PSALTer results panel

Wave operator and propagator

	$0^+.h^\perp$	$0^+.h^\parallel$	$0^+.\mathcal{A}_a^\parallel$	$0^+.\mathcal{A}_s^{\perp t}$	$0^+.\mathcal{A}_s^\parallel$	$0^+.\mathcal{A}_s^{\perp h}$	$0^-.\mathcal{A}_a^\parallel$
$0^+.h^\perp\dagger$	0	0	0 0		$\frac{i\,a_0\,k}{4}$	$-\frac{i\,a_0\,k}{4\sqrt{2}}$	0
$0^+.h^\parallel\dagger$	0	0	$\frac{i\,a_0\,k}{2\sqrt{2}}$	0	$-\frac{i\,a_0\,k}{4\sqrt{3}}$	$\frac{i\,a_0\,k}{4\sqrt{6}}$	0
$0^+.\mathcal{A}_a^\parallel\dagger$	0	$-\frac{i\,a_0\,k}{2\sqrt{2}}$	$-\frac{a_0}{2}-(c_{10}-c_{11}-c_{12}+c_7+c_8+c_9)k^2$	0	$\frac{(-c_{10}+c_7+c_8-c_9)k^2}{\sqrt{6}}$	$\frac{(c_{10}-c_7-c_8+c_9)k^2}{2\sqrt{3}}$	0
$0^+.\mathcal{A}_s^{\perp t}\dagger$	0	0	0 0		$\frac{a_0}{2}$	$-\frac{a_0}{2\sqrt{2}}$	0
$0^+.\mathcal{A}_s^\parallel\dagger$	$-\frac{1}{4}\,i\,a_0\,k$	$\frac{i\,a_0\,k}{4\sqrt{3}}$	$\frac{(-c_{10}+c_7+c_8-c_9)k^2}{\sqrt{6}}$	$\frac{a_0}{2}$	$-\frac{2}{3}(c_{10}+c_{11}+c_{12}+c_7+c_8+c_9)k^2$	$\frac{-3a_0+4(c_{10}+c_{11}+c_{12}+c_7+c_8+c_9)k^2}{6\sqrt{2}}$	0
$0^+.\mathcal{A}_s^{\perp h}\dagger$	$\frac{i\,a_0\,k}{4\sqrt{2}}$	$-\frac{i\,a_0\,k}{4\sqrt{6}}$	$\frac{(c_{10}-c_7-c_8+c_9)k^2}{2\sqrt{3}}$	$-\frac{a_0}{2\sqrt{2}}$	$\frac{-3a_0+4(c_{10}+c_{11}+c_{12}+c_7+c_8+c_9)k^2}{6\sqrt{2}}$	$\frac{1}{6}(3a_0-2(c_{10}+c_{11}+c_{12}+c_7+c_8+c_9)k^2)$	0
$0^-.\mathcal{A}_a^\parallel\dagger$	0	0	0 0		0	0	$-\frac{a_0}{2}$

	$3^-.\mathcal{W}_s^\parallel{}_{\alpha\beta\chi}$
$3^-.\mathcal{W}_s^\parallel\dagger^{\alpha\beta\chi}$	$-\frac{2}{a_0}$

	$3^-.\mathcal{A}_s^\parallel{}_{\alpha\beta\chi}$
$3^-.\mathcal{A}_s^\parallel\dagger^{\alpha\beta\chi}$	$-\frac{a_0}{2}$

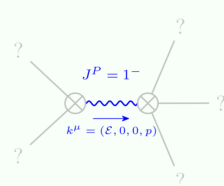
	$2^+.h^\parallel{}_{\alpha\beta}$	$2^+.\mathcal{A}_a^\parallel{}_{\alpha\beta}$	$2^+.\mathcal{A}_s^\parallel{}_{\alpha\beta}$	$2^+.\mathcal{A}_s^\perp{}_{\alpha\beta}$	$2^-.\mathcal{A}_a^\parallel{}_{\alpha\beta\chi}$	$2^-.\mathcal{A}_s^\parallel{}_{\alpha\beta\chi}$
$2^+.h^\parallel\dagger^{\alpha\beta}$	0	$-\frac{i\,a_0\,k}{4\sqrt{2}}$	$-\frac{i\,a_0\,k}{4\sqrt{3}}$	$\frac{i\,a_0\,k}{4\sqrt{6}}$	0	0
$2^+.\mathcal{A}_a^\parallel\dagger^{\alpha\beta}$	$\frac{i\,a_0\,k}{4\sqrt{2}}$	$\frac{1}{4}(a_0-(c_{10}-c_{11}-c_{12}+c_7+c_8+c_9)k^2)$	$\frac{(c_{10}-c_7-c_8+c_9)k^2}{2\sqrt{6}}$	$\frac{(-c_{10}+c_7+c_8-c_9)k^2}{4\sqrt{3}}$	0	0
$2^+.\mathcal{A}_s^\parallel\dagger^{\alpha\beta}$	$\frac{i\,a_0\,k}{4\sqrt{3}}$	$\frac{(c_{10}-c_7-c_8+c_9)k^2}{2\sqrt{6}}$	$\frac{1}{6}(-3a_0-(c_{10}+c_{11}+c_{12}+c_7+c_8+c_9)k^2)$	$\frac{(c_{10}+c_{11}+c_{12}+c_7+c_8+c_9)k^2}{6\sqrt{2}}$	0	0
$2^+.\mathcal{A}_s^\perp\dagger^{\alpha\beta}$	$-\frac{i\,a_0\,k}{4\sqrt{6}}$	$\frac{(-c_{10}+c_7+c_8-c_9)k^2}{4\sqrt{3}}$	$\frac{(c_{10}+c_{11}+c_{12}+c_7+c_8+c_9)k^2}{6\sqrt{2}}$	$\frac{1}{12}(3a_0-(c_{10}+c_{11}+c_{12}+c_7+c_8+c_9)k^2)$	0	0
$2^-.\mathcal{A}_a^\parallel\dagger^{\alpha\beta\chi}$	0	0	0	0	$\frac{a_0}{4}$	0
$2^-.\mathcal{A}_s^\parallel\dagger^{\alpha\beta\chi}$	0	0	0	0	0	$\frac{a_0}{4}$

$$
\begin{aligned}
S == \iiiint\Big(&\tfrac{1}{4}\big(2a_0\,\mathcal{A}^{\alpha\beta}{}_\alpha\,\mathcal{A}^\chi{}_{\beta\chi}+\mathcal{A}^{\alpha\beta\chi}(-2a_0\,\mathcal{A}_{\beta\chi\alpha}+4\,\mathcal{W}_{\alpha\beta\chi})+4\,\mathcal{T}^{\alpha\beta}\,h_{\alpha\beta}-\\
&a_0\,h^\chi{}_\chi\,\partial_\beta\mathcal{A}^{\alpha\beta}{}_\alpha+a_0\,h^\chi{}_\chi\,\partial_\beta\mathcal{A}^{\alpha\beta}{}_\alpha-2a_0\,h_{\alpha\chi}\,\partial_\beta\mathcal{A}^{\alpha\beta\chi}+\\
&2c_{15}\,\partial^\alpha\mathcal{A}^{\chi\delta}{}_\delta\,\partial_\beta\mathcal{A}_{\chi\alpha}{}^\beta+2c_{14}\,\partial^\alpha\mathcal{A}_{\chi\alpha}{}^\beta\,\partial_\beta\mathcal{A}^{\chi\delta}{}_\delta+\\
&2c_{12}\,\partial^\alpha\mathcal{A}^{\chi\delta}{}_\chi\,\partial_\beta\mathcal{A}_{\delta\alpha}{}^\beta+4c_{10}\,\partial^\alpha\mathcal{A}^{\chi\delta}{}_\chi\,\partial_\beta\mathcal{A}_{\delta\alpha}{}^\beta+\\
&2a_0\,h_{\beta\chi}\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha-2c_{14}\,\partial_\beta\mathcal{A}_\chi{}^\delta{}_\delta\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha-2c_{12}\,\partial_\beta\mathcal{A}^\delta{}_{\chi\delta}\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha-\\
&2c_8\,\partial_\beta\mathcal{A}^\delta{}_{\delta\chi}\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha+2c_{14}\,\partial_\chi\mathcal{A}_\beta{}^\delta{}_\delta\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha-2c_{11}\,\partial_\chi\mathcal{A}^\delta{}_{\beta\delta}\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha-\\
&2c_7\,\partial_\chi\mathcal{A}^\delta{}_{\delta\beta}\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha-2c_{15}\,\partial_\beta\mathcal{A}_\chi{}^\delta{}_\delta\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha-2c_{10}\,\partial_\beta\mathcal{A}^\delta{}_{\chi\delta}\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha+\\
&2c_{15}\,\partial_\chi\mathcal{A}_\beta{}^\delta{}_\delta\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha-2c_9\,\partial_\delta\mathcal{A}_{\beta\delta}\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha+4c_{13}\,\partial_\alpha\mathcal{A}_{\chi\beta}{}^\delta\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\delta-\\
&4c_{13}\,\partial_\chi\mathcal{A}_{\alpha\beta}{}^\delta\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\delta-2c_9\,\partial_\chi\mathcal{A}^{\alpha\beta\chi}\,\partial_\delta\mathcal{A}_{\alpha\beta}{}^\delta-2c_{11}\,\partial_\beta\mathcal{A}^{\alpha\beta\chi}\,\partial_\delta\mathcal{A}_{\alpha\chi}{}^\delta-\\
&2c_7\,\partial_\beta\mathcal{A}^{\alpha\beta\chi}\,\partial_\delta\mathcal{A}_\alpha{}^\delta{}_\chi+2c_{12}\,\partial^\chi\mathcal{A}_{\beta\alpha}{}^\beta\,\partial_\delta\mathcal{A}^{\alpha\delta}{}_\chi-\\
&2c_{10}\,\partial_\chi\mathcal{A}^{\alpha\beta\chi}\,\partial_\delta\mathcal{A}_{\beta\alpha}{}^\delta+4c_8\,\partial^\chi\mathcal{A}^\alpha{}_\alpha{}^\beta\,\partial_\delta\mathcal{A}_{\beta\chi}{}^\delta-2c_{12}\,\partial_\beta\mathcal{A}^{\alpha\beta\chi}\,\partial_\delta\mathcal{A}_{\chi\alpha}{}^\delta-\\
&2c_{15}\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha\,\partial_\delta\mathcal{A}_{\chi\beta}{}^\delta+2c_9\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha\,\partial_\delta\mathcal{A}_{\chi\beta}{}^\delta-2c_8\,\partial_\beta\mathcal{A}^{\alpha\beta\chi}\,\partial_\delta\mathcal{A}_{\chi\alpha}{}^\delta-\\
&2c_{14}\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\beta\,\partial_\delta\mathcal{A}_{\chi\alpha}{}^\delta+2c_{11}\,\partial^\chi\mathcal{A}_{\beta\alpha}{}^\beta\,\partial_\delta\mathcal{A}^{\delta\alpha}{}_\chi+\\
&4c_7\,\partial^\chi\mathcal{A}^{\alpha\beta}{}_\alpha\,\partial_\delta\mathcal{A}_{\chi\beta}{}^\delta+2c_9\,\partial_\beta\mathcal{A}_{\delta\alpha}{}^\beta\,\partial^\delta\mathcal{A}^{\chi\alpha}{}_\chi+\\
&2c_{11}\,\partial_\beta\mathcal{A}_{\delta\alpha}{}^\beta\,\partial^\delta\mathcal{A}^\chi{}_\chi{}^\alpha\big)\Big)[t,x,y,z]\,dz\,dy\,dx\,dt
\end{aligned}
$$

	$2^+.\mathcal{T}^\parallel{}_{\alpha\beta}$	$2^+.\mathcal{W}_a^\parallel{}_{\alpha\beta}$	$2^+.\mathcal{W}_s^\parallel{}_{\alpha\beta}$	$2^+.\mathcal{W}_s^\perp{}_{\alpha\beta}$	$2^-.\mathcal{W}_a^\parallel{}_{\alpha\beta\chi}$	$2^-.\mathcal{W}_s^\parallel{}_{\alpha\beta\chi}$
$2^+.\mathcal{T}^\parallel\dagger^{\alpha\beta}$	$\frac{8(c_{10}-c_{11}-c_{12}+c_7+c_8+c_9-\frac{a_0}{k^2})}{a_0^2}$	$-\frac{4i\sqrt{2}}{a_0\,k}$	$\frac{4i(a_0+(-2c_{10}+c_{11}+c_{12}-2c_9)k^2)}{\sqrt{3}\,a_0^2\,k}$	$\frac{4i\sqrt{\frac{2}{3}}(a_0+(-2c_{10}+c_{11}+c_{12}-2c_9)k^2)}{a_0^2\,k}$	0	0
$2^+.\mathcal{W}_a^\parallel\dagger^{\alpha\beta}$	$\frac{4i\sqrt{2}}{a_0\,k}$	0	$\frac{2\sqrt{\frac{2}{3}}}{a_0}$	$\frac{4}{\sqrt{3}\,a_0}$	0	0
$2^+.\mathcal{W}_s^\parallel\dagger^{\alpha\beta}$	$-\frac{4i(a_0+(-2c_{10}+c_{11}+c_{12}-2c_9)k^2)}{\sqrt{3}\,a_0^2\,k}$	$\frac{2\sqrt{\frac{2}{3}}}{a_0}$	$\frac{8(-a_0+(c_{10}+c_9)k^2)}{3a_0^2}$	$-\frac{2\sqrt{2}(a_0-4(c_{10}+c_9)k^2)}{3a_0^2}$	0	0
$2^+.\mathcal{W}_s^\perp\dagger^{\alpha\beta}$	$-\frac{4i\sqrt{\frac{2}{3}}(a_0+(-2c_{10}+c_{11}+c_{12}-2c_9)k^2)}{a_0^2\,k}$	$\frac{4}{\sqrt{3}\,a_0}$	$-\frac{2\sqrt{2}(a_0-4(c_{10}+c_9)k^2)}{3a_0^2}$	$\frac{8(a_0+2(c_{10}+c_9)k^2)}{3a_0^2}$	0	0
$2^-.\mathcal{W}_a^\parallel\dagger^{\alpha\beta\chi}$	0 0		0	0	$\frac{4}{a_0}$	0
$2^-.\mathcal{W}_s^\parallel\dagger^{\alpha\beta\chi}$	0 0		0	0	0	$\frac{4}{a_0}$

Spin-parity form	Covariant form	Multiplicities
$k\,0^+.\mathcal{W}_s^\parallel+2\,k\,0^+.\mathcal{W}_s^{\perp h}-6\,i\,0^+.\mathcal{T}^\perp==0$ 2	$\partial_\beta\partial_\alpha\mathcal{T}^{\alpha\beta}+\partial_\chi\partial^\chi\partial_\alpha\mathcal{W}^{\alpha\beta}{}_\beta==\partial_\chi\partial_\beta\partial_\alpha\mathcal{W}^{\alpha\beta\chi}$	1
$k\,0^+.\mathcal{W}_s^{\perp t}+2\,i\,0^+.\mathcal{T}^\perp==0$	$2\,\partial_\beta\partial_\alpha\mathcal{T}^{\alpha\beta}==\partial_\chi\partial_\beta\partial_\alpha\mathcal{W}^{\alpha\beta\chi}$	1
$3\,k\,1^-.\mathcal{W}_a^{\perp\alpha}+k\,1^-.\mathcal{W}_s^{\perp t\alpha}+6\,i\,1^-.\mathcal{T}^{\perp\alpha}==k\,1^-.\mathcal{W}_s^{\perp h\alpha}$	$2\,\partial_\chi\partial_\beta\partial^\alpha\mathcal{T}^{\beta\chi}+\partial_\delta\partial^\delta\partial_\chi\partial_\beta\mathcal{W}^{\beta\alpha\chi}==2\,\partial_\chi\partial^\chi\partial_\beta\mathcal{T}^{\alpha\beta}+\partial_\delta\partial_\chi\partial_\beta\partial^\alpha\mathcal{W}^{\beta\chi\delta}$	3
Total expected gauge generators:		5

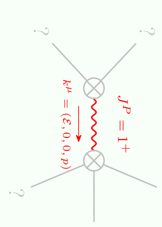
Massive and massless spectra



Massive particle

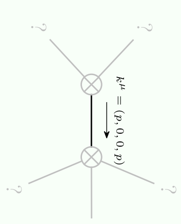
Pole residue:	(Hidden for brevity)
Square mass:	$\frac{a_0(c_{10}-c_{11}+c_{12}-16c_{13}+4c_{14}+4c_{15}-c_7+c_8-c_9)}{5(4c_{10}c_{13}-4c_{11}c_{13}+4c_{12}c_{13}+c_{14}^2+2c_{14}c_{15}+c_{15}^2-4c_{13}c_7+4c_{13}c_8-4c_{13}c_9)}>0$
Spin:	1
Parity:	Odd

Pole residue:	$\frac{1}{(c_{10}-c_{11}+c_{12}-c_7+c_8-c_9)^3}(6c_{10}^2+4c_{11}^2+4c_{12}^2-8c_{12}c_7+6c_7^2+8c_{12}c_8-12c_7c_8+6c_8^2-8c_{11}(c_{12}-c_7+c_8-c_9)-8c_{12}c_9+4c_7c_9-4c_8c_9+6c_9^2-4c_{10}(2c_{11}-2c_{12}+c_7-c_8+3c_9))>0$
Square mass:	$-\frac{a_0}{c_{10}-c_{11}+c_{12}-c_7+c_8-c_9}>0$
Spin:	1
Parity:	Even



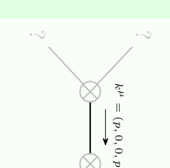
Massive particle

Pole residue:	$\frac{9+a_0^2}{a_0^2(-c_{10}+c_{11}-c_{12}+16c_{13}-4c_{14}-4c_{15}+c_7-c_8+c_9)}>0$
Polarisations:	2



Massless particle

Pole residue:	$-\frac{1}{a_0}>0$
Polarisations:	2



Massless particle

Unitarity conditions

(Timeout after 10 seconds)