

PSALTer results panel

Wave operator and propagator

[illegible]

$\mathcal{O}_1 \sigma^4$	$\mathcal{O}_1 \tau^4$	$\mathcal{O}_1 \tau^4$	$\mathcal{O}_1 \sigma^4$
$\frac{1}{k^2 (6 \alpha_1 + 2 (\alpha_3 - \alpha_4 + \alpha_5) + \theta \varphi') + \frac{1}{3} \text{MPI} (1 - \frac{\text{MPI}}{2 \beta_1 + \beta_2 + 3 \beta_3})}$	$-\frac{i \sqrt{2} (2 \beta_1 + \beta_2 + 3 \beta_3 + \text{MPI})}{k (-2 (2 \beta_1 + \beta_2 + 3 \beta_3) k^2 (6 \alpha_1 + 2 (\alpha_3 - \alpha_4 + \alpha_5) + \theta \varphi') + (2 \beta_1 + \beta_2 + 3 \beta_3) \text{MPI} + \text{MPI}^2)}$	0	0
$\frac{i \sqrt{2} (2 \beta_1 + \beta_2 + 3 \beta_3 + \text{MPI})}{k (\text{MPI}^2 + (2 \beta_1 + \beta_2 + 3 \beta_3) (-2 k^2 (6 \alpha_1 + 2 (\alpha_3 - \alpha_4 + \alpha_5) + \theta \varphi') + \text{MPI}))}$	$-\frac{2 \beta_1 + \beta_2 + 3 \beta_3 + 2 k^2 (2 (3 \alpha_1 - \alpha_2 - \alpha_3 + \alpha_4) + \theta \varphi') + \text{MPI}}{k^2 (-2 (2 \beta_1 + \beta_2 + 3 \beta_3) k^2 (6 \alpha_1 + 2 (\alpha_3 - \alpha_4 + \alpha_5) + \theta \varphi') + (2 \beta_1 + \beta_2 + 3 \beta_3) \text{MPI} + \text{MPI}^2)}$	0	0
	0	0	0
0	0	0	$\frac{2}{8 \beta_1 - 8 \beta_2 + 2 k^2 (2 \alpha_2 + 6 \alpha_4 - \theta \varphi') + \text{MPI}}$

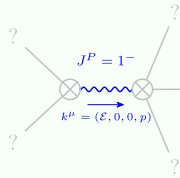
[illegible]

$\hat{\mathcal{Z}}^* \mathcal{I}_{\text{off}}$	$\hat{\mathcal{Z}}^* \mathcal{I}_{\text{off}}$	$\hat{\mathcal{Z}}^* \mathcal{I}_{\text{off}}$
$\frac{1}{4} (4 \beta_1 + 2 \beta_2 + 2 \kappa^2 (-3 \alpha_2 + \alpha_3 - 4 \alpha_4 + 2 \theta \hat{\psi}) - \text{MPI})$	$-\frac{f(4 \beta_1 + 2 \beta_2 - \text{MPI})}{2 \sqrt{2}}$	0
$\frac{f(4 \beta_1 + 2 \beta_2 - \text{MPI})}{2 \sqrt{2}}$	$(2 \beta_1 + \beta_2) \kappa^2$	0
0	0	$\frac{1}{4} (4 \beta_1 + 2 \beta_2 + 2 \kappa^2 (-2 \alpha_2 + \theta \hat{\psi}) - \text{MPI})$

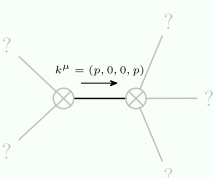
[illegible][illegible]

Spin-parity form	Covariant form	Multiplicities
$0^+ 1^+ = 0$	$\partial_\beta \partial_\alpha \tau (\Delta + \mathcal{K})^{\alpha\beta} = 0$	1
$2 \ i \ k 1^- \sigma^{i\alpha} + 1^- 1^+ = 0$	$\partial_\chi \partial_\beta \partial^\alpha \tau (\Delta + \mathcal{K})^{\beta\gamma} = \partial_\chi \partial^\alpha \partial_\beta \tau (\Delta + \mathcal{K})^{\alpha\beta} + 2 \partial_\alpha \partial^\alpha \partial_\chi \partial_\beta \sigma^{\beta\alpha\chi}$	3
$1^- 1^+ = 0$	$\partial_\chi \partial_\beta \partial^\alpha \tau (\Delta + \mathcal{K})^{\beta\gamma} = \partial_\chi \partial^\alpha \partial_\beta \tau (\Delta + \mathcal{K})^{\beta\alpha}$	3
$i \ k 1^+ \sigma^{i\alpha\beta} + 1^+ 1^+ = 0$	$\partial_\chi \partial^\alpha \tau (\Delta + \mathcal{K})^{\beta\gamma} + \partial_\chi \partial^\beta \tau (\Delta + \mathcal{K})^{\gamma\alpha} +$ $\partial_\chi \partial^\chi \tau (\Delta + \mathcal{K})^{\alpha\beta} + 2 \partial_\alpha \partial_\chi \partial^\alpha \sigma^{\chi\beta\alpha} + 2 \partial_\alpha \partial^\alpha \partial_\chi \sigma^{\chi\alpha\beta} =$ $\partial_\chi \partial^\alpha \tau (\Delta + \mathcal{K})^{\chi\beta} + \partial_\chi \partial^\beta \tau (\Delta + \mathcal{K})^{\alpha\chi} + \partial_\chi \partial^\chi \tau (\Delta + \mathcal{K})^{\beta\alpha} + 2 \partial_\alpha \partial_\chi \partial^\beta \sigma^{\alpha\chi\beta}$	3
Total expected gauge generators:		10

Massive and massless spectra

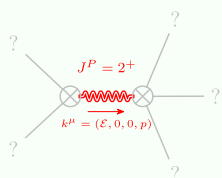


Massive particle

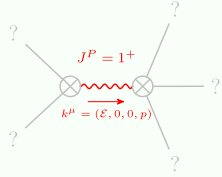


Massless particle

Poleresidue:	$\left \frac{1}{\text{MPI}} \right > 0$
Polarisations:	2



Massive particle

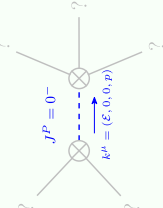


Massive particle

Pole residue: -	$ \begin{aligned} & (48 \cdot (-13 \cdot 824 \cdot \beta_3^3 \cdot \theta \cdot \psi + 4096 \cdot \beta_1^4 \cdot (1+6 \cdot \psi^2 + 256 \cdot \beta_2^4 \cdot (1+6 \cdot \psi)^2 - 13824 \cdot \beta_3^3 \cdot \psi^2 \cdot \text{MPI} + \\ & 288 \beta_3^2 \cdot \theta \cdot \tilde{\psi} \cdot \text{MPI} + 2304 \beta_3^2 \cdot \theta \cdot \tilde{\psi} \cdot \text{MPI} - 9216 \beta_3^2 \cdot \theta \cdot \tilde{\psi} \cdot \text{MPI} + 2304 \beta_3^2 \cdot \psi \cdot \text{MPI}^2 - \\ & 4608 \beta_3^2 \cdot \psi^2 \cdot \text{MPI}^2 + 144 \beta_3 \cdot \theta \cdot \tilde{\psi} \cdot \text{MPI}^2 + 1152 \beta_3 \cdot \theta \cdot \tilde{\psi} \cdot \text{MPI}^2 - 2304 \beta_3 \cdot \theta \cdot \tilde{\psi} \cdot \text{MPI}^2 - \\ & 96 \beta_3 \cdot \text{MPI}^3 + \theta \text{MPI}^3 + 768 \beta_3 \cdot \psi \cdot \text{MPI}^3 + 16 \theta \cdot \psi \text{MPI}^3 + 112 \theta \cdot \tilde{\psi} \cdot \text{MPI}^3 + \\ & 384 \theta \cdot \tilde{\psi} \cdot \text{MPI}^3 - 32 \text{MPI}^4 + 64 \beta_1^3 \cdot (-\theta \cdot 16 \cdot \theta \cdot \psi - 112 \theta \cdot \tilde{\psi} - 384 \theta \cdot \tilde{\psi} - 576 \theta \cdot \psi + \\ & 128 \beta_2 \cdot (1+6 \cdot \psi)^2 + 96 \beta_3 \cdot (1+16 \cdot \psi + 60 \cdot \psi^2) - 16 \text{MPI} + 576 \cdot \psi^2 \cdot \text{MPI}) + \\ & 8 \beta_2^3 \cdot (-\theta(1+8 \cdot \psi + 24 \cdot \psi^2)^2 + 96 \beta_3 \cdot (1+16 \cdot \psi + 60 \cdot \psi^2) + 16 \cdot (-1 + 36 \cdot \psi^2) \cdot \text{MPI}) + \\ & 2 \beta_2 \cdot (13824 \beta_3^3 \cdot \psi^2 - 288 \beta_3^2 \cdot \psi \cdot (\psi(1+8 \cdot \psi + 40 \cdot \psi^2) + 8(2+5 \cdot \psi) \cdot \text{MPI}) + \\ & \text{MPI}^2 \cdot (-3 \cdot \theta(1+16 \cdot \psi + 88 \cdot \psi^2 + 192 \cdot \psi^3 + 384 \cdot \psi^4) + 16(5+24 \cdot \psi) \cdot \text{MPI}) - \\ & 288 \beta_3 \cdot \text{MPI}(16 \cdot \theta \cdot \tilde{\psi} + (-1+16 \cdot \psi^2) \cdot \text{MPI})) + 12 \beta_2^2 \cdot \\ & (768 \beta_3^2 \cdot \psi(1+7 \cdot \psi) - 48 \beta_3 \cdot (\theta \cdot \tilde{\psi}(1+8 \cdot \psi + 24 \cdot \psi^2) + 2(1+8 \cdot \psi + 4 \cdot \psi^2) \cdot \text{MPI}) + \\ & \text{MPI}(\theta(1+16 \cdot \psi + 88 \cdot \psi^2 + 192 \cdot \psi^3) - 16(1+12 \cdot \psi + 24 \cdot \psi^2) \cdot \text{MPI})) + \\ & 48 \beta_1^2 \cdot (768 \beta_3^2 \cdot \psi(1+7 \cdot \psi) + 128(\beta_2 + 6 \beta_2 \cdot \psi)^2 - \\ & 48 \beta_3 \cdot (\theta \cdot \tilde{\psi}(1+8 \cdot \psi + 24 \cdot \psi^2) + 2(1+8 \cdot \psi + 4 \cdot \psi^2) \cdot \text{MPI}) + \\ & \text{MPI}(\theta(1+16 \cdot \psi + 88 \cdot \psi^2 + 192 \cdot \psi^3) - 16(1+12 \cdot \psi + 24 \cdot \psi^2) \cdot \text{MPI}) + \\ & 2 \beta_2 \cdot (-\theta(1+8 \cdot \psi + 24 \cdot \psi^2)^2 + 96 \beta_3 \cdot (1+16 \cdot \psi + 60 \cdot \psi^2) + \\ & 16 \cdot (-1 + 36 \cdot \psi^2) \cdot \text{MPI})) + 4 \beta_1 \cdot (13824 \beta_3^3 \cdot \psi^2 + 512 \beta_2^3 \cdot (1+6 \cdot \psi)^2 - \\ & 288 \beta_3^2 \cdot \psi(\theta \cdot \psi(1+8 \cdot \psi + 40 \cdot \psi^2) + 8(2+5 \cdot \psi) \cdot \text{MPI}) + \\ & \text{MPI}^2 \cdot (-3 \cdot \theta(1+16 \cdot \psi + 88 \cdot \psi^2 + 192 \cdot \psi^3 + 384 \cdot \psi^4) + 16(5+24 \cdot \psi) \cdot \text{MPI}) - \\ & 288 \beta_3 \cdot \text{MPI}(16 \cdot \theta \cdot \tilde{\psi} + (-1+16 \cdot \psi^2) \cdot \text{MPI}) + \\ & 12 \beta_2^2 \cdot (-\theta(1+8 \cdot \psi + 24 \cdot \psi^2)^2 + 96 \beta_3 \cdot (1+16 \cdot \psi + 60 \cdot \psi^2) + \\ & 16 \cdot (-1 + 36 \cdot \psi^2) \cdot \text{MPI}) + 12 \beta_2 \cdot (768 \beta_3^2 \cdot \psi(1+7 \cdot \psi) - \\ & 48 \beta_3 \cdot (\theta \cdot \tilde{\psi}(1+8 \cdot \psi + 24 \cdot \psi^2) + 2(1+8 \cdot \psi + 4 \cdot \psi^2) \cdot \text{MPI}) + \\ & \text{MPI}(\theta(1+16 \cdot \psi + 88 \cdot \psi^2 + 192 \cdot \psi^3) - 16(1+12 \cdot \psi + 24 \cdot \psi^2) \cdot \text{MPI})))))))/ \\ & (\theta \cdot (-48 \beta_3 \cdot \psi^2 - 4 \beta_1 \cdot (1+8 \cdot \psi + 24 \cdot \psi^2) - 2 \beta_2 \cdot (1+8 \cdot \psi + 24 \cdot \psi^2) + \text{MPI} + 8 \cdot \psi \cdot \text{MPI})^2 \\ & (384 \beta_1^2 + 96 \beta_2^2 + 288 \beta_2 \beta_3 - 48 \beta_3 \cdot \theta \cdot \tilde{\psi} - \\ & 2 \beta_2 \cdot \theta(1+8 \cdot \psi + 24 \cdot \psi^2) + 48 \beta_2 \cdot \text{MPI} - \\ & 144 \beta_3 \cdot \text{MPI} + \theta \text{MPI} + 8 \cdot \theta \cdot \psi \text{MPI} - 48 \text{MPI}^2 + \\ & 4 \beta_1 \cdot (96 \beta_2 + 144 \beta_3 \cdot -\theta \cdot 8 \cdot \theta \cdot \psi - 24 \theta \cdot \tilde{\psi} + 24 \text{MPI})))))) > 0 \end{aligned} $
Square mass:	$ \frac{24(4 \beta_1 + 2 \beta_2 \cdot \text{MPI}(2 \beta_1 + \beta_2 + 3 \beta_2 \cdot \text{MPI}))}{\theta(48 \beta_3 \cdot \psi^2 + 4 \beta_1 \cdot (1+8 \psi + 24 \psi^2) + 2 \beta_2 \cdot (1+8 \psi + 24 \psi^2) \cdot \text{MPI} - 8 \psi \cdot \text{MPI})} > 0 $
Spin:	1
Parity:	Odd

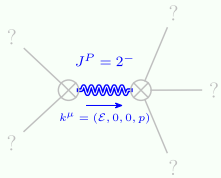
Pole residue:	$\frac{(3 \alpha_2 (4 \beta_1 + 2 \beta_2 - \text{MPI}) + \alpha_3 (4 \beta_1 + 2 \beta_2 - \text{MPI}) - 2 (8 \alpha_4 \beta_1 - 8 \alpha_6 \beta_1 + 4 \alpha_4 \beta_2 - 4 \alpha_6 \beta_2 - 4 \beta_1 \theta \varphi^2 - 2 \beta_2 \theta \varphi^2 - 2 \alpha_4 \text{MPI} + 2 \alpha_6 \text{MPI} + 2 \beta_1 \text{MPI} + \beta_2 \text{MPI} + \theta \varphi^2 \text{MPI}))}{((2 \beta_1 + \beta_2)(3 \alpha_1 - \alpha_3 + 4 \alpha_4 - 4 \alpha_6 - 2 \theta \varphi^2) \text{MPI})} > 0$
Square mass:	$\frac{(4 \beta_1 + 2 \beta_2 - \text{MPI}) \text{MPI}}{4 (2 \beta_1 + \beta_2) (3 \alpha_1 - \alpha_3 + 4 \alpha_4 - 4 \alpha_6 - 2 \theta \varphi^2)} > 0$
Spin:	2
Parity:	Even

Pole residue:	$ \begin{aligned} & (\alpha_2 (48 \beta_1^2 - 80 \beta_1 \beta_2 + 44 \beta_2^2 + 8 \beta_1 \text{MPI} - 12 \beta_2 \text{MPI} + \text{MPI}^2) - \\ & \quad \alpha_3 (48 \beta_1^2 - 80 \beta_1 \beta_2 + 44 \beta_2^2 + 8 \beta_1 \text{MPI} - 12 \beta_2 \text{MPI} + \text{MPI}^2) + \\ & \quad 4 \alpha_4 (48 \beta_1^2 - 80 \beta_1 \beta_2 + 44 \beta_2^2 + 8 \beta_1 \text{MPI} - 12 \beta_2 \text{MPI} + \text{MPI}^2) - \\ & \quad 4 \alpha_6 (48 \beta_1^2 - 80 \beta_1 \beta_2 + 44 \beta_2^2 + 8 \beta_1 \text{MPI} - 12 \beta_2 \text{MPI} + \text{MPI}^2) - \\ & \quad 2(2 \beta_1 - \beta_2)(32 \beta_1^2 - 16 \beta_2^2 + 10 \beta_2 \text{MPI} - \text{MPI}^2 - 4 \beta_1 (4 \beta_2 + \text{MPI}))) / \\ & \quad ((\alpha_2 - \alpha_3 + 4 \alpha_4 - 4 \alpha_6)(2 \beta_1 - \beta_2)(8 \alpha_2 \beta_1 - 8 \alpha_3 \beta_1 + 32 \alpha_4 \beta_1 - 32 \alpha_6 \beta_1 - 32 \beta_1^2 - 4 \alpha_2 \beta_2 + \\ & \quad 4 \alpha_3 \beta_2 - 16 \alpha_4 \beta_2 + 16 \alpha_6 \beta_2 + 16 \beta_1 \beta_2 + 16 \beta_2^2 + 4 \beta_1 \text{MPI} - 10 \beta_2 \text{MPI} + \text{MPI}^2))) > 0 \end{aligned} $
Square mass:	$ \begin{aligned} & \frac{-32 \beta_2^2 + 16 \beta_2^2 + 10 \beta_2 \text{MPI} + \text{MPI}^2 + 4 \beta_1 (4 \beta_2 + \text{MPI})}{4(\alpha_2 - \alpha_3 + 4 \alpha_4 - 4 \alpha_6)(2 \beta_1 - \beta_2)} > 0 \end{aligned} $
Spin:	1
Parity:	Even



Massive particle

Pole residue: $\{-4 \alpha_4 \beta_4 + 4 \alpha_3 \beta_3 - 2 \alpha_2 \beta_2 + 2 \alpha_1 \beta_1 - 6 \alpha_4 \beta_4 + 6 \alpha_3 \beta_3 + 2 \beta_2 \theta \tilde{\varphi} + \beta_2 \theta \tilde{\varphi} + 3 \beta_3 \theta \tilde{\varphi} - 2 \alpha_4 \text{MPI} + 2 \alpha_3 \text{MPI} + 2 \alpha_2 \text{MPI} + 2 \beta_2 \text{MPI} + 3 \beta_3 \text{MPI} + \theta \tilde{\varphi} \text{MPI} + 6 \alpha_4 (2 \beta_1 + \beta_2 + 3 \beta_3 + \text{MPI}) + 2 \alpha_3 (2 \beta_1 + \beta_2 + 3 \beta_3 + \text{MPI})\}$	$\frac{1}{-2 \alpha_4 - 6 \alpha_3 + \theta \tilde{\varphi}} > 0$
$((2 \beta_1 + \beta_2 + 3 \beta_3) (6 \alpha_4 + 2 \alpha_3 + 2 \alpha_2 + 2 \alpha_1 + \theta \tilde{\varphi}) \text{MPI}) > 0$	0
$\text{MPI}(2 \beta_1 + \beta_2 + 3 \beta_3 + \text{MPI})$	Odd
Square mass: $\frac{2(2 \beta_1 + \beta_2 + 3 \beta_3)(6 \alpha_4 + 2 \alpha_3 + 2 \alpha_2 + \theta \tilde{\varphi})}{(2 \beta_1 + \beta_2 + 3 \beta_3)(6 \alpha_4 + 2 \alpha_3 + 2 \alpha_2 + \theta \tilde{\varphi})} > 0$	
Spin:	0
Parity:	Even



Massive particle

Unitarity conditions

(Timeout after 10 seconds)