_{\alpha}^{\lambda}-24r_3\partial_{\theta}^{\beta}\omega_{\lambda}^{\lambda\alpha}\partial_{\alpha}\omega_{\beta}^{\beta'}-3r_3\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial^{\lambda}\omega_{\theta}^{\theta\kappa}+6r_5\partial_{\alpha}\omega_{\lambda}^{\alpha}\partial^{\lambda}\omega_{\theta}^{\theta\kappa}+3r_3\partial_{\theta}\omega_{\lambda}^{\alpha}\partial^{\lambda}\omega_{\kappa}^{\theta\kappa}-6r_5\partial_{\theta}\omega_{\lambda}^{\alpha}\partial^{\lambda}\omega_{\kappa}^{\theta\kappa})) [t, x, y, z] dz dy dx dt$$

	$\sigma_{2^+}^{\#1} \alpha\beta$	$\tau_{2^+}^{\#1} \alpha\beta$	$\sigma_{2^+}^{\#1} \alpha\beta\chi$
$\sigma_{2^+}^{\#1} \dagger^{\alpha\beta}$	$-\frac{2}{3k^2r_3}$	0	0
$\tau_{2^+}^{\#1} \dagger^{\alpha\beta}$	0	0	0
$\sigma_{2^+}^{\#1} \dagger^{\alpha\beta\chi}$	0	0	0

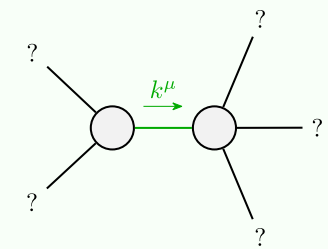
	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^+}^{\#1}$
$\sigma_{0^+}^{\#1} \dagger$	$\frac{1}{(1+2k^2)^2t_3}$	$-\frac{i\sqrt{2}k}{(1+2k^2)^2t_3}$	0	0
$\tau_{0^+}^{\#1} \dagger$	$\frac{i\sqrt{2}k}{(1+2k^2)^2t_3}$	$\frac{2k^2}{(1+2k^2)^2t_3}$	0	0
$\tau_{0^+}^{\#2} \dagger$	0	0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

Source constraints/gauge generators	Multiplicities
$\sigma_0^{\#1} == 0$	1
$\tau_0^{\#2} == 0$	1
$\tau_0^{\#1} - 2ik\sigma_0^{\#1} == 0$	1
$\tau_1^{\#2\alpha} + 2ik\sigma_1^{\#2\alpha} == 0$	3
$\tau_1^{\#1\alpha} == 0$	3
$\tau_1^{\#1\alpha\beta} == 0$	3
$\sigma_1^{\#2\alpha\beta} == 0$	3
$\sigma_2^{\#1\alpha\beta\chi} == 0$	5
$\tau_2^{\#1\alpha\beta} == 0$	5
Total constraints:	25

	$\omega_{2^+}^{\#1} \alpha\beta$	$f_{2^+}^{\#1} \alpha\beta$	$\omega_{2^+}^{\#1} \alpha\beta\chi$
$\omega_{2^+}^{\#1} \dagger^{\alpha\beta}$	$-\frac{3k^2r_3}{2}$	0	0
$f_{2^+}^{\#1} \dagger^{\alpha\beta}$	0	0	0
$\omega_{2^+}^{\#1} \dagger^{\alpha\beta\chi}$	0	0	0

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^+}^{\#1}$
$\omega_{0^+}^{\#1} \dagger$	t_3	$-i\sqrt{2}kt_3$	0	0
$f_{0^+}^{\#1} \dagger$	$i\sqrt{2}kt_3$	$2k^2t_3$	0	0
$f_{0^+}^{\#2} \dagger$	0	0	0	0
$\omega_{0^+}^{\#1} \dagger$	0	0	0	0

Massive and massless spectra



Quadratic pole	
Pole residue:	$-\frac{1}{r_3(2r_3+r_5)(r_3+2r_5)p^2} > 0$
Polarisations:	2

(No massive particles)

Unitarity conditions

$$r_3 < 0 \&\& (r_5 < -\frac{r_3}{2} \parallel r_5 > -2r_3) \parallel r_3 > 0 \&\& -2r_3 < r_5 < -\frac{r_3}{2}$$