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

	$\overset{\#1}{1^+}\mathcal{A}_{\alpha\beta}$	$\overset{\#2}{1^+}\mathcal{A}_{\alpha\beta}$	$\overset{\#1}{1^+}f_{\alpha\beta}$	$\overset{\#1}{1^-}\mathcal{A}_\alpha$	$\overset{\#2}{1^-}\mathcal{A}_\alpha$	$\overset{\#1}{1^-}f_\alpha$	$\overset{\#2}{1^-}f_\alpha$
$\overset{\#1}{1^+}\mathcal{A}^{\dagger\alpha\beta}$	$-\frac{t_1}{2}$	$-\frac{t_1}{\sqrt{2}}$	$-\frac{i\,k\,t_1}{\sqrt{2}}$	0	0	0	0
$\overset{\#2}{1^+}\mathcal{A}^{\dagger\alpha\beta}$	$-\frac{t_1}{\sqrt{2}}$	0	0	0	0	0	0
$\overset{\#1}{1^+}f^{\dagger\alpha\beta}$	$\frac{i\,k\,t_1}{\sqrt{2}}$	0	0	0	0	0	0
$\overset{\#1}{1^-}\mathcal{A}^{\dagger\alpha}$	0	0	0	$\frac{1}{6}(t_1+4t_3)$	$\frac{t_1-2t_3}{3\sqrt{2}}$	0	$\frac{1}{3}\,i\,k(t_1-2t_3)$
$\overset{\#2}{1^-}\mathcal{A}^{\dagger\alpha}$	0	0	0	$\frac{t_1-2t_3}{3\sqrt{2}}$	$\frac{t_1+t_3}{3}$	0	$\frac{1}{3}\,i\sqrt{2}\,k(t_1+t_3)$
$\overset{\#1}{1^-}f^{\dagger\alpha}$	0	0	0	0	0	0	0
$\overset{\#2}{1^-}f^{\dagger\alpha}$	0	0	0	$-\frac{1}{3}\,i\,k(t_1-2t_3)$	$-\frac{1}{3}\,i\sqrt{2}\,k(t_1+t_3)$	0	$\frac{2}{3}k^2(t_1+t_3)$

$$S == \iiiint\Big(\tfrac{1}{6}\big(2(t_1-2t_3)\,\mathcal{A}^{\alpha\iota}{}_\alpha\,\mathcal{A}^\theta{}_{\iota\theta} + 6\,f^{\alpha\beta}\,\tau_{\alpha\beta} + 6\,\mathcal{A}^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - 4\,t_1\,\mathcal{A}_\alpha{}^\theta{}_\theta\,\partial_\iota f^{\alpha\iota} + 8\,t_3\,\mathcal{A}_\alpha{}^\theta{}_\theta\,\partial_\iota f^{\alpha\iota} +$$
$$4\,t_1\,\mathcal{A}_\iota{}^\theta{}_\theta\,\partial^\iota f^\alpha{}_\alpha - 8\,t_3\,\mathcal{A}_\iota{}^\theta{}_\theta\,\partial^\iota f^\alpha{}_\alpha - 2\,t_1\,\partial_\iota f^\theta{}_\theta\,\partial^\iota f^\alpha{}_\alpha + 4\,t_3\,\partial_\iota f^\theta{}_\theta\,\partial^\iota f^\alpha{}_\alpha -$$
$$2\,t_1\,\partial_\iota f^{\alpha\iota}\,\partial_\theta f^\theta{}_\alpha + 4\,t_3\,\partial_\iota f^{\alpha\iota}\,\partial_\theta f^\theta{}_\alpha + 4\,t_1\,\partial_\iota f^\alpha{}_\alpha\,\partial_\theta f^{\theta\iota} - 8\,t_3\,\partial_\iota f^\alpha{}_\alpha\,\partial_\theta f^{\theta\iota} +$$
$$6\,t_1\,\partial_\alpha f_{\iota\theta}\,\partial^\theta f^{\alpha\iota} - 3\,t_1\,\partial_\iota f_{\alpha\theta}\,\partial^\theta f^{\alpha\iota} + 3\,t_1\,\partial_\theta f_{\iota\alpha}\,\partial^\theta f^{\alpha\iota} + 3\,t_1\,\partial_\theta f_{\alpha\iota}\,\partial^\theta f^{\alpha\iota} +$$
$$3\,t_1\,\partial_\theta f_{\iota\alpha}\,\partial^\theta f^{\alpha\iota} + 6\,t_1\,\mathcal{A}_{\alpha\theta\iota}\,(\partial^\iota f^{\alpha\theta} + 2\,\partial^\theta f^{\alpha\iota}) + 8\,r_2\,\partial_\beta\mathcal{A}_{\alpha\iota\theta}\,\partial^\theta\mathcal{A}^{\alpha\beta\iota} -$$
$$4\,r_2\,\partial_\beta\mathcal{A}_{\alpha\theta\iota}\,\partial^\theta\mathcal{A}^{\alpha\beta\iota} + 4\,r_2\,\partial_\beta\mathcal{A}_{\iota\theta\alpha}\,\partial^\theta\mathcal{A}^{\alpha\beta\iota} - 2\,r_2\,\partial_\iota\mathcal{A}_{\alpha\beta\theta}\,\partial^\theta\mathcal{A}^{\alpha\beta\iota} +$$
$$2\,r_2\,\partial_\theta\mathcal{A}_{\alpha\beta\iota}\,\partial^\theta\mathcal{A}^{\alpha\beta\iota} - 4\,r_2\,\partial_\theta\mathcal{A}_{\alpha\iota\beta}\,\partial^\theta\mathcal{A}^{\alpha\beta\iota}\big)\Big)[t,x,y,z]\,dz\,dy\,dx\,dt$$

	$\overset{\#1}{0^+}\mathcal{A}$	$\overset{\#1}{0^+}f$	$\overset{\#2}{0^+}f$	$\overset{\#1}{0^-}\mathcal{A}$
$\overset{\#1}{0^+}\mathcal{A}^\dagger$	t_3	$-i\sqrt{2}\,k\,t_3$	0	0
$\overset{\#1}{0^+}f^\dagger$	$i\sqrt{2}\,k\,t_3$	$2k^2t_3$	0	0
$\overset{\#2}{0^+}f^\dagger$	0	0	0	0
$\overset{\#1}{0^-}\mathcal{A}^\dagger$	0	0	0	$k^2r_2-t_1$

	$\overset{\#1}{0^+}\sigma$	$\overset{\#1}{0^+}\tau$	$\overset{\#2}{0^+}\tau$	$\overset{\#1}{0^-}\sigma$
$\overset{\#1}{0^+}\sigma^\dagger$	$\frac{1}{(1+2k^2)^2t_3}$	$-\frac{i\sqrt{2}\,k}{(1+2k^2)^2t_3}$	0	0
$\overset{\#1}{0^+}\tau^\dagger$	$\frac{i\sqrt{2}\,k}{(1+2k^2)^2t_3}$	$\frac{2k^2}{(1+2k^2)^2t_3}$	0	0
$\overset{\#2}{0^+}\tau^\dagger$	0	0	0	0
$\overset{\#1}{0^-}\sigma^\dagger$	0	0	0	$\frac{1}{k^2r_2-t_1}$

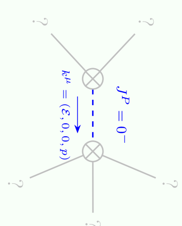
	$\overset{\#1}{2^+}\mathcal{A}^{\dagger\alpha\beta}$	$\overset{\#1}{2^+}f^{\dagger\alpha\beta}$	$\overset{\#1}{2^-}\mathcal{A}^{\dagger\alpha\beta\chi}$
$\overset{\#1}{2^-}\mathcal{A}_{\alpha\beta\chi}$	0	0	$\frac{t_1}{2}$
$\overset{\#1}{2^+}f_{\alpha\beta}$	$-\frac{i\,k\,t_1}{\sqrt{2}}$	k^2t_1	0
$\overset{\#1}{2^+}\mathcal{A}_{\alpha\beta}$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

	$\overset{\#1}{1^+}\sigma_{\alpha\beta}$	$\overset{\#2}{1^+}\sigma_{\alpha\beta}$	$\overset{\#1}{1^+}\tau_{\alpha\beta}$	$\overset{\#1}{1^-}\sigma_\alpha$	$\overset{\#2}{1^-}\sigma_\alpha$	$\overset{\#1}{1^-}\tau_\alpha$	$\overset{\#2}{1^-}\tau_\alpha$
$\overset{\#1}{1^+}\sigma^{\dagger\alpha\beta}$	0	$-\frac{\sqrt{2}}{t_1+k^2t_1}$	$-\frac{i\sqrt{2}\,k}{t_1+k^2t_1}$	0	0	0	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	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	0
$\overset{\#1}{1^-}\sigma^{\dagger\alpha}$	0	0	0	$\frac{2(t_1+t_3)}{3t_1t_3}$	$-\frac{\sqrt{2}(t_1-2t_3)}{3(1+2k^2)t_1t_3}$	0	$-\frac{2ikt_1-4ikt_3}{3t_1t_3+6k^2t_1t_3}$
$\overset{\#2}{1^-}\sigma^{\dagger\alpha}$	0	0	0	$-\frac{\sqrt{2}(t_1-2t_3)}{3(1+2k^2)t_1t_3}$	$\frac{t_1+4t_3}{3(1+2k^2)^2t_1t_3}$	0	$\frac{i\sqrt{2}\,k(t_1+4t_3)}{3(1+2k^2)^2t_1t_3}$
$\overset{\#1}{1^-}\tau^{\dagger\alpha}$	0	0	0	0	0	0	0
$\overset{\#2}{1^-}\tau^{\dagger\alpha}$	0	0	0	$\frac{2ikt_1-4ikt_3}{3t_1t_3+6k^2t_1t_3}$	$-\frac{i\sqrt{2}\,k(t_1+4t_3)}{3(1+2k^2)^2t_1t_3}$	0	$\frac{2k^2(t_1+4t_3)}{3(1+2k^2)^2t_1t_3}$

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

Massive and massless spectra

Massive particle	
Pole residue:	$-\frac{1}{r_2} > 0$
Square mass:	$\frac{t_1}{r_2} > 0$
Spin:	0
Parity:	Odd



(No particles)

Unitarity conditions