

Particle spectrograph

Wave operator and propagator

$-\frac{3k^2r_3}{2}$	0	0
0	0	0
0	0	0

Source constraints		
SO(3) irreps	Fundamental fields	Multiplicities
$\tau_{0+}^{\#2} == 0$	$\partial_\beta \partial_\alpha \tau^{\alpha\beta} == 0$	1
$\tau_{0+}^{\#1} - 2i k \sigma_{0+}^{\#1} == 0$	$\partial_\beta \partial_\alpha \tau^{\alpha\beta} == \partial_\beta \partial^\beta \tau^\alpha_\alpha + 2 \partial_\chi \partial^\chi \partial_\beta \sigma^{\alpha\beta}_\alpha$	1
$\tau_{1+}^{\#2\alpha} + 2i k \sigma_{1+}^{\#2\alpha} == 0$	$\partial_\chi \partial_\beta \partial^\alpha \tau^{\beta\chi} == \partial_\chi \partial^\chi \partial_\beta \tau^{\alpha\beta} + 2 \partial_\delta \partial^\delta \partial_\chi \partial_\beta \sigma^{\alpha\beta\chi}$	3
$\tau_{1+}^{\#1\alpha} == 0$	$\partial_\chi \partial_\beta \partial^\alpha \tau^{\beta\chi} == \partial_\chi \partial^\chi \partial_\beta \tau^{\beta\alpha}$	3
$\tau_{1+}^{\#1\alpha\beta} == 0$	$\partial_\chi \partial^\alpha \tau^{\beta\chi} + \partial_\chi \partial^\beta \tau^{\chi\alpha} + \partial_\chi \partial^\chi \tau^{\alpha\beta} == \partial_\chi \partial^\alpha \tau^{\chi\beta} + \partial_\chi \partial^\beta \tau^{\alpha\chi} + \partial_\chi \partial^\chi \tau^{\beta\alpha}$	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
$\sigma_{2+}^{\#1\alpha\beta\chi} == 0$	$3 \partial_\epsilon \partial_\delta \partial^\chi \partial^\alpha \sigma^{\beta\delta\epsilon} + 3 \partial_\epsilon \partial^\epsilon \partial_\chi \partial^\alpha \sigma^{\beta\delta}_\delta + 2 \partial_\epsilon \partial^\epsilon \partial_\delta \partial^\alpha \sigma^{\beta\chi\delta} + 4 \partial_\epsilon \partial^\epsilon \partial_\delta \partial^\alpha \sigma^{\delta\chi} + 2 \partial_\epsilon \partial^\epsilon \partial_\delta \partial^\beta \sigma^{\chi\delta\alpha} + 4 \partial_\epsilon \partial^\epsilon \partial_\delta \partial^\chi \sigma^{\alpha\beta\delta} + 4 \partial_\epsilon \partial^\epsilon \partial_\delta \partial^\delta \sigma^{\alpha\beta\chi} + 2 \partial_\epsilon \partial^\epsilon \partial_\delta \partial^\delta \sigma^{\alpha\chi\beta} + 3 \eta^{\alpha\chi} \partial_\theta \partial^\theta \partial_\epsilon \partial^\alpha \sigma^{\delta\epsilon}_\delta + 3 \eta^{\beta\chi} \partial_\theta \partial^\theta \partial_\epsilon \partial_\delta \sigma^{\alpha\delta\epsilon} + 3 \eta^{\alpha\chi} \partial_\theta \partial^\theta \partial_\epsilon \partial^\epsilon \sigma^{\beta\delta}_\delta$	5
$\tau_{2+}^{\#1\alpha\beta} == 0$	$4 \partial_\delta \partial_\chi \partial^\beta \partial^\alpha \tau^{\chi\delta} + 2 \partial_\delta \partial^\delta \partial^\beta \partial^\alpha \tau^\chi_\chi + 3 \partial_\delta \partial^\delta \partial_\chi \partial^\alpha \tau^{\chi\beta} + 3 \partial_\delta \partial^\delta \partial_\chi \tau^{\beta\alpha} + 2 \eta^{\alpha\beta} \partial_\epsilon \partial^\epsilon \partial_\delta \partial_\chi \tau^{\chi\delta} == 3 \partial_\delta \partial^\delta \partial_\chi \partial^\alpha \tau^{\beta\chi} + 3 \partial_\delta \partial^\delta \partial_\chi \partial^\alpha \tau^{\chi\beta} + 3 \partial_\delta \partial^\delta \partial_\chi \partial^\beta \tau^{\alpha\chi} + 3 \partial_\delta \partial^\delta \partial_\chi \partial^\beta \tau^{\chi\alpha} + 2 \eta^{\alpha\beta} \partial_\epsilon \partial_\delta \partial^\delta \tau^\chi_\chi$	24
Total constraints/gauge generators:		24

Quadratic (free) action

S = ∫∫∫∫(16(-4t3ωακωκ+6fαβταβ+6ωαβχσaβχ+8t3ωακ∂fακ-8t3ωκ∂fακ+4t3∂fκκ∂fαα-3r3∂βωι∂ωαβ-3r3∂ιωαβ∂ωβθ-3r3∂αωαβι∂θωβι+6r3∂ιωαβ∂θωβι-3r3∂αωαβι∂θωβι+6r3∂ιωαβ∂θωβι+8r2∂βωαιθ∂θωαβι-4r2∂βωαθι∂θωαβι+4r2∂βωιθ∂θωαβι-24r3∂βωιθ∂ωαβι-2r2∂ιωαβθ∂θωαβι+2r2∂θωαβι∂θωαβι-4r2∂θωαβι∂θωαβι+6r5∂ιωκ∂θωκ-6r5∂θωκ∂θωκ+4t3∂fακ∂κfκ-8t3∂fαα∂κfκ-6r5∂αωαιθ∂κωκ+12r5∂θωακ∂κωκ+6r5∂αωαιθ∂κωθι-12r5∂θωακ∂κωθκ))[t,x,y,z]dxdydzdt

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

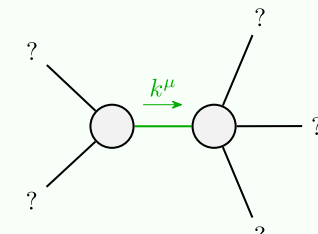
$\omega_{1+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1+}^{\#2} \dagger^{\alpha\beta}$	$f_{1+}^{\#1} \dagger^{\alpha\beta}$	$\omega_{1+}^{\#1} \dagger^\alpha$	$\omega_{1+}^{\#2} \dagger^\alpha$	$f_{1+}^{\#1} \dagger^\alpha$	$f_{1+}^{\#2} \dagger^\alpha$
$k^2(2r_3+r_5)$	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0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

$\sigma_{0+}^{\#1} \dagger$	$\tau_{0+}^{\#1} \dagger$	$\tau_{0+}^{\#2} \dagger$	$\sigma_{0+}^{\#1} \dagger$
$\frac{1}{(1+2k^2)^2t_3}$	$-\frac{i\sqrt{2}k}{(1+2k^2)^2t_3}$	0	0
$\frac{i\sqrt{2}k}{(1+2k^2)^2t_3}$	$\frac{2k^2}{(1+2k^2)^2t_3}$	0	0
0	0	0	0
0	0	0	$\frac{1}{k^2}r_2$

$\omega_{0+}^{\#1} \dagger$	$f_{0+}^{\#1} \dagger$	$f_{0+}^{\#2} \dagger$	$\omega_{0+}^{\#1} \dagger$
t_3	$-i\sqrt{2}kt_3$	0	0
$i\sqrt{2}kt_3$	$2k^2t_3$	0	0
0	0	0	0
0	0	0	k^2r_2

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

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