Particle spectrograph

Wave operator and propagator

	$\sigma^{\#1}_{1^+\,\alpha\beta}$	$\sigma^{\#2}_{1^+\,\alpha\beta}$	$\tau^{\#1}_{1^+\,\alpha\beta}$	$\sigma^{\#1}_{1^-\,\alpha}$	$\sigma^{\#2}_{1^-\,\alpha}$	$\tau^{\#1}_{1^-\,\alpha}$	$\tau^{\#2}_{1^-\,\alpha}$
$\sigma^{\#1}_{1^+}\dagger^{\alpha\beta}$	0	$\frac{2\sqrt{2}}{(\alpha_0-4\beta_1)(1+k^2)}$	$\frac{2i\sqrt{2}k}{(\alpha_0-4\beta_1)(1+k^2)}$	0	0	0	0
$\sigma^{\#2}_{1^+}\dagger^{\alpha\beta}$	$\frac{2\sqrt{2}}{(\alpha_0-4\beta_1)(1+k^2)}$	$-\frac{2}{(\alpha_0-4\beta_1)(1+k^2)^2}$	$-\frac{2ik}{(\alpha_0-4\beta_1)(1+k^2)^2}$	0	0	0	0
$\tau^{\#1}_{1^+}\dagger^{\alpha\beta}$	$-\frac{2i\sqrt{2}k}{(\alpha_0-4\beta_1)(1+k^2)}$	$\frac{2ik}{(\alpha_0-4\beta_1)(1+k^2)^2}$	$-\frac{2k^2}{(\alpha_0-4\beta_1)(1+k^2)^2}$	0	0	0	0
$\sigma^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	$-\frac{2\sqrt{2}}{(\alpha_0-4\beta_1)(1+2k^2)}$	0	$-\frac{4ik}{(\alpha_0-4\beta_1)(1+2k^2)}$
$\sigma^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$-\frac{2\sqrt{2}}{(\alpha_0-4\beta_1)(1+2k^2)}$	$-\frac{2}{(\alpha_0-4\beta_1)(1+2k^2)^2}$	0	$-\frac{2i\sqrt{2}k}{(\alpha_0-4\beta_1)(1+2k^2)^2}$
$\tau^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	0	0	0
$\tau^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{4ik}{(\alpha_0-4\beta_1)(1+2k^2)}$	$\frac{2i\sqrt{2}k}{(\alpha_0-4\beta_1)(1+2k^2)^2}$	0	$-\frac{4k^2}{(\alpha_0-4\beta_1)(1+2k^2)^2}$

	$\omega^{\#1}_{0^+}$	$f^{\#1}_{0^+}$	$f^{\#2}_{0^+}$	$\omega^{\#1}_{0^-}$
$\omega^{\#1}_{0^+}\dagger$	$\frac{1}{2}(\alpha_0-4\beta_1)$	$-\frac{i(\alpha_0-4\beta_1)k}{\sqrt{2}}$	0	0
$f^{\#1}_{0^+}\dagger$	$\frac{i(\alpha_0-4\beta_1)k}{\sqrt{2}}$	$-4\beta_1 k^2$	0	0
$f^{\#2}_{0^+}\dagger$	0	0	0	0
$\omega^{\#1}_{0^-}\dagger$	0	0	0	$\frac{\alpha_0}{2}-2\beta_1+\alpha_3 k^2$

	$\sigma^{\#1}_{0^+}$	$\tau^{\#1}_{0^+}$	$\tau^{\#2}_{0^+}$	$\sigma^{\#1}_{0^-}$
$\sigma^{\#1}_{0^+}\dagger$	$\frac{8\beta_1}{\alpha_0^2-4\alpha_0\beta_1}$	$-\frac{i\sqrt{2}}{\alpha_0 k}$	0	0
$\tau^{\#1}_{0^+}\dagger$	$\frac{i\sqrt{2}}{\alpha_0 k}$	$-\frac{1}{\alpha_0 k^2}$	0	0
$\tau^{\#2}_{0^+}\dagger$	0	0	0	0
$\sigma^{\#1}_{0^-}\dagger$	0	0	0	$\frac{2}{\alpha_0-4\beta_1+2\alpha_3 k^2}$

	$\omega^{\#1}_{2^+\,\alpha\beta}$	$f^{\#1}_{2^+\,\alpha\beta}$	$\omega^{\#1}_{2^-\,\alpha\beta\chi}$
$\omega^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{\alpha_0}{4}+\beta_1$	$\frac{i(\alpha_0-4\beta_1)k}{2\sqrt{2}}$	0
$f^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{i(\alpha_0-4\beta_1)k}{2\sqrt{2}}$	$2\beta_1 k^2$	0
$\omega^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0	$-\frac{\alpha_0}{4}+\beta_1$

Quadratic (free) action

$$S == \iiiint\Big(f^{\alpha\beta}\,\tau_{\alpha\beta}+\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}-\tfrac{1}{2}\alpha_0\big(\omega_{\alpha\chi\beta}\,\omega^{\alpha\beta\chi}+\omega^{\alpha\beta}{}_{\alpha}\,\omega_{\beta}{}^{\chi}{}_{\chi}+2f^{\alpha\beta}\,\partial_\beta\omega_\alpha{}^\chi{}_\chi- 2\partial_\beta\omega^{\alpha\beta}{}_\alpha-2f^{\alpha\beta}\,\partial_\chi\omega_\alpha{}^\chi{}_\beta+2f^\alpha{}_\alpha\,\partial_\chi\omega^{\beta\chi}{}_\beta\big)+ \beta_1\big(2\,\omega^{\alpha\beta}{}_\alpha\,\omega_\beta{}^\chi{}_\chi-4\,\omega_\alpha{}^\chi{}_\chi\,\partial_\beta f^{\alpha\beta}+4\,\omega_\beta{}^\chi{}_\chi\,\partial^\beta f^\alpha{}_\alpha- 2\partial_\beta f^\chi{}_\chi\partial^\beta f^\alpha{}_\alpha-2\partial_\beta f^{\alpha\beta}\partial_\chi f_\alpha{}^\chi+4\partial^\beta f^\alpha{}_\alpha\partial_\chi f_\beta{}^\chi- 2\partial_\alpha f_{\beta\chi}\partial^\chi f^{\alpha\beta}-\partial_\alpha f_{\chi\beta}\partial^\chi f^{\alpha\beta}+\partial_\beta f_{\alpha\chi}\partial^\chi f^{\alpha\beta}+\partial_\chi f_{\alpha\beta}\partial^\chi f^{\alpha\beta}+\partial_\chi f_{\beta\alpha}\partial^\chi f^{\alpha\beta}+2\,\omega_{\alpha\chi\beta}\,(\omega^{\alpha\beta\chi}+2\partial^\chi f^{\alpha\beta})\big)+ \tfrac{1}{3}\alpha_3\big(4\,\partial_\beta\omega_{\alpha\chi\delta}-2\,\partial_\beta\omega_{\alpha\delta\chi}+2\,\partial_\beta\omega_{\chi\delta\alpha}-\partial_\chi\omega_{\alpha\beta\delta}+ \partial_\delta\omega_{\alpha\beta\chi}-2\,\partial_\delta\omega_{\alpha\chi\beta}\big)\partial^\delta\omega^{\alpha\beta\chi}\Big)[t,x,y,z]\,dz\,dy\,dx\,dt$$

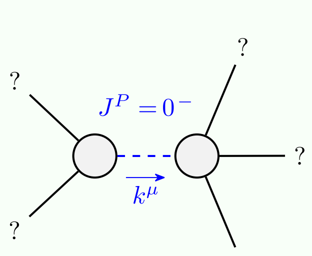
Source constraints

SO(3) irreps	Fundamental fields	Multiplicities
$\tau^{\#2}_{0^+}==0$	$\partial_\beta\partial_\alpha\tau^{\alpha\beta}==0$	1
$\tau^{\#2\,\alpha}_{1^-}+2ik\,\sigma^{\#2\,\alpha}_{1^-}==0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi}==\partial_\chi\partial^\chi\partial_\beta\tau^{\alpha\beta}+2\,\partial_\delta\partial^\delta\partial_\chi\partial_\beta\sigma^{\alpha\beta\chi}$	3
$\tau^{\#1\,\alpha}_{1^-}==0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi}==\partial_\chi\partial^\chi\partial_\beta\tau^{\beta\alpha}$	3
$\tau^{\#1\,\alpha\beta}_{1^+}+ik\,\sigma^{\#2\,\alpha\beta}_{1^+}==0$	$\partial_\chi\partial^\alpha\tau^{\beta\chi}+\partial_\chi\partial^\beta\tau^{\chi\alpha}+\partial_\chi\partial^\chi\tau^{\alpha\beta}+2\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta}+2\,\partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\beta\chi}==\partial_\chi\partial^\alpha\tau^{\chi\beta}+\partial_\chi\partial^\beta\tau^{\alpha\chi}+\partial_\chi\partial^\chi\tau^{\beta\alpha}+2\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta}$	3
Total constraints/gauge generators:		10

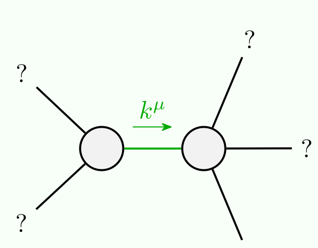
	$\omega^{\#1}_{1^+\,\alpha\beta}$	$\omega^{\#2}_{1^+\,\alpha\beta}$	$f^{\#1}_{1^+\,\alpha\beta}$	$\omega^{\#1}_{1^-\,\alpha}$	$\omega^{\#2}_{1^-\,\alpha}$	$f^{\#1}_{1^-\,\alpha}$	$f^{\#2}_{1^-\,\alpha}$
$\omega^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\frac{1}{4}(\alpha_0-4\beta_1)$	$\frac{\alpha_0-4\beta_1}{2\sqrt{2}}$	$\frac{i(\alpha_0-4\beta_1)k}{2\sqrt{2}}$	0	0	0	0
$\omega^{\#2}_{1^+}\dagger^{\alpha\beta}$	$\frac{\alpha_0-4\beta_1}{2\sqrt{2}}$	0	0	0	0	0	0
$f^{\#1}_{1^+}\dagger^{\alpha\beta}$	$-\frac{i(\alpha_0-4\beta_1)k}{2\sqrt{2}}$	0	0	0	0	0	0
$\omega^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{1}{4}(\alpha_0-4\beta_1)$	$-\frac{\alpha_0-4\beta_1}{2\sqrt{2}}$	0	$-\frac{1}{2}i(\alpha_0-4\beta_1)k$
$\omega^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$-\frac{\alpha_0-4\beta_1}{2\sqrt{2}}$	0	0	0
$f^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	0	0	0
$f^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{1}{2}i(\alpha_0-4\beta_1)k$	0	0	0

	$\sigma^{\#1}_{2^+\,\alpha\beta}$	$\tau^{\#1}_{2^+\,\alpha\beta}$	$\sigma^{\#1}_{2^-\,\alpha\beta\chi}$
$\sigma^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{16\beta_1}{\alpha_0^2-4\alpha_0\beta_1}$	$\frac{2i\sqrt{2}}{\alpha_0 k}$	0
$\tau^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{2i\sqrt{2}}{\alpha_0 k}$	$\frac{2}{\alpha_0 k^2}$	0
$\sigma^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0	$\frac{1}{-\frac{\alpha_0}{4}+\beta_1}$

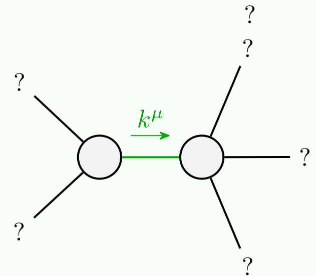
Massive and massless spectra



Massive particle	
Pole residue:	$-\frac{1}{\alpha_3}>0$
Polarisations:	1
Square mass:	$-\frac{\alpha_0-4\beta_1}{2\alpha_3}>0$
Spin:	0
Parity:	Odd



Quadratic pole	
Pole residue:	$\frac{1}{-\alpha_0+4\beta_1}>0$
Polarisations:	2



Quadratic pole	
Pole residue:	$\frac{1}{\alpha_0}>0$
Polarisations:	2

Unitarity conditions

(Unitarity is demonstrably impossible)