

PSALTER results panel

$$\begin{aligned} S = & \iiint (\rho \varphi + h^{\alpha\beta} \mathcal{T}_{\alpha\beta} + \tfrac{1}{2} \alpha_{\dot{2}} \partial_{\alpha} \varphi \partial^{\alpha} \varphi + \tfrac{1}{8} \alpha_{\dot{1}} (36 (1 + 2 \varphi) \partial_{\alpha} \partial^{\alpha} \varphi - 12 \partial_{\alpha} h^{\beta}_{\beta} \partial^{\alpha} \varphi + 18 \partial_{\alpha} \varphi \partial^{\alpha} \varphi + 12 \partial^{\alpha} \varphi \partial_{\beta} h^{\beta}_{\alpha} - 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^{\chi}_{\beta} - 2 \partial_{\beta} h_{\alpha\chi} \partial^{\chi} h^{\alpha\beta} + \partial_{\chi} h_{\alpha\beta} \partial^{\chi} h^{\alpha\beta}) - \\ & \alpha_{\dot{6}} (12 \partial_{\beta} \partial_{\alpha} h^{\chi}_{\chi} \partial^{\beta} \partial^{\alpha} \varphi + 36 \partial_{\beta} \partial_{\alpha} \varphi \partial^{\beta} \partial^{\alpha} \varphi - 12 \partial^{\beta} \partial^{\alpha} \varphi \partial_{\chi} \partial_{\alpha} h^{\chi}_{\beta} - 12 \partial^{\beta} \partial^{\alpha} \varphi \partial_{\chi} \partial_{\beta} h^{\chi}_{\alpha} + 12 \partial^{\beta} \partial^{\alpha} \varphi \partial_{\chi} \partial^{\chi} h_{\alpha\beta} + 12 \partial_{\alpha} \partial^{\alpha} \varphi (6 \partial_{\beta} \partial^{\beta} \varphi - \partial_{\chi} \partial_{\beta} h^{\beta\chi} + \partial_{\chi} \partial^{\chi} h^{\beta}_{\beta}) + \\ & \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^{\delta}_{\chi} + 2 \partial^{\chi} \partial_{\alpha} h^{\alpha\beta} \partial_{\delta} \partial_{\chi} h^{\delta}_{\beta} - 4 \partial^{\chi} \partial^{\beta} h^{\alpha}_{\alpha} \partial_{\delta} \partial_{\chi} h^{\delta}_{\beta} + \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}) + \\ & \alpha_{\dot{5}} (9 \partial_{\alpha} \partial^{\alpha} \varphi (9 \partial_{\beta} \partial^{\beta} \varphi - 2 \partial_{\chi} \partial_{\beta} h^{\beta\chi} + 2 \partial_{\chi} \partial^{\chi} h^{\beta}_{\beta}) + \partial_{\beta} \partial_{\alpha} h^{\alpha\beta} \partial_{\delta} \partial_{\chi} h^{\chi\delta} + \partial_{\beta} \partial^{\beta} h^{\alpha}_{\alpha} (-2 \partial_{\delta} \partial_{\chi} h^{\chi\delta} + \partial_{\delta} \partial^{\delta} h^{\chi}_{\chi})) + \alpha_{\dot{7}} (9 \partial_{\alpha} \partial^{\alpha} \varphi \partial_{\beta} \partial^{\beta} \varphi + 6 \partial_{\beta} \partial_{\alpha} h^{\chi}_{\chi} \partial^{\beta} \partial^{\alpha} \varphi + 18 \partial_{\beta} \partial_{\alpha} \varphi \partial^{\beta} \partial^{\alpha} \varphi - \\ & 6 \partial^{\beta} \partial^{\alpha} \varphi \partial_{\chi} \partial_{\alpha} h^{\chi}_{\beta} - 6 \partial^{\beta} \partial^{\alpha} \varphi \partial_{\chi} \partial_{\beta} h^{\chi}_{\alpha} + 6 \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})) [t, x, y, z] dz dy dx dt \end{aligned}$$

Wave operator

${}^0_{\dot{}}\varphi$

${}^0_{\dot{}}h^{\perp}$

${}^0_{\dot{}}h^{\parallel}$

${}^0_{\dot{}}\varphi \dagger$

${}^0_{\dot{}}h^{\perp} \dagger$

${}^0_{\dot{}}h^{\parallel} \dagger$

$\frac{1}{4} k^2 (9 \alpha_{\dot{1}} + 2 (\alpha_{\dot{2}} + 54 (3 \alpha_{\dot{5}} - 4 \alpha_{\dot{6}} + \alpha_{\dot{7}}) k^2))$

0

$-\frac{3}{4} \sqrt{3} k^2 (\alpha_{\dot{1}} - 4 (3 \alpha_{\dot{5}} - 4 \alpha_{\dot{6}} + \alpha_{\dot{7}}) k^2)$

0

0

0

$-\frac{3}{4} \sqrt{3} k^2 (\alpha_{\dot{1}} - 4 (3 \alpha_{\dot{5}} - 4 \alpha_{\dot{6}} + \alpha_{\dot{7}}) k^2)$

0

$-\frac{\alpha_{\dot{1}} k^2}{4} + (3 \alpha_{\dot{5}} - 4 \alpha_{\dot{6}} + \alpha_{\dot{7}}) k^4$

${}^1_{\dot{}}h^{\perp}{}_{\alpha}$

${}^1_{\dot{}}h^{\perp} \dagger^{\alpha}$

${}^2_{\dot{}}h^{\parallel}{}_{\alpha\beta}$

0

$\frac{\alpha_{\dot{1}} k^2}{8} + (-\alpha_{\dot{6}} + \alpha_{\dot{7}}) k^4$

Saturated propagator

${}^0_{\dot{}}\rho$

${}^0_{\dot{}}\mathcal{T}^{\perp}$

${}^0_{\dot{}}\mathcal{T}^{\parallel}$

${}^0_{\dot{}}\rho \dagger$

${}^0_{\dot{}}\mathcal{T}^{\perp} \dagger$

${}^0_{\dot{}}\mathcal{T}^{\parallel} \dagger$

$\frac{2}{(18 \alpha_{\dot{1}} + \alpha_{\dot{2}}) k^2}$

0

$-\frac{6 \sqrt{3}}{(18 \alpha_{\dot{1}} + \alpha_{\dot{2}}) k^2}$

0

0

0

$-\frac{6 \sqrt{3}}{(18 \alpha_{\dot{1}} + \alpha_{\dot{2}}) k^2}$

0

$-\frac{2 (9 \alpha_{\dot{1}} + 2 (\alpha_{\dot{2}} + 54 (3 \alpha_{\dot{5}} - 4 \alpha_{\dot{6}} + \alpha_{\dot{7}}) k^2))}{(18 \alpha_{\dot{1}} + \alpha_{\dot{2}}) k^2 (\alpha_{\dot{1}} - 4 (3 \alpha_{\dot{5}} - 4 \alpha_{\dot{6}} + \alpha_{\dot{7}}) k^2)}$

${}^1_{\dot{}}\mathcal{T}^{\perp}{}_{\alpha}$

${}^1_{\dot{}}\mathcal{T}^{\perp} \dagger^{\alpha}$

${}^2_{\dot{}}\mathcal{T}^{\parallel}{}_{\alpha\beta}$

0

$\frac{8}{k^2 (\alpha_{\dot{1}} + 8 (-\alpha_{\dot{6}} + \alpha_{\dot{7}}) k^2)}$

Source constraints

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

Massive spectrum

A Feynman diagram for a massive particle with spin-parity $J^P = 0^+$. It shows two vertices connected by a dashed red line. Each vertex has four external lines (two incoming, two outgoing) represented by grey circles with a cross. A red arrow labeled $k^{\mu} = (\mathcal{E}, 0, 0, p)$ points from left to right between the vertices.

Massive particle

A Feynman diagram for a massive particle with spin-parity $J^P = 2^+$. It shows two vertices connected by a wavy red line. Each vertex has four external lines (two incoming, two outgoing) represented by grey circles with a cross. A red arrow labeled $k^{\mu} = (\mathcal{E}, 0, 0, p)$ points from left to right between the vertices.

Massive particle

Pole residue:	$\frac{4}{\alpha_{\dot{1}}} > 0$
Square mass:	$\frac{\alpha_{\dot{1}}}{4 (3 \alpha_{\dot{5}} - 4 \alpha_{\dot{6}} + \alpha_{\dot{7}})} > 0$
Spin:	0
Parity:	Even

Pole residue:	$-\frac{8}{\alpha_{\dot{1}}} > 0$
Square mass:	$\frac{\alpha_{\dot{1}}}{8 \alpha_{\dot{6}} - 8 \alpha_{\dot{7}}} > 0$
Spin:	2
Parity:	Even

Massless spectrum

A Feynman diagram for a massless particle. It shows two vertices connected by a solid black line. Each vertex has four external lines (two incoming, two outgoing) represented by grey circles with a cross. A black arrow labeled $k^{\mu} = (p, 0, 0, p)$ points from left to right between the vertices.

Massless particle

A Feynman diagram for a massless particle. It shows two vertices connected by a solid black line. Each vertex has four external lines (two incoming, two outgoing) represented by grey circles with a cross. A black arrow labeled $k^{\mu} = (p, 0, 0, p)$ points from left to right between the vertices.

Massless particle

Pole residue:	$\frac{p^2}{\alpha_{\dot{1}}} > 0$
Polarisations:	2

Pole residue:	$\frac{1 + 18 p^2}{18 \alpha_{\dot{1}} + \alpha_{\dot{2}}} > 0$
Polarisations:	1

Unitarity conditions

(Demonstrably impossible)