PSALTer results panel

Wave operator and propagator

	$1^+\mathcal{A}_s{}^{\perp}{}^{\dagger\alpha\beta}$	$1^-h^{\perp}{}^{\dagger\alpha}$	$1^-\mathcal{A}_s{}^{\perp t}{}^{\dagger\alpha}$	$1^-\mathcal{A}_s{}^{\parallel t}{}^{\dagger\alpha}$	$1^-\mathcal{A}_s{}^{\perp h}{}^{\dagger\alpha}$	$1^-\mathcal{A}_s{}^{\parallel h}{}^{\dagger\alpha}$
$1^+\mathcal{A}_s{}^{\perp}{}_{\alpha\beta}$	$\frac{a_0}{4}$	0	0	0	0	0
$1^-h^{\perp}{}_{\alpha}$	0	0	$\frac{i k a_0}{4\sqrt{6}}$	$-\frac{1}{4} i \sqrt{\frac{5}{6}} k a_0$	$-\frac{i k a_0}{8\sqrt{3}}$	$\frac{i k a_0}{4\sqrt{6}}$
$1^-\mathcal{A}_s{}^{\perp t}{}_{\alpha}$	0	$-\frac{i k a_0}{4\sqrt{6}}$	$\frac{1}{6}(-k^2(h_{11}+h_7)-2a_0)$	$\frac{1}{6}\sqrt{5}(k^2(h_{12}+h_8)+a_0)$	$\frac{2k^2(h_{11}+h_7)+a_0}{12\sqrt{2}}$	$\frac{1}{12}(k^2(h_{12}-2h_8)+a_0)$
$1^-\mathcal{A}_s{}^{\parallel t}{}_{\alpha}$	0	$\frac{1}{4} i \sqrt{\frac{5}{6}} k a_0$	$\frac{1}{6}\sqrt{5}(k^2(h_{12}+h_8)+a_0)$	$\frac{1}{6}(-5k^2(h_{11}+h_7)+2a_0)$	$\frac{1}{12}\sqrt{\frac{5}{2}}(-2k^2(h_{12}+h_8)+a_0)$	$\frac{1}{12}\sqrt{5}(-k^2(h_{11}-2h_7)+a_0)$
$1^-\mathcal{A}_s{}^{\perp h}{}_{\alpha}$	0	$\frac{i k a_0}{8\sqrt{3}}$	$\frac{2k^2(h_{11}+h_7)+a_0}{12\sqrt{2}}$	$\frac{1}{12}\sqrt{\frac{5}{2}}(-2k^2(h_{12}+h_8)+a_0)$	$\frac{1}{12}(-k^2(h_{11}+h_7)+a_0)$	$-\frac{k^2(h_{12}-2h_8)+4a_0}{12\sqrt{2}}$
$1^-\mathcal{A}_s{}^{\parallel h}{}_{\alpha}$	0	$-\frac{i k a_0}{4\sqrt{6}}$	$\frac{1}{12}(k^2(h_{12}-2h_8)+a_0)$	$\frac{1}{12}\sqrt{5}(-k^2(h_{11}-2h_7)+a_0)$	$-\frac{k^2(h_{12}-2h_8)+4a_0}{12\sqrt{2}}$	$\frac{1}{12}(k^2(4h_{11}-2h_7)-a_0)$

Spin-parity form	Covariant form	Multiplicities
$k\, 0^+\mathcal{W}_s{}^{\perp t} + 2 i\, 0^+\mathcal{T}^{\perp} == 0$ 2	$\partial_\beta\partial_\alpha\mathcal{T}^{\alpha\beta} == \partial_\chi\partial_\beta\partial_\alpha\mathcal{W}^{\alpha\beta\chi}$	1
$2k\, 1^-\mathcal{W}_s{}^{\perp h\alpha} + k\, 1^-\mathcal{W}_s{}^{\perp t\alpha} + 6 i\, 1^-\mathcal{T}^{\perp\alpha} == 0$ 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:		4

	$0^+\mathcal{T}^{\perp}$	$0^+\mathcal{T}^{\parallel}$	$0^+\mathcal{W}_s{}^{\perp t}$	$0^+\mathcal{W}_s{}^{\parallel}$	$0^+\mathcal{W}_s{}^{\perp h}$
$0^+\mathcal{T}^{\perp}{}^\dagger$	$\frac{4k^2(6k^2(h_{11}+h_{12}+h_7+h_8)-a_0)}{3(4+k^2)^2 a_0^2}$	$-\frac{8k^2(h_{11}+h_{12})}{\sqrt{3}(4+k^2)a_0^2}$	$\frac{8 i k(6k^2(h_{11}+h_{12}+h_7+h_8)-a_0)}{3(4+k^2)^2 a_0^2}$	$\frac{10 i k}{3(4+k^2)a_0}$	$\frac{4 i \sqrt{2} k}{3(4+k^2)a_0}$
$0^+\mathcal{T}^{\parallel}{}^\dagger$	$-\frac{8k^2(h_{11}+h_{12})}{\sqrt{3}(4+k^2)a_0^2}$	$\frac{4(2k^2(-h_{11}-h_{12}+h_7+h_8)+a_0)}{k^2 a_0^2}$	$-\frac{16 i k(h_{11}+h_{12})}{\sqrt{3}(4+k^2)a_0^2}$	$-\frac{2i}{\sqrt{3} k a_0}$	$\frac{4 i \sqrt{\frac{2}{3}}}{k a_0}$
$0^+\mathcal{W}_s{}^{\perp t}{}^\dagger$	$-\frac{8 i k(6k^2(h_{11}+h_{12}+h_7+h_8)-a_0)}{3(4+k^2)^2 a_0^2}$	$\frac{16 i k(h_{11}+h_{12})}{\sqrt{3}(4+k^2)a_0^2}$	$\frac{16(6k^2(h_{11}+h_{12}+h_7+h_8)-a_0)}{3(4+k^2)^2 a_0^2}$	$\frac{20}{3(4+k^2)a_0}$	$\frac{8\sqrt{2}}{3(4+k^2)a_0}$
$0^+\mathcal{W}_s{}^{\parallel}{}^\dagger$	$-\frac{10 i k}{12a_0+3k^2a_0}$	$\frac{2i}{\sqrt{3} k a_0}$	$\frac{20}{12a_0+3k^2a_0}$	0	0
$0^+\mathcal{W}_s{}^{\perp h}{}^\dagger$	$-\frac{4 i \sqrt{2} k}{12a_0+3k^2a_0}$	$-\frac{4 i \sqrt{\frac{2}{3}}}{k a_0}$	$\frac{8\sqrt{2}}{12a_0+3k^2a_0}$	0	0

	$2^+\mathcal{T}^{\parallel}{}^{\dagger\alpha\beta}$	$2^+\mathcal{W}_s{}^{\parallel}{}^{\dagger\alpha\beta}$	$2^+\mathcal{W}_s{}^{\perp}{}^{\dagger\alpha\beta}$	$2^-\mathcal{W}_s{}^{\parallel}{}^{\dagger\alpha\beta\chi}$
$2^+\mathcal{T}^{\parallel}{}_{\alpha\beta}$	$-\frac{2(k^4(h_{11}+h_{12})^2+4k^2(h_{11}+h_{12}-h_7-h_8)a_0+4a_0^2)}{k^2 a_0^3}$	$-\frac{4i(k^2(h_{11}+h_{12})+a_0)}{\sqrt{3} k a_0^2}$	$\frac{2 i \sqrt{\frac{2}{3}}(k^2(h_{11}+h_{12})+4a_0)}{k a_0^2}$	0
$2^+\mathcal{W}_s{}^{\parallel}{}_{\alpha\beta}$	$\frac{4i(k^2(h_{11}+h_{12})+a_0)}{\sqrt{3} k a_0^2}$	$-\frac{8}{3a_0}$	$\frac{4\sqrt{2}}{3a_0}$	0
$2^+\mathcal{W}_s{}^{\perp}{}_{\alpha\beta}$	$-\frac{2 i \sqrt{\frac{2}{3}}(k^2(h_{11}+h_{12})+4a_0)}{k a_0^2}$	$\frac{4\sqrt{2}}{3a_0}$	$-\frac{4}{3a_0}$	0
$2^-\mathcal{W}_s{}^{\parallel}{}_{\alpha\beta\chi}$	0	0	0	$\frac{4}{a_0}$

$$
\begin{aligned}
\mathcal{S} == \iiiint \Big(\tfrac{1}{4}\big(&-2a_0\, \mathcal{A}_{\alpha\chi\beta}\mathcal{A}^{\alpha\beta\chi} + 2a_0\, \mathcal{A}^{\alpha}{}_{\alpha}{}^{\beta}\mathcal{A}^{\chi}{}_{\beta\chi} + 4\mathcal{A}^{\alpha\beta\chi}\mathcal{W}_{\alpha\beta\chi} + \\
&4\mathcal{T}^{\alpha\beta}h_{\alpha\beta} + 2a_0\, h^{\alpha\beta}\partial_\beta\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi} - \\
&2a_0\, h^{\alpha\beta}\partial_\chi\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta} - a_0\, h^{\alpha}{}_{\alpha}\partial_\chi\mathcal{A}^{\beta}{}_{\beta}{}^{\chi} + \\
&a_0\, h^{\alpha}{}_{\alpha}\partial_\chi\mathcal{A}^{\beta\chi}{}_{\beta} - 2h_8\partial_\beta\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^\chi\mathcal{A}^{\alpha}{}_{\alpha}{}^{\beta} - \\
&2h_{12}\partial_\beta\mathcal{A}^{\delta}{}_{\chi\delta}\partial^\chi\mathcal{A}^{\alpha}{}_{\alpha}{}^{\beta} - \\
&2h_7\partial_\chi\mathcal{A}_{\beta}{}^{\delta}{}_{\delta}\partial^\chi\mathcal{A}^{\alpha}{}_{\alpha}{}^{\beta} - 2h_{11}\partial_\chi\mathcal{A}^{\delta}{}_{\beta\delta}\partial^\chi\mathcal{A}^{\alpha}{}_{\alpha}{}^{\beta} - \\
&2h_7\partial_\beta\mathcal{A}^{\alpha\beta\chi}\partial_\delta\mathcal{A}_{\alpha}{}^{\delta}{}_{\chi} - 2h_8\partial_\beta\mathcal{A}^{\alpha\beta\chi}\partial_\delta\mathcal{A}_{\alpha\chi}{}^{\delta} + \\
&2h_{12}\partial^\chi\mathcal{A}^{\alpha}{}_{\alpha}{}^{\beta}\partial_\delta\mathcal{A}_{\beta\chi}{}^{\delta} - 2h_{11}\partial_\alpha\mathcal{A}^{\alpha\beta\chi}\partial_\delta\mathcal{A}_{\beta}{}^{\delta}{}_{\chi} - \\
&2h_{12}\partial_\alpha\mathcal{A}^{\alpha\beta\chi}\partial_\delta\mathcal{A}_{\beta\chi}{}^{\delta} + \\
&4h_7\partial^\chi\mathcal{A}^{\alpha}{}_{\alpha}{}^{\beta}\partial_\delta\mathcal{A}_{\beta}{}^{\delta}{}_{\chi} + 4h_8\partial^\chi\mathcal{A}^{\alpha}{}_{\alpha}{}^{\beta}\partial_\delta\mathcal{A}_{\beta\chi}{}^{\delta} + \\
&2h_{11}\partial^\chi\mathcal{A}^{\alpha\beta}{}_{\alpha}\partial_\delta\mathcal{A}_{\beta}{}^{\delta}{}_{\chi} + 2h_{12}\partial^\chi\mathcal{A}^{\alpha\beta}{}_{\alpha} \\
&\partial_\delta\mathcal{A}_{\beta}{}^{\delta}{}_{\chi} + 2h_{11}\partial^\chi\mathcal{A}^{\alpha}{}_{\alpha}{}^{\beta}\partial_\delta\mathcal{A}_{\chi\beta}{}^{\delta}\big)\Big)[\\
&t, x, y, z]\, dz\, dy\, dx\, dt
\end{aligned}
$$

	$2^+h^{\parallel}{}_{\alpha\beta}$	$2^+\mathcal{A}_s{}^{\parallel}{}_{\alpha\beta}$	$2^+\mathcal{A}_s{}^{\perp}{}_{\alpha\beta}$	$2^-\mathcal{A}_s{}^{\parallel}{}_{\alpha\beta\chi}$
$2^+h^{\parallel}{}^{\dagger\alpha\beta}$	0	$-\frac{i k a_0}{4\sqrt{3}}$	$-\frac{i k a_0}{2\sqrt{6}}$	0
$2^+\mathcal{A}_s{}^{\parallel}{}^{\dagger\alpha\beta}$	$\frac{i k a_0}{4\sqrt{3}}$	$\frac{1}{6}(-k^2(h_{11}+h_{12}+h_7+h_8)-3a_0)$	$-\frac{k^2(h_{11}+h_{12}+4(h_7+h_8))}{12\sqrt{2}}$	0
$2^+\mathcal{A}_s{}^{\perp}{}^{\dagger\alpha\beta}$	$\frac{i k a_0}{2\sqrt{6}}$	$-\frac{k^2(h_{11}+h_{12}+4(h_7+h_8))}{12\sqrt{2}}$	$\frac{1}{6}k^2(h_{11}+h_{12}-2(h_7+h_8))+\frac{a_0}{4}$	0
$2^-\mathcal{A}_s{}^{\parallel}{}^{\dagger\alpha\beta\chi}$	0	0	0	$\frac{a_0}{4}$

	$0^+h^{\perp}$	$0^+h^{\parallel}$	$0^+\mathcal{A}_s{}^{\perp t}$	$0^+\mathcal{A}_s{}^{\parallel}$	$0^+\mathcal{A}_s{}^{\perp h}$
$0^+h^{\perp}{}^\dagger$	0	0	0	$\frac{i k a_0}{4}$	$\frac{i k a_0}{8\sqrt{2}}$
$0^+h^{\parallel}{}^\dagger$	0	0	0	$-\frac{i k a_0}{4\sqrt{3}}$	$\frac{5 i k a_0}{8\sqrt{6}}$
$0^+\mathcal{A}_s{}^{\perp t}{}^\dagger$	0	0	0	$\frac{a_0}{2}$	$\frac{a_0}{4\sqrt{2}}$
$0^+\mathcal{A}_s{}^{\parallel}{}^\dagger$	$-\frac{1}{4} i k a_0$	$\frac{i k a_0}{4\sqrt{3}}$	$\frac{a_0}{2}$	$-\frac{2}{3}k^2(h_{11}+h_{12}+h_7+h_8)$	$\frac{2k^2(-2h_{11}-2h_{12}+h_7+h_8)+3a_0}{12\sqrt{2}}$
$0^+\mathcal{A}_s{}^{\perp h}{}^\dagger$	$-\frac{i k a_0}{8\sqrt{2}}$	$-\frac{5 i k a_0}{8\sqrt{6}}$	$\frac{a_0}{4\sqrt{2}}$	$\frac{2k^2(-2h_{11}-2h_{12}+h_7+h_8)+3a_0}{12\sqrt{2}}$	$\frac{1}{12}(k^2(8h_{11}+8h_{12}-7(h_7+h_8))-3a_0)$

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

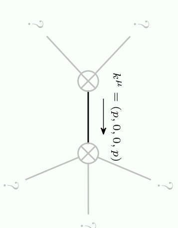
	$3^-\mathcal{A}_s{}^{\parallel}{}^{\dagger\alpha\beta\chi}$
$3^-\mathcal{A}_s{}^{\parallel}{}_{\alpha\beta\chi}$	$-\frac{a_0}{2}$

Massive and massless spectra

Massless particle

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

Polarisations: 2



(No particles)

Unitarity conditions

$$(h_{11} \mid h_7) \in \mathbb{R} \;\&\&\; a_0 < 0 \;\&\&\; h_8 < h_7 \;\&\&\; \left(\frac{1}{2}(2h_{11}+h_7-h_8) - \frac{1}{2}\sqrt{\frac{5}{3}}\sqrt{h_7^2 - 2h_7h_8 + h_8^2} \le h_{12} < h_{11} \;\|\; h_{11} < h_{12} \le \frac{1}{2}(2h_{11}+h_7-h_8) + \frac{1}{2}\sqrt{\frac{5}{3}}\sqrt{h_7^2 - 2h_7h_8 + h_8^2}\right)$$