Particle spectrograph

Wave operator and propagator

	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}\,\dagger$	$\frac{8\,\beta_1}{{\alpha_0}^2-4\,\alpha_0\,\beta_1+8\,\alpha_6\,\beta_1\,k^2}$	$-\frac{i\,\sqrt{2}\,(\alpha_0-4\,\beta_1)}{\alpha_0\,(\alpha_0-4\,\beta_1)\,k+8\,\alpha_6\,\beta_1\,k^3}$	0	0
$\tau_{0^+}^{\#1}\,\dagger$	$\frac{i\,\sqrt{2}\,(\alpha_0-4\,\beta_1)}{\alpha_0\,(\alpha_0-4\,\beta_1)\,k+8\,\alpha_6\,\beta_1\,k^3}$	$-\frac{\alpha_0-4\,\beta_1+2\,\alpha_6\,k^2}{k^2\,({\alpha_0}^2-4\,\alpha_0\,\beta_1+8\,\alpha_6\,\beta_1\,k^2)}$	0	0
$\tau_{0^+}^{\#2}\,\dagger$	0	0	0	0
$\sigma_{0^-}^{\#1}\,\dagger$	0	0	0	$\frac{2}{\alpha_0-4\,\beta_1}$

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

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

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

Quadratic (free) action

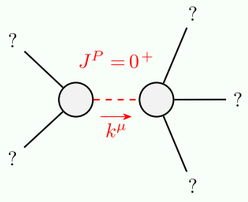
$$S == \iiiint(-\tfrac{1}{2}\,(\alpha_0-4\,\beta_1)\,\mathcal{A}^{\alpha\beta}{}_{\alpha}\,\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}+f^{\alpha\beta}\,\tau_{\alpha\beta}+\mathcal{A}^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}-4\,\beta_1\,\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\,\partial_\beta f^{\alpha\beta}-\alpha_0\,f^{\alpha\beta}\,\partial_\beta\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}+\alpha_0\,\partial_\beta\mathcal{A}^{\alpha\beta}{}_{\alpha}+4\,\beta_1\,\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\,\partial^\beta f^{\alpha}{}_{\alpha}-2\,\beta_1\,\partial_\beta f^{\chi}{}_{\chi}\,\partial^\beta f^{\alpha}{}_{\alpha}-2\,\beta_1\,\partial_\beta f^{\alpha\beta}\,\partial_\chi f_{\alpha}{}^{\chi}+4\,\beta_1\,\partial^\beta f^{\alpha}{}_{\alpha}\,\partial_\chi f_{\beta}{}^{\chi}+\alpha_0\,f^{\alpha\beta}\,\partial_\chi\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta}-\alpha_0\,f^{\alpha}{}_{\alpha}\,\partial_\chi\mathcal{A}^{\beta\chi}{}_{\beta}-2\,\beta_1\,\partial_\alpha f_{\beta\chi}\,\partial^\chi f^{\alpha\beta}-\beta_1\,\partial_\alpha f_{\chi\beta}\,\partial^\chi f^{\alpha\beta}+\beta_1\,\partial_\beta f_{\alpha\chi}\,\partial^\chi f^{\alpha\beta}+\beta_1\,\partial_\chi f_{\alpha\beta}\,\partial^\chi f^{\alpha\beta}+\beta_1\,\partial_\chi f_{\beta\alpha}\,\partial^\chi f^{\alpha\beta}-\tfrac{1}{2}\,\mathcal{A}_{\alpha\chi\beta}\,((\alpha_0-4\,\beta_1)\,\mathcal{A}^{\alpha\beta\chi}-8\,\beta_1\,\partial^\chi f^{\alpha\beta})+\tfrac{2}{3}\,\alpha_6\,\partial_\beta\mathcal{A}^{\alpha\beta}{}_{\alpha}\,\partial_\delta\mathcal{A}^{\chi\delta}{}_{\chi})[t,\,x,\,y,\,z]\,dz\,dy\,dx\,dt$$

	$\mathcal{A}_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\mathcal{A}_{0^-}^{\#1}$
$\mathcal{A}_{0^+}^{\#1}\,\dagger$	$\frac{\alpha_0}{2}-2\,\beta_1+\alpha_6\,k^2$	$-\frac{i\,(\alpha_0-4\,\beta_1)\,k}{\sqrt{2}}$	0	0
$f_{0^+}^{\#1}\,\dagger$	$\frac{i\,(\alpha_0-4\,\beta_1)\,k}{\sqrt{2}}$	$-4\,\beta_1\,k^2$	0	0
$f_{0^+}^{\#2}\,\dagger$	0	0	0	0
$\mathcal{A}_{0^-}^{\#1}\,\dagger$	0	0	0	$\frac{1}{2}\,(\alpha_0-4\,\beta_1)$

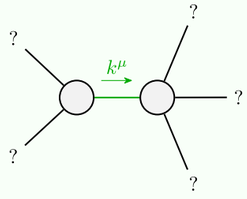
	$\mathcal{A}_{1^+}^{\#1}{}_{\alpha\beta}$	$\mathcal{A}_{1^+}^{\#2}{}_{\alpha\beta}$	$f_{1^+}^{\#1}{}_{\alpha\beta}$	$\mathcal{A}_{1^-}^{\#1}{}_{\alpha}$	$\mathcal{A}_{1^-}^{\#2}{}_{\alpha}$	$f_{1^-}^{\#1}{}_{\alpha}$	$f_{1^-}^{\#2}{}_{\alpha}$
$\mathcal{A}_{1^+}^{\#1}\,\dagger^{\alpha\beta}$	$\frac{1}{4}\,(\alpha_0-4\,\beta_1)$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

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

Massive and massless spectra



Massive particle	
Pole residue:	$\frac{1}{\alpha_0}+\frac{1}{\alpha_6}-\frac{1}{4\,\beta_1}>0$
Polarisations:	1
Square mass:	$-\frac{\alpha_0\,(\alpha_0-4\,\beta_1)}{8\,\alpha_6\,\beta_1}>0$
Spin:	0
Parity:	Even



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

Unitarity conditions

$$\alpha_0>0\;\&\&\;\alpha_6>0\;\&\&\;\beta_1<0\,||\,\beta_1>\frac{\alpha_0}{4}$$