Particle spectrograph

Wave operator and propagator

Spin-parity form	Covariant form	Multiplicities
$\overset{\#2}{0^+}\tau == 0$	$\partial_\beta\partial_\alpha\tau^{\alpha\beta} == 0$	1
$\overset{\#1}{0^+}\tau - 2\,i\,k\,\overset{\#1}{0^+}\sigma == 0$	$\partial_\beta\partial_\alpha\tau^{\alpha\beta} == \partial_\beta\partial^\beta\tau^\alpha{}_\alpha + 2\,\partial_\chi\partial^\chi\partial_\beta\sigma^{\alpha\beta}{}_\alpha$	1
$\overset{\#2}{1^-}\tau^\alpha + 2\,i\,k\,\overset{\#2}{1^-}\sigma^\alpha == 0$	$\partial_\chi\partial^\alpha\partial_\beta\tau^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau^{\alpha\beta} + 2\,\partial_\delta\partial^\delta\partial_\chi\partial_\beta\sigma^{\alpha\beta\chi}$	3
$\overset{\#1}{1^-}\tau^\alpha == 0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau^{\beta\alpha}$	3
$\overset{\#1}{1^+}\tau^{\alpha\beta} + i\,k\,\overset{\#2}{1^+}\sigma^{\alpha\beta} == 0$	$\partial_\chi\partial^\alpha\tau^{\beta\chi} + \partial_\chi\partial^\beta\tau^{\chi\alpha} + \partial_\chi\partial^\chi\tau^{\alpha\beta} + 2\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta} + 2\,\partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\beta\chi} == \partial_\chi\partial^\alpha\tau^{\chi\beta} + \partial_\chi\partial^\beta\tau^{\alpha\chi} + \partial_\chi\partial^\chi\tau^{\beta\alpha} + 2\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta}$	3
$\overset{\#1}{2^+}\tau^{\alpha\beta} - 2\,i\,k\,\overset{\#1}{2^+}\sigma^{\alpha\beta} == 0$	$-i(4\,\partial_\delta\partial_\chi\partial^\beta\partial^\alpha\tau^{\chi\delta} + 2\,\partial_\delta\partial^\delta\partial^\beta\partial^\alpha\tau^\chi{}_\chi - 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\alpha\tau^{\beta\chi} - 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\alpha\tau^{\chi\beta} - 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\beta\tau^{\alpha\chi} - 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\beta\tau^{\chi\alpha} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\tau^{\alpha\beta} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\tau^{\beta\alpha} + 4\,i\,k^\chi\,\partial_\epsilon\partial_\chi\partial^\beta\partial^\alpha\sigma^{\delta\epsilon}{}_\delta - 6\,i\,k^\chi\,\partial_\epsilon\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\delta\epsilon} - 6\,i\,k^\chi\,\partial_\epsilon\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\delta\epsilon} + 2\,\eta^{\alpha\beta}\,\partial_\epsilon\partial^\epsilon\partial_\chi\partial_\delta\tau^{\chi\delta} + 6\,i\,k^\chi\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\sigma^{\alpha\delta\beta} + 6\,i\,k^\chi\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\sigma^{\beta\delta\alpha} - 2\,\eta^{\alpha\beta}\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\tau^\chi{}_\chi - 4\,i\,\eta^{\alpha\beta}\,k^\chi\,\partial_\phi\partial^\phi\partial_\epsilon\partial_\chi\sigma^{\delta\epsilon}{}_\delta) == 0$	5
Total expected gauge generators:		16

$$\mathcal{S} == \iiiint \Big(f^{\alpha\beta}\tau_{\alpha\beta} + \mathcal{A}^{\alpha\beta\chi}\sigma_{\alpha\beta\chi} + \tfrac{1}{2}t_1\big(2\mathcal{A}^{\alpha\iota}{}_\alpha\mathcal{A}_\iota{}^\theta{}_\theta - 4\mathcal{A}_\alpha{}^\theta{}_\theta\partial_\iota f^{\alpha\iota} + 4\mathcal{A}_\iota{}^\theta{}_\theta\partial^\iota f^\alpha{}_\alpha - 2\partial_\iota f^\theta{}_\theta\partial^\iota f^\alpha{}_\alpha - 2\partial_\iota f^{\alpha\iota}\partial_\theta f_\alpha{}^\theta + 4\partial^\iota f^\alpha{}_\alpha\partial_\theta f_\iota{}^\theta - 2\partial_\alpha f_{\iota\theta}\partial^\theta f^{\alpha\iota} - \partial_\alpha f_{\theta\iota}\partial^\theta f^{\alpha\iota} + \partial_\iota f_{\alpha\theta}\partial^\theta f^{\alpha\iota} + \partial_\theta f_{\alpha\iota}\partial^\theta f^{\alpha\iota} + \partial_\theta f_{\iota\alpha}\partial^\theta f^{\alpha\iota} + 2\mathcal{A}_{\alpha\theta\iota}(\mathcal{A}^{\alpha\iota\theta} + 2\partial^\theta f^{\alpha\iota})\big) + \tfrac{1}{3}r_2\big(4\partial_\beta\mathcal{A}_{\alpha\iota\theta} - 2\partial_\beta\mathcal{A}_{\alpha\theta\iota} + 2\partial_\beta\mathcal{A}_{\iota\theta\alpha} - \partial_\iota\mathcal{A}_{\alpha\beta\theta} + \partial_\theta\mathcal{A}_{\alpha\beta\iota} - 2\partial_\theta\mathcal{A}_{\alpha\iota\beta}\big)\partial^\theta\mathcal{A}^{\alpha\beta\iota}\Big)[t,x,y,z]\,dz\,dy\,dx\,dt$$

	$\overset{\#1}{1^+}\sigma_{\alpha\beta}$	$\overset{\#2}{1^+}\sigma_{\alpha\beta}$	$\overset{\#1}{1^+}\tau_{\alpha\beta}$	$\overset{\#1}{1^-}\sigma_\alpha$	$\overset{\#2}{1^-}\sigma_\alpha$	$\overset{\#1}{1^-}\tau_\alpha$	$\overset{\#2}{1^-}\tau_\alpha$
$\overset{\#1}{1^+}\sigma^\dagger{}^{\alpha\beta}$	0	$-\frac{\sqrt{2}}{t_1+k^2t_1}$	$-\frac{i\sqrt{2}k}{t_1+k^2t_1}$	0	0		0
$\overset{\#2}{1^+}\sigma^\dagger{}^{\alpha\beta}$	$-\frac{\sqrt{2}}{t_1+k^2t_1}$	$\frac{1}{(1+k^2)^2t_1}$	$\frac{i k}{(1+k^2)^2t_1}$	0	0		0
$\overset{\#1}{1^+}\tau^\dagger{}^{\alpha\beta}$	$\frac{i\sqrt{2}k}{t_1+k^2t_1}$	$-\frac{i k}{(1+k^2)^2t_1}$	$\frac{k^2}{(1+k^2)^2t_1}$	0	0		0
$\overset{\#1}{1^-}\sigma^\dagger{}^\alpha$	0	0		0	$\frac{\sqrt{2}}{t_1+2k^2t_1}$	0	$\frac{2ik}{t_1+2k^2t_1}$
$\overset{\#2}{1^-}\sigma^\dagger{}^\alpha$	0	0		$\frac{\sqrt{2}}{t_1+2k^2t_1}$	$\frac{1}{(1+2k^2)^2t_1}$	0	$\frac{i\sqrt{2}k}{(1+2k^2)^2t_1}$
$\overset{\#1}{1^-}\tau^\dagger{}^\alpha$	0	0		0	0		0
$\overset{\#2}{1^-}\tau^\dagger{}^\alpha$	0	0		$-\frac{2ik}{t_1+2k^2t_1}$	$-\frac{i\sqrt{2}k}{(1+2k^2)^2t_1}$	0	$\frac{2k^2}{(1+2k^2)^2t_1}$

	$\overset{\#1}{2^+}\sigma_{\alpha\beta}$	$\overset{\#1}{2^+}\tau_{\alpha\beta}$	$\overset{\#1}{2^-}\sigma_{\alpha\beta\chi}$
$\overset{\#1}{2^+}\sigma^\dagger{}^{\alpha\beta}$	$\frac{2}{(1+2k^2)^2t_1}$	$-\frac{2i\sqrt{2}k}{(1+2k^2)^2t_1}$	0
$\overset{\#1}{2^+}\tau^\dagger{}^{\alpha\beta}$	$\frac{2i\sqrt{2}k}{(1+2k^2)^2t_1}$	$\frac{4k^2}{(1+2k^2)^2t_1}$	0
$\overset{\#1}{2^-}\sigma^\dagger{}^{\alpha\beta\chi}$	0	0	$\frac{2}{t_1}$

	$\overset{\#1}{2^+}\mathcal{A}_{\alpha\beta}$	$\overset{\#1}{2^+}f_{\alpha\beta}$	$\overset{\#1}{2^-}\mathcal{A}_{\alpha\beta\chi}$
$\overset{\#1}{2^+}\mathcal{A}^\dagger{}^{\alpha\beta}$	$\frac{t_1}{2}$	$-\frac{i k t_1}{\sqrt{2}}$	0
$\overset{\#1}{2^+}f^\dagger{}^{\alpha\beta}$	$\frac{i k t_1}{\sqrt{2}}$	$k^2 t_1$	0
$\overset{\#1}{2^-}\mathcal{A}^\dagger{}^{\alpha\beta\chi}$	0	0	$\frac{t_1}{2}$

	$\overset{\#1}{0^+}\mathcal{A}$	$\overset{\#1}{0^+}f$	$\overset{\#2}{0^+}f$	$\overset{\#1}{0^-}\mathcal{A}$
$\overset{\#1}{0^+}\mathcal{A}^\dagger$	$-t_1$	$i\sqrt{2}\,k\,t_1$	0	0
$\overset{\#1}{0^+}f^\dagger$	$-i\sqrt{2}\,k\,t_1$	$-2k^2t_1$	0	0
$\overset{\#2}{0^+}f^\dagger$	0	0	0	0
$\overset{\#1}{0^-}\mathcal{A}^\dagger$	0	0	0	$k^2r_2-t_1$

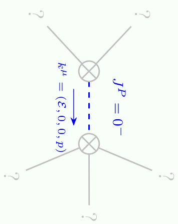
	$\overset{\#1}{0^+}\sigma$	$\overset{\#1}{0^+}\tau$	$\overset{\#2}{0^+}\tau$	$\overset{\#1}{0^-}\sigma$
$\overset{\#1}{0^+}\sigma^\dagger$	$-\frac{1}{(1+2k^2)^2t_1}$	$\frac{i\sqrt{2}k}{(1+2k^2)^2t_1}$	0	0
$\overset{\#1}{0^+}\tau^\dagger$	$-\frac{i\sqrt{2}k}{(1+2k^2)^2t_1}$	$-\frac{2k^2}{(1+2k^2)^2t_1}$	0	0
$\overset{\#2}{0^+}\tau^\dagger$	0	0	0	0
$\overset{\#1}{0^-}\sigma^\dagger$	0	0	0	$\frac{1}{k^2r_2-t_1}$

	$\overset{\#1}{1^+}\mathcal{A}_{\alpha\beta}$	$\overset{\#2}{1^+}\mathcal{A}_{\alpha\beta}$	$\overset{\#1}{1^+}f_{\alpha\beta}$	$\overset{\#1}{1^-}\mathcal{A}_\alpha$	$\overset{\#2}{1^-}\mathcal{A}_\alpha$	$\overset{\#1}{1^-}f_\alpha$	$\overset{\#2}{1^-}f_\alpha$
$\overset{\#1}{1^+}\mathcal{A}^\dagger{}^{\alpha\beta}$	$-\frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$-\frac{i k t_1}{\sqrt{2}}$	0	0	0	0
$\overset{\#2}{1^+}\mathcal{A}^\dagger{}^{\alpha\beta}$	$-\frac{t_1}{\sqrt{2}}$	0	0	0		0	0
$\overset{\#1}{1^+}f^\dagger{}^{\alpha\beta}$	$\frac{i k t_1}{\sqrt{2}}$	0	0	0		0	0
$\overset{\#1}{1^-}\mathcal{A}^\dagger{}^\alpha$	0	0		$-\frac{t_1}{2}$	$\frac{t_1}{\sqrt{2}}$	0	$i\,k\,t_1$
$\overset{\#2}{1^-}\mathcal{A}^\dagger{}^\alpha$	0	0	0	$\frac{t_1}{\sqrt{2}}$	0	0	0
$\overset{\#1}{1^-}f^\dagger{}^\alpha$	0	0	0		0	0	0
$\overset{\#2}{1^-}f^\dagger{}^\alpha$	0	0		$-i\,k\,t_1$	0	0	0

Massive and massless spectra

Pole residue:	$-\frac{1}{r_2} > 0$
Squaremass:	$\frac{t_1}{r_2} > 0$
Spin:	0
Parity:	Odd

Massive particle



(No particles)

Unitarity conditions