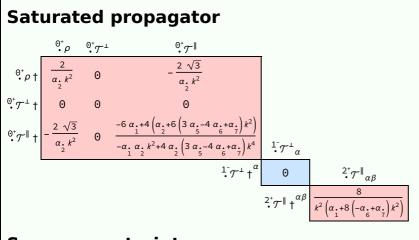# PSALTer results panel

$$\mathcal{S} = \iiiint \Big(\rho\, \varphi + h^{\alpha\beta}\ \mathcal{T}_{\alpha\beta} + \tfrac{1}{2}\, \alpha_2\, \partial_\alpha\varphi\, \partial^\alpha\varphi + \tfrac{1}{8}\, \alpha_1 \Big(12\, \partial_\alpha\partial^\alpha\varphi - 4\, \partial_\alpha h^\beta{}_\beta\, \partial^\alpha\varphi - 6\, \partial_\alpha\varphi\, \partial^\alpha\varphi + 4\, \partial^\alpha\varphi\, \partial_\beta h_\alpha{}^\beta -$$

$$4\, \partial_\beta\partial_\alpha h^{\alpha\beta} + 4\, \partial_\beta\partial^\beta h^\alpha{}_\alpha - \partial_\beta h^\chi{}_\chi\, \partial^\beta h^\alpha{}_\alpha + 2\, \partial^\beta h^\alpha{}_\alpha\, \partial_\chi h_\beta{}^\chi - 2\, \partial_\beta h_{\alpha\chi}\, \partial^\chi h^{\alpha\beta} + \partial_\chi h_{\alpha\beta}\, \partial^\chi h^{\alpha\beta} \Big) -$$

$$\alpha_6 \Big(4\, \partial_\beta\partial_\alpha h^\chi{}_\chi\, \partial^\beta\partial^\alpha\varphi + 4\, \partial_\beta\partial_\alpha\varphi\, \partial^\beta\partial^\alpha\varphi - 4\, \partial^\beta\partial^\alpha\varphi\, \partial_\chi\partial_\alpha h_\beta{}^\chi - 4\, \partial^\beta\partial^\alpha\varphi\, \partial_\chi\partial_\beta h_\alpha{}^\chi + 4\, \partial^\beta\partial^\alpha\varphi\, \partial_\chi\partial^\chi h_{\alpha\beta} +$$

$$4\, \partial_\alpha\partial^\alpha\varphi \Big(2\, \partial_\beta\partial^\beta\varphi - \partial_\chi\partial_\beta h^{\beta\chi} + \partial_\chi\partial^\chi h^\beta{}_\beta \Big) + \partial_\chi\partial_\beta h^\delta{}_\delta\, \partial^\chi\partial^\beta h^\alpha{}_\alpha + 2\, \partial^\chi\partial_\alpha h^{\alpha\beta}\, \partial_\delta\partial_\beta h_\chi{}^\delta + 2\, \partial^\chi\partial_\alpha h^{\alpha\beta}\, \partial_\delta\partial_\chi h_\beta{}^\delta -$$

$$4\, \partial^\chi\partial^\beta h^\alpha{}_\alpha\, \partial_\delta\partial_\chi h_\beta{}^\delta + \partial_\chi\partial^\chi h^{\alpha\beta}\, \partial_\delta\partial^\delta h_{\alpha\beta} - 4\, \partial^\chi\partial_\alpha h^{\alpha\beta}\, \partial_\delta\partial^\delta h_{\beta\chi} + 2\, \partial^\chi\partial^\beta h^\alpha{}_\alpha\, \partial_\delta\partial^\delta h_{\beta\chi} \Big) +$$

$$\alpha_5 \Big(\partial_\alpha\partial^\alpha\varphi \Big(9\, \partial_\beta\partial^\beta\varphi - 6\, \partial_\chi\partial_\beta h^{\beta\chi} + 6\, \partial_\chi\partial^\chi h^\beta{}_\beta \Big) + \partial_\beta\partial_\alpha h^{\alpha\beta}\, \partial_\delta\partial_\chi h^{\chi\delta} + \partial_\beta\partial^\beta h^\alpha{}_\alpha \Big({-2}\, \partial_\delta\partial_\chi h^{\chi\delta} + \partial_\delta\partial^\delta h^\chi{}_\chi \Big) \Big) +$$

$$\alpha_7 \Big(\partial_\alpha\partial^\alpha\varphi\, \partial_\beta\partial^\beta\varphi + 2\, \partial_\beta\partial_\alpha h^\chi{}_\chi\, \partial^\beta\partial^\alpha\varphi + 2\, \partial_\beta\partial_\alpha\varphi\, \partial^\beta\partial^\alpha\varphi - 2\, \partial^\beta\partial^\alpha\varphi\, \partial_\chi\partial_\alpha h_\beta{}^\chi - 2\, \partial^\beta\partial^\alpha\varphi\, \partial_\chi\partial_\beta h_\alpha{}^\chi + 2\, \partial^\beta\partial^\alpha\varphi\, \partial_\chi\partial^\chi h_{\alpha\beta} +$$

$$\partial_\beta\partial_\alpha h_{\chi\delta}\, \partial^\delta\partial^\chi h^{\alpha\beta} - \partial_\chi\partial_\beta h_{\alpha\delta}\, \partial^\delta\partial^\chi h^{\alpha\beta} - \partial_\delta\partial_\beta h_{\alpha\chi}\, \partial^\delta\partial^\chi h^{\alpha\beta} + \partial_\delta\partial_\chi h_{\alpha\beta}\, \partial^\delta\partial^\chi h^{\alpha\beta} \Big) \Big) [t,\ x,\ y,\ z]\, dz\, dy\, dx\, dt$$

Wave operator

	$\overset{0^+}{\bullet}\varphi$	$\overset{0^+}{\bullet}h^\perp$	$\overset{0^+}{\bullet}h^\parallel$
$\overset{0^+}{\bullet}\varphi\,\dagger$	$\tfrac{1}{4}\,k^2\Big({-3}\,\alpha_1 + 2\Big(\alpha_2 + 6\Big(3\,\alpha_5 - 4\,\alpha_6 + \alpha_7\Big)k^2\Big)\Big)$	0	$-\tfrac{1}{4}\,\sqrt{3}\,k^2\Big(\alpha_1 - 4\Big(3\,\alpha_5 - 4\,\alpha_6 + \alpha_7\Big)k^2\Big)$
$\overset{0^+}{\bullet}h^\perp\,\dagger$	0	0	0
$\overset{0^+}{\bullet}h^\parallel\,\dagger$	$-\tfrac{1}{4}\,\sqrt{3}\,k^2\Big(\alpha_1 - 4\Big(3\,\alpha_5 - 4\,\alpha_6 + \alpha_7\Big)k^2\Big)$	0	$-\tfrac{\alpha_1\,k^2}{4} + \Big(3\,\alpha_5 - 4\,\alpha_6 + \alpha_7\Big)k^4$

	$\overset{1^-}{\bullet}h^\perp{}_\alpha$
$\overset{1^-}{\bullet}h^\perp\,\dagger^\alpha$	0

	$\overset{2^+}{\bullet}h^\parallel{}_{\alpha\beta}$
$\overset{2^+}{\bullet}h^\parallel\,\dagger^{\alpha\beta}$	$\tfrac{\alpha_1\,k^2}{8} + \Big({-\alpha_6} + \alpha_7\Big)k^4$

Saturated propagator

	$\overset{0^+}{\bullet}\rho$	$\overset{0^+}{\bullet}\mathcal{T}^\perp$	$\overset{0^+}{\bullet}\mathcal{T}^\parallel$
$\overset{0^+}{\bullet}\rho\,\dagger$	$\dfrac{2}{\alpha_2\,k^2}$	0	$-\dfrac{2\,\sqrt{3}}{\alpha_2\,k^2}$
$\overset{0^+}{\bullet}\mathcal{T}^\perp\,\dagger$	0	0	0
$\overset{0^+}{\bullet}\mathcal{T}^\parallel\,\dagger$	$-\dfrac{2\,\sqrt{3}}{\alpha_2\,k^2}$	0	$\dfrac{-6\,\alpha_1 + 4\Big(\alpha_2 + 6\Big(3\,\alpha_5 - 4\,\alpha_6 + \alpha_7\Big)k^2\Big)}{-\alpha_1\,\alpha_2\,k^2 + 4\,\alpha_2\Big(3\,\alpha_5 - 4\,\alpha_6 + \alpha_7\Big)k^4}$

	$\overset{1^-}{\bullet}\mathcal{T}^\perp{}_\alpha$
$\overset{1^-}{\bullet}\mathcal{T}^\perp\,\dagger^\alpha$	0

	$\overset{2^+}{\bullet}\mathcal{T}^\parallel{}_{\alpha\beta}$
$\overset{2^+}{\bullet}\mathcal{T}^\parallel\,\dagger^{\alpha\beta}$	$\dfrac{8}{k^2\Big(\alpha_1 + 8\Big({-\alpha_6} + \alpha_7\Big)k^2\Big)}$

Source constraints

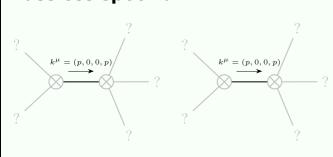| Spin-parity form	Covariant form	Multiplicities
$\overset{0^+}{\bullet}\mathcal{T}^\perp == 0$	$\partial_\beta\partial_\alpha\mathcal{T}^{\alpha\beta} == 0$	1
$\overset{1^-}{\bullet}\mathcal{T}^{\perp\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\mathcal{T}^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\mathcal{T}^{\alpha\beta}$	3
Total expected gauge generators:		4

Massive spectrum

$J^P = 0^+$

$k^\mu = (\mathcal{E}, 0, 0, p)$

Massive particle

$J^P = 2^+$

$k^\mu = (\mathcal{E}, 0, 0, p)$

Massive particle

Pole residue:	$\dfrac{4}{\alpha_1} > 0$
Square mass:	$\dfrac{\alpha_1}{4\left(3\,\alpha_5 - 4\,\alpha_6 + \alpha_7\right)} > 0$
Spin:	0
Parity:	Even

Pole residue:	$-\dfrac{8}{\alpha_1} > 0$
Square mass:	$\dfrac{\alpha_1}{8\,\alpha_6 - 8\,\alpha_7} > 0$
Spin:	2
Parity:	Even

Massless spectrum

$k^\mu = (p, 0, 0, p)$

$k^\mu = (p, 0, 0, p)$

Massless particle

Massless particle

Pole residue:	$\dfrac{p^2}{\alpha_1} > 0$
Polarisations:	2

Pole residue:	$\dfrac{1 + 2\,p^2}{\alpha_2} > 0$
Polarisations:	1

Unitarity conditions

(Demonstrably impossible)