Particle spectrograph

Wave operator and propagator

	$\mathcal{A}^{\#1}_{0^+}$	$f^{\#1}_{0^+}$	$f^{\#2}_{0^+}$	$\mathcal{A}^{\#1}_{0^-}$
$\mathcal{A}^{\#1}_{0^+}\dagger$	$\frac{1}{2}(\alpha_0+4(\alpha_1+\alpha_2+3\alpha_3)k^2)$	$-\frac{i\alpha_0 k}{\sqrt{2}}$	0	0
$f^{\#1}_{0^+}\dagger$	$\frac{i\alpha_0 k}{\sqrt{2}}$	0	0	0
$f^{\#2}_{0^+}\dagger$	0	0	0	0
$\mathcal{A}^{\#1}_{0^-}\dagger$	0	0	0	$\frac{\alpha_0}{2}$

	$\sigma^{\#1}_{0^+}$	$\tau^{\#1}_{0^+}$	$\tau^{\#2}_{0^+}$	$\sigma^{\#1}_{0^-}$
$\sigma^{\#1}_{0^+}\dagger$	0	$-\frac{i\sqrt{2}}{\alpha_0 k}$	0	0
$\tau^{\#1}_{0^+}\dagger$	$\frac{i\sqrt{2}}{\alpha_0 k}$	$-\frac{\alpha_0+4(\alpha_1+\alpha_2+3\alpha_3)k^2}{\alpha_0^2 k^2}$	0	0
$\tau^{\#2}_{0^+}\dagger$	0	0	0	0
$\sigma^{\#1}_{0^-}\dagger$	0	0	0	$\frac{2}{\alpha_0}$

	$\mathcal{A}^{\#1}_{2^+\,\alpha\beta}$	$f^{\#1}_{2^+\,\alpha\beta}$	$\mathcal{A}^{\#1}_{2^-\,\alpha\beta\chi}$
$\mathcal{A}^{\#1}_{2^+}\dagger^{\alpha\beta}$	$\frac{1}{4}(-\alpha_0+2(\alpha_1+\alpha_2)k^2)$	$\frac{i\alpha_0 k}{2\sqrt{2}}$	0
$f^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{i\alpha_0 k}{2\sqrt{2}}$	0	0
$\mathcal{A}^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0	$-\frac{\alpha_0}{4}$

	$\sigma^{\#1}_{1^+\,\alpha\beta}$	$\sigma^{\#2}_{1^+\,\alpha\beta}$	$\tau^{\#1}_{1^+\,\alpha\beta}$	$\sigma^{\#1}_{1^-\,\alpha}$	$\sigma^{\#2}_{1^-\,\alpha}$	$\tau^{\#1}_{1^-\,\alpha}$	$\tau^{\#2}_{1^-\,\alpha}$
$\sigma^{\#1}_{1^+}\dagger^{\alpha\beta}$	0	$\frac{2\sqrt{2}}{\alpha_0+\alpha_0 k^2}$	$\frac{2i\sqrt{2}k}{\alpha_0+\alpha_0 k^2}$	0	0	0	0
$\sigma^{\#2}_{1^+}\dagger^{\alpha\beta}$	$\frac{2\sqrt{2}}{\alpha_0+\alpha_0 k^2}$	$-\frac{2(\alpha_0+2(\alpha_1-\alpha_2)k^2)}{\alpha_0^2(1+k^2)^2}$	$-\frac{2ik(\alpha_0+2(\alpha_1-\alpha_2)k^2)}{\alpha_0^2(1+k^2)^2}$	0	0	0	0
$\tau^{\#1}_{1^+}\dagger^{\alpha\beta}$	$-\frac{2i\sqrt{2}k}{\alpha_0+\alpha_0 k^2}$	$\frac{2ik(\alpha_0+2(\alpha_1-\alpha_2)k^2)}{\alpha_0^2(1+k^2)^2}$	$-\frac{2k^2(\alpha_0+2(\alpha_1-\alpha_2)k^2)}{\alpha_0^2(1+k^2)^2}$	0	0	0	0
$\sigma^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	$-\frac{2\sqrt{2}}{\alpha_0+2\alpha_0 k^2}$	0	$-\frac{4ik}{\alpha_0+2\alpha_0 k^2}$
$\sigma^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$-\frac{2\sqrt{2}}{\alpha_0+2\alpha_0 k^2}$	$-\frac{2(\alpha_0+4\alpha_1 k^2)}{(\alpha_0+2\alpha_0 k^2)^2}$	0	$-\frac{2i\sqrt{2}k(\alpha_0+4\alpha_1 k^2)}{(\alpha_0+2\alpha_0 k^2)^2}$
$\tau^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	0	0	0
$\tau^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{4ik}{\alpha_0+2\alpha_0 k^2}$	$\frac{2i\sqrt{2}k(\alpha_0+4\alpha_1 k^2)}{(\alpha_0+2\alpha_0 k^2)^2}$	0	$-\frac{4k^2(\alpha_0+4\alpha_1 k^2)}{(\alpha_0+2\alpha_0 k^2)^2}$

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

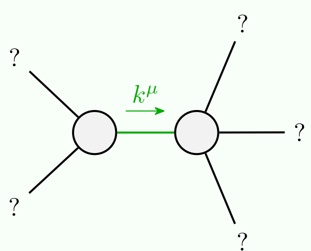
	$\mathcal{A}^{\#1}_{1^+\,\alpha\beta}$	$\mathcal{A}^{\#2}_{1^+\,\alpha\beta}$	$f^{\#1}_{1^+\,\alpha\beta}$	$\mathcal{A}^{\#1}_{1^-\,\alpha}$	$\mathcal{A}^{\#2}_{1^-\,\alpha}$	$f^{\#1}_{1^-\,\alpha}$	$f^{\#2}_{1^-\,\alpha}$
$\mathcal{A}^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\frac{1}{4}(\alpha_0+2(\alpha_1-\alpha_2)k^2)$	$\frac{\alpha_0}{2\sqrt{2}}$	$\frac{i\alpha_0 k}{2\sqrt{2}}$	0	0	0	0
$\mathcal{A}^{\#2}_{1^+}\dagger^{\alpha\beta}$	$\frac{\alpha_0}{2\sqrt{2}}$	0	0	0	0	0	0
$f^{\#1}_{1^+}\dagger^{\alpha\beta}$	$-\frac{i\alpha_0 k}{2\sqrt{2}}$	0	0	0	0	0	0
$\mathcal{A}^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{\alpha_0}{4}+\alpha_1 k^2$	$-\frac{\alpha_0}{2\sqrt{2}}$	0	$-\frac{1}{2}i\alpha_0 k$
$\mathcal{A}^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$-\frac{\alpha_0}{2\sqrt{2}}$	0	0	0
$f^{\#1}_{1^-}\dagger^{\alpha}$	0	0	0	0	0	0	0
$f^{\#2}_{1^-}\dagger^{\alpha}$	0	0	0	$\frac{i\alpha_0 k}{2}$	0	0	0

Quadratic (free) action

$$S == \iiiint(f^{\alpha\beta}\,\tau_{\alpha\beta} + \mathcal{A}^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - \frac{1}{2}\alpha_0(\mathcal{A}_{\alpha\chi\beta}\mathcal{A}^{\alpha\beta\chi} + \mathcal{A}^{\alpha\beta}{}_{\alpha}\mathcal{A}_{\beta}{}^{\chi}{}_{\chi} + 2f^{\alpha\beta}\partial_\beta\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi} - 2\partial_\beta\mathcal{A}^{\alpha\beta}{}_{\alpha} - 2f^{\alpha\beta}\partial_\chi\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta} + 2f^{\alpha}{}_{\alpha}\partial_\chi\mathcal{A}^{\beta\chi}{}_{\beta}) - \alpha_1(\partial_\chi\mathcal{A}_{\beta}{}^{\delta}{}_{\delta}\partial^\chi\mathcal{A}^{\alpha\beta}{}_{\alpha} + (\partial_\alpha\mathcal{A}^{\alpha\beta\chi} - 2\partial^\chi\mathcal{A}^{\alpha\beta}{}_{\alpha})\partial_\delta\mathcal{A}_{\beta}{}^{\delta}{}_{\chi}) + 4\alpha_3\partial_\beta\mathcal{A}^{\alpha\beta}{}_{\alpha}\partial_\delta\mathcal{A}^{\chi\delta}{}_{\chi} - \alpha_2(\partial_\chi\mathcal{A}_{\delta}{}^{\zeta}{}_{\zeta}\partial^\delta\mathcal{A}^{\beta\chi}{}_{\beta} + (\partial_\beta\mathcal{A}^{\beta\chi\delta} - 2\partial^\delta\mathcal{A}^{\beta\chi}{}_{\beta})\partial_\zeta\mathcal{A}_{\delta}{}^{\zeta}{}_{\chi}))[t, x, y, z]\,dz\,dy\,dx\,dt$$

	$\sigma^{\#1}_{2^+\,\alpha\beta}$	$\tau^{\#1}_{2^+\,\alpha\beta}$	$\sigma^{\#1}_{2^-\,\alpha\beta\chi}$
$\sigma^{\#1}_{2^+}\dagger^{\alpha\beta}$	0	$\frac{2i\sqrt{2}}{\alpha_0 k}$	0
$\tau^{\#1}_{2^+}\dagger^{\alpha\beta}$	$-\frac{2i\sqrt{2}}{\alpha_0 k}$	$\frac{2(\alpha_0-2(\alpha_1+\alpha_2)k^2)}{\alpha_0^2 k^2}$	0
$\sigma^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0	$-\frac{4}{\alpha_0}$

Massive and massless spectra



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

(No massive particles)

Unitarity conditions

$\alpha_0 > 0$