Particle spectrograph

Wave operator and propagator

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

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

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}{}^{\dagger}$	$\frac{\alpha_0}{2}$	$\frac{i\alpha_0 k}{\sqrt{2}}$	0	0
$f_{0^+}^{\#1}{}^{\dagger}$	$-\frac{i\alpha_0 k}{\sqrt{2}}$	0	0	0
$f_{0^+}^{\#2}{}^{\dagger}$	0	0	0	0
$\omega_{0^-}^{\#1}{}^{\dagger}$	0	0	0	$\frac{\alpha_0}{2}$

	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}{}^{\dagger}$	0	$-\frac{i\sqrt{2}}{\alpha_0 k}$	0	0
$\tau_{0^+}^{\#1}{}^{\dagger}$	$\frac{i\sqrt{2}}{\alpha_0 k}$	$-\frac{1}{\alpha_0 k^2}$	0	0
$\tau_{0^+}^{\#2}{}^{\dagger}$	0	0	0	0
$\sigma_{0^-}^{\#1}{}^{\dagger}$	0	0	0	$\frac{2}{\alpha_0}$

Quadratic (free) action

$$S == \iiiint (f^{\alpha\beta}\,\tau_{\alpha\beta} + \omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} + \alpha_0\,(-\tfrac{1}{2}\,\omega_{\alpha\zeta\beta}\,\omega^{\alpha\beta\zeta} - \tfrac{1}{2}\,\omega^{\alpha\beta}{}_{\alpha}\,\omega_{\beta}{}^{\zeta}{}_{\zeta} - f^{\alpha\beta}\,\partial_{\beta}\omega_{\alpha}{}^{\zeta}{}_{\zeta} + \partial_{\beta}\omega^{\alpha\beta}{}_{\alpha} + f^{\alpha\beta}\,\partial_{\zeta}\omega_{\alpha}{}^{\zeta}{}_{\beta} - f^{\alpha}{}_{\alpha}\,\partial_{\zeta}\omega^{\beta\zeta}{}_{\beta}))[t, x, y, z]\,dz\,dy\,dx\,dt$$

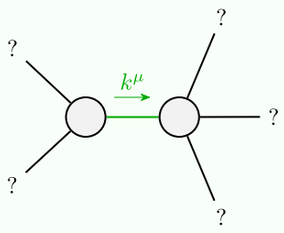
	$\omega_{2^+}^{\#1}{}^{\alpha\beta}$	$f_{2^+}^{\#1}{}^{\alpha\beta}$	$\omega_{2^-}^{\#1}{}^{\alpha\beta\chi}$
$\omega_{2^+}^{\#1}{}^{\dagger\alpha\beta}$	$-\frac{\alpha_0}{4}$	$\frac{i\alpha_0 k}{2\sqrt{2}}$	0
$f_{2^+}^{\#1}{}^{\dagger\alpha\beta}$	$-\frac{i\alpha_0 k}{2\sqrt{2}}$	0	0
$\omega_{2^-}^{\#1}{}^{\dagger\alpha\beta\chi}$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

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

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\tau_{0^+}^{\#2} == 0$	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:	10

Massive and massless spectra



Quadratic pole

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

(No massive particles)

Unitarity conditions

$\alpha_0 > 0$