Particle spectrograph

Wave operator and propagator

Source constraints

SO(3) irreps	Fundamental fields	Multiplicities
$\sigma_{0^-}^{\#1} == 0$	$\epsilon\,\eta_{\alpha\beta\chi\delta}\,\partial^\delta \sigma^{\alpha\beta\chi} == 0$	1
$\sigma_{0^+}^{\#1} == 0$	$\partial_\beta \sigma^{\alpha\beta}{}_\alpha == 0$	1
$\sigma_{1^-}^{\#2\,\alpha} == 0$	$\partial_\chi \partial_\beta \sigma^{\alpha\beta\chi} == 0$	3
$\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	$\partial_\delta \partial_\chi \partial^\alpha \sigma^{\beta\chi\delta} + \partial_\delta \partial^\delta \partial_\chi \sigma^{\alpha\beta\chi} == \partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\chi\delta}$	3
$\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	$3\,\partial_\delta \partial_\chi \partial^\alpha \sigma^{\beta\chi\delta} + 3\,\partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\chi\delta} + 2\,\eta^{\alpha\beta}\,\partial_\epsilon \partial^\epsilon \partial_\delta \sigma^{\chi\delta}{}_\chi == 2\,\partial_\delta \partial^\beta \partial^\alpha \sigma^{\chi\delta}{}_\chi + 3\,(\partial_\delta \partial^\delta \partial_\chi \sigma^{\alpha\chi\beta} + \partial_\delta \partial^\delta \partial_\chi \sigma^{\beta\chi\alpha})$	5
Total constraints/gauge generators:		13

Quadratic (free) action

$$S == \iiint (\omega^{\alpha\beta\chi}\ \sigma_{\alpha\beta\chi} - \frac{2}{3} r_1 (2\,\partial_\beta \omega_{\alpha\iota\theta} - \partial_\beta \omega_{\alpha\theta\iota} + 4\,\partial_\beta \omega_{\iota\theta\alpha} + \partial_\iota \omega_{\alpha\beta\theta} - \partial_\theta \omega_{\alpha\beta\iota} - \partial_\theta \omega_{\alpha\iota\beta})\,\partial^\theta \omega^{\alpha\beta\iota} + r_5 (\partial_\iota \omega_\theta{}^\kappa{}_\kappa\,\partial^\theta \omega^{\alpha\iota}{}_\alpha - \partial_\theta \omega_\iota{}^\kappa{}_\kappa\,\partial^\theta \omega^{\alpha\iota}{}_\alpha - (\partial_\alpha \omega^{\alpha\iota\theta} - 2\,\partial^\theta \omega^{\alpha\iota}{}_\alpha)\,(\partial_\kappa \omega_\iota{}^\kappa{}_\theta - \partial_\kappa \omega_\theta{}^\kappa{}_\iota)))[t, x, y, z]\,dz\,dy\,dx\,dt$$

$\sigma_2^{\#1\,\alpha\beta} \dagger^{\alpha\beta}$ / $\omega_2^{\#1\,\alpha\beta} \dagger^{\alpha\beta}$

0	$\frac{1}{k^2 r_1}$
0	0

$\sigma_2^{\#1\,\alpha\beta} \dagger^{\alpha\beta\chi}$ / $\omega_2^{\#1\,\alpha\beta} \dagger^{\alpha\beta\chi}$

0	$k^2 r_1$
0	0

$\sigma_2^{\#1\,\alpha\beta} \dagger^{\alpha\beta\chi}$ / $\omega_2^{\#1\,\alpha\beta} \dagger^{\alpha\beta\chi}$

0	$\frac{1}{k^2 r_1}$
0	0

$\sigma_0^{\#1} \dagger$ / $\omega_0^{\#1} \dagger$

0	0
0	0

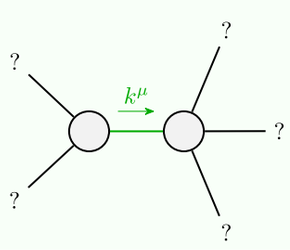
$\sigma_{1^+}^{\#1\,\alpha\beta} \dagger^{\alpha\beta}$ / $\sigma_{1^+}^{\#2\,\alpha\beta} \dagger^{\alpha\beta}$ / $\sigma_{1^-}^{\#1\,\alpha} \dagger^{\alpha}$ / $\sigma_{1^-}^{\#2\,\alpha} \dagger^{\alpha}$

$\frac{1}{k^2 (2 r_1 + r_5)}$	0	0	0
0	0	0	0
0	0	$\frac{1}{k^2 (r_1 + r_5)}$	0
0	0	0	0

$\omega_{1^+}^{\#1\,\alpha\beta} \dagger^{\alpha\beta}$ / $\omega_{1^+}^{\#2\,\alpha\beta} \dagger^{\alpha\beta}$ / $\omega_{1^-}^{\#1\,\alpha} \dagger^{\alpha}$ / $\omega_{1^-}^{\#2\,\alpha} \dagger^{\alpha}$

$k^2 (2 r_1 + r_5)$	0	0	0
0	0	0	0
0	0	$k^2 (r_1 + r_5)$	0
0	0	0	0

Massive and massless spectra



Quadratic pole

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

(No massive particles)

Unitarity conditions

$$r_1 < 0\ \&\&\ (r_5 < -r_1\ ||\ r_5 > -2\,r_1) \parallel r_1 > 0\ \&\&\ -2\,r_1 < r_5 < -r_1$$