Particle spectrograph

Wave operator and propagator

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

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

Quadratic (free) action

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

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

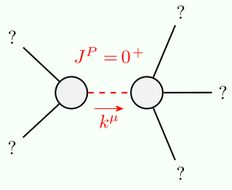
	$\omega_{2^+}^{\#1}{}_{\alpha\beta}$	$f_{2^+}^{\#1}{}_{\alpha\beta}$	$\omega_{2^-}^{\#1}{}_{\alpha\beta\chi}$
$\omega_{2^+}^{\#1\,\alpha\beta}\dagger$	$-\frac{\alpha_0}{4}+\beta_1$	$\frac{i\,(\alpha_0-4\,\beta_1)\,k}{2\,\sqrt{2}}$	0
$f_{2^+}^{\#1\,\alpha\beta}\dagger$	$-\frac{i\,(\alpha_0-4\,\beta_1)\,k}{2\,\sqrt{2}}$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

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

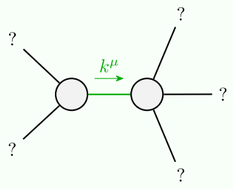
	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}\dagger$	$\frac{\alpha_0}{2}-2\,\beta_1+\alpha_6\,k^2$	$\frac{i\,(\alpha_0-4\,\beta_1)\,k}{\sqrt{2}}$	0	0
$f_{0^+}^{\#1}\dagger$	$-\frac{i\,(\alpha_0-4\,\beta_1)\,k}{\sqrt{2}}$	$-4\,\beta_1\,k^2$	0	0
$f_{0^+}^{\#2}\dagger$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

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

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

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