

## PSALTer results panel

## Wave operator and propagator

	$0^+ \mathcal{T}$	$0^+ \rho$	$0^+ \sigma^1$	$0^+ \tau^1$	$0^+ \tau^{\pm}$	$0^+ \sigma^1$
$0^+ \mathcal{T}^+$	0	0	0	0	0	0
$0^+ \rho^+$	0	$\frac{3(-12\lambda + v_i + 24k^2(r_i r_{-i} + 2r_i))}{32k^2(-12\lambda^2 + \lambda_i v_i + 2k^2 v_i(r_i r_{-i} + 2r_i))}$	$-\frac{1}{4i\sqrt{\frac{2}{3}}k\lambda + \frac{8i\sqrt{\frac{2}{3}}v_i v_{-i}(r_i r_{-i} + 2r_i)}{12\lambda + v_i}}$	$-\frac{\sqrt{3}(-12\lambda + v_i + 24k^2(r_i r_{-i} + 2r_i))}{32k^2(-12\lambda^2 + \lambda_i v_i + 2k^2 v_i(r_i r_{-i} + 2r_i))}$	0	0
$0^+ \sigma^1^+$	0	$-\frac{i\sqrt{\frac{2}{3}}}{4(-k\lambda + \frac{2k^3 v_i(r_i r_{-i} + 2r_i)}{12\lambda + v_i})}$	$-\frac{v_i}{-12\lambda^2 + \lambda_i v_i + 2k^2 v_i(r_i r_{-i} + 2r_i)}$	$-\frac{i}{8\sqrt{\frac{2}{3}}(\frac{2}{3} + \frac{k^3 v_i(r_i r_{-i} + 2r_i)}{12\lambda + v_i})}$	0	0
$0^+ \tau^1^+$	0	$\frac{\sqrt{3}(-12\lambda + v_i + 24k^2(r_i r_{-i} + 2r_i))}{32k^2(12\lambda^2 + v_i + 2k^2 v_i(\frac{1}{3} + 2r_i))}$	$-\frac{i}{8\sqrt{2}(\frac{2}{3} + \frac{k^3 v_i(r_i r_{-i} + 2r_i)}{12\lambda + v_i})}$	$\frac{-12\lambda + v_i + 24k^2(r_i r_{-i} + 2r_i)}{32k^2(-12\lambda^2 + \lambda_i v_i + 2k^2 v_i(r_i r_{-i} + 2r_i))}$	0	0
$0^+ \tau^+ \tau^+$	0	0	0	0	0	0
$0^+ \sigma^1^+ \tau^+$	0	0	0	0	0	$\frac{1}{-2\lambda + k^2 r_i + v_i}$

[illegible]

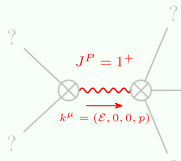
Spin-parity form	Covariant form	Multiplicities
$0^+ \tau^+ = 0$	$\partial_\beta \partial_\alpha \tau^{\alpha\beta} = 0$	1
$0^+ \rho + 0^+ \tau^\dagger = 0$	$\partial_\alpha \partial^\alpha \rho + \partial_\beta \partial^\beta \tau^\dagger_\alpha = \partial_\beta \partial_\alpha \tau^{\alpha\beta}$	1
$0^+ \mathcal{T} = 0$	$\partial_\alpha \mathcal{T}^\alpha = 0$	1
$2 \text{ f } k \downarrow \sigma^+_\alpha + 1^- \tau^+_\alpha = 0$	$\partial_\chi \partial_\beta \partial^\alpha \tau^{\beta\chi} = \partial_\chi \partial^\chi \partial_\beta \tau^{\alpha\beta} + 2 \partial_\delta \partial^\delta \partial_\chi \partial_\beta \sigma^{\beta\alpha\chi}$	3
$1^- \tau^\dagger_\alpha = 0$	$\partial_\chi \partial_\beta \partial^\alpha \tau^{\beta\chi} = \partial_\chi \partial^\chi \partial_\beta \tau^{\beta\alpha}$	3
$1^- \mathcal{T}^\alpha = 0$	$\partial_\beta \partial^\alpha \mathcal{T}^\beta = \partial_\beta \partial^\beta \mathcal{T}^\alpha$	3
$i \downarrow k \downarrow \sigma^+_\alpha + 1^+ \tau^\dagger_\alpha = 0$	$\partial_\chi \partial^\alpha \tau^{\beta\chi} + \partial_\chi \partial^\beta \tau^{\alpha\chi} + \partial_\chi \partial^\chi \tau^{\alpha\beta} + 2 \partial_\delta \partial_\chi \partial^\alpha \sigma^{\chi\beta\delta} + 2 \partial_\delta \partial^\delta \partial_\chi \sigma^{\alpha\beta\delta} =$ $\partial_\chi \partial^\alpha \tau^{\chi\beta} + \partial_\chi \partial^\beta \tau^{\alpha\chi} + \partial_\chi \partial^\chi \tau^{\beta\alpha} + 2 \partial_\delta \partial_\chi \partial^\beta \sigma^{\chi\alpha\delta}$	3
Total expected gauge generators:		15

	$1^+ \mathcal{A}^1_{a\beta}$	$1^+ \mathcal{A}^1_{a\beta}$	$1^+ f^1_{a\beta}$	$1^+ \mathcal{B}_\alpha$	$1^+ \mathcal{A}^1_\alpha$	$1^+ \mathcal{A}^1_\alpha$	$1^+ f^1_\alpha$	$1^+ f^1_\alpha$
$1^+ \mathcal{A}^1 \uparrow^{a\beta}$	$\frac{1}{6} (-6 \lambda. + 6 k^2 (2 r.{}_3 + r.{}_5) + t.{}_1 + 4 t.{}_2)$	$-\frac{6 \lambda. + t. - 2 t.{}_2}{3 \sqrt{2}}$	$-\frac{i k (6 \lambda. + t. - 2 t.{}_2)}{3 \sqrt{2}}$	0	0	0 0	0	0
$1^+ \mathcal{A}^1 \uparrow^{a\beta}$	$-\frac{6 \lambda. + t. - 2 t.{}_2}{3 \sqrt{2}}$	$\frac{t. + t.{}_2}{3}$	$\frac{1}{3} i k (t.{}_1 + t.{}_2)$	0	0	0 0	0	0
$1^+ f^1 \uparrow^{a\beta}$	$\frac{i k (6 \lambda. + t. - 2 t.{}_2)}{3 \sqrt{2}}$	$-\frac{1}{3} i k (t.{}_1 + t.{}_2)$	$\frac{1}{3} k^2 (t.{}_1 + t.{}_2)$	0	0	0 0	0	0
$1^+ \mathcal{B}^1 \uparrow^\alpha$	0	0	0	0	0	0 0	0	0
$1^+ \mathcal{A}^1 \uparrow^\alpha$	0	0	0	0	$\frac{1}{18} (-6 \lambda. + v. + 3 (6 k^2 (r.{}_1 + r.{}_4 + r.{}_5) + t.{}_1))$	$\frac{24 \lambda. - v. + 6 t.{}_1}{18 \sqrt{2}}$	0	$\frac{1}{18} i k (24 \lambda. - v. + 6 t.{}_1)$
$1^+ \mathcal{A}^1 \uparrow^\alpha$	0	0	0	0	$\frac{24 \lambda. - v. + 6 t.{}_1}{18 \sqrt{2}}$	$\frac{1}{36} (12 \lambda. + v. + 12 t.{}_1)$	0	$\frac{i k (12 \lambda. + v. + 12 t.{}_1)}{18 \sqrt{2}}$
$1^+ f^1 \uparrow^\alpha$	0	0	0	0	0	0 0	0	0
$1^+ f^1 \uparrow^\alpha$	0	0	0	0	$-\frac{1}{18} i k (24 \lambda. - v. + 6 t.{}_1)$	$-\frac{i k (12 \lambda. + v. + 12 t.{}_1)}{18 \sqrt{2}}$	0	$\frac{1}{18} k^2 (12 \lambda. + v. + 12 t.{}_1)$

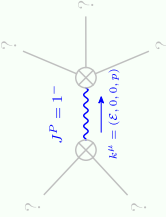
$k^2 (a_i + a_j)$	$k^2 (2i - 2j + r_i + r_j)(a_i + a_j) - \frac{1}{2} k^2 \lambda_i (2i + a_j)$	$k^2 (a_i + a_j)$	$i \sqrt{2} (2i + a_j)$	$\frac{2k^2 (2i - 2j + r_i + r_j)(a_i + a_j) - \frac{1}{2} k^2 \lambda_i (2i + a_j)}{i \sqrt{2} (2i + a_j)}$	0
0	0	0	$\lambda_i + k^2 (2i + 2j + r_i + r_j) + \frac{1}{2}$	$k^2 (2i - 2j + r_i + r_j)(a_i + a_j) - \frac{1}{2} k^2 \lambda_i (2i + a_j)$	0
0	0	0	0	0	1
					$\frac{1}{\lambda_i + k^2 (2i + a_j)}$

$2^1\mathcal{Y}^1 + {}^{o6}$	$\lambda_+ + k^2(2r_- - 2r_+ + r_+ + \frac{t_-}{4} + \frac{t_+}{2})$	$-\frac{i\lambda(2\lambda_+ + t_+)}{\sqrt{2}}$	0
$2^2\mathcal{Y}^1 + {}^{o6}$	$i\lambda(2\lambda_+ + t_+)$	$k^2(\lambda_+ + t_+)$	0
$2^3\mathcal{Y}^1 + {}^{o6}$	0	0	$\lambda_+ + k^2r_+ + \frac{t_+}{2}$

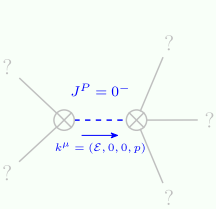
## Massive and massless spectra



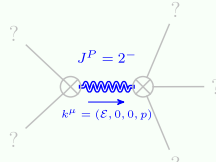
Pole/residue:	$\frac{3(r_{\frac{3}{5}}t_{\frac{1}{1}}^2t_{\frac{2}{1}}^2+2r_{\frac{3}{5}}t_{\frac{1}{1}}^2t_{\frac{2}{1}}^2+4\lambda^2(6r_{\frac{3}{5}}+3r_{\frac{3}{5}}t_{\frac{1}{2}}+t_{\frac{1}{2}})+2\lambda(2r_{\frac{3}{5}}t_{\frac{1}{1}}t_{\frac{2}{1}}^2+4r_{\frac{3}{5}}(t_{\frac{1}{2}}-2t_{\frac{2}{2}})-4r_{\frac{3}{5}}t_{\frac{2}{1}}t_{\frac{2}{2}}^2)+2r_{\frac{3}{5}}(t_{\frac{1}{1}}^2+2t_{\frac{2}{1}}^2))}{(2r_{\frac{3}{5}}+r_{\frac{3}{5}})(t_{\frac{1}{1}}+t_{\frac{1}{2}})(12\lambda^2+2r_{\frac{3}{5}}t_{\frac{1}{2}}+6\lambda(t_{\frac{1}{1}}t_{\frac{2}{1}})+2r_{\frac{3}{5}}t_{\frac{1}{2}}-3t_{\frac{1}{1}}t_{\frac{2}{2}}+4r_{\frac{3}{5}}(t_{\frac{1}{1}}+t_{\frac{1}{2}}))}>0$
Square mass:	$\frac{3(2\lambda+t_{\frac{1}{1}})(2\lambda-t_{\frac{1}{2}})}{2(2r_{\frac{3}{5}}+r_{\frac{3}{5}})(t_{\frac{1}{1}}+t_{\frac{1}{2}})}>0$
Spin:	1
Parity:	Even



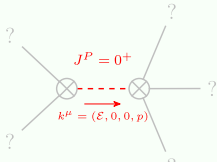
Pole residue:	$-\frac{1}{2}((3(288\lambda^3+v^2(r_1+r_2-r_3-t_1)-12v_1t_1^2+72(r_1+r_2+r_3+t_1)t_1^2+432\lambda^2(r_1+r_2+r_3+t_1)-2\lambda_1(v_1^2+12v_1(r_1+r_2+r_3+t_1)-72t_1(2r_1+2r_2+2r_3+t_1))))/(r_1+r_2+r_3+t_1)(12\lambda_1+v_1+12t_1)(72\lambda_1^2+v_1(r_1+r_2+r_3+t_1)-3t_1)+12(r_1+r_2+r_3+t_1)(v_1-2(r_1+r_2+r_3+t_1))))>0$
Square mass:	$\frac{3(12\lambda_1-v_1)(2\lambda_1+t_1)}{2(r_1^4+r_2^4+r_3^4)(12\lambda_1+v_1+12t_1)}>0$
Spin:	1
Parity:	Odd



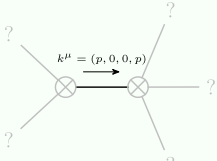
Massive particle	
Pole residue:	$\frac{1}{r_2} > 0$
Square mass:	$\frac{2\lambda_{\pi\pi}}{r_2^2} > 0$
Spin:	0
Parity:	Odd



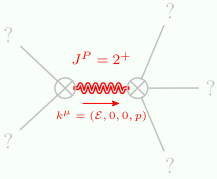
Massive particle	
Pole residue:	$\frac{1}{r_1} > 0$
Square mass:	$-\frac{2\lambda_+ t_1}{2r_1} > 0$
Spin:	2
Parity:	Odd



Pole residue:	$\frac{v_1 \cdot (v_1 + r_1 - 2r_2) + 4 \lambda_1 \cdot (v_1 + 3r_1 - 3r_2 + 6r_3)}{8 \lambda_1 \cdot v_1 \cdot (r_1 - r_2 + 2r_3)} > 0$
Square mass:	$\frac{12 \lambda_1^2 \lambda_2 v_1}{2 v_1 r_1 - 2 v_1 r_2 + 4 v_1 r_3} > 0$
Spin:	0
Parity:	Even



Massless particle	
Pole residue:	$\frac{1}{\lambda} > 0$
Polarisations:	2



Poler residue:	$\frac{\lambda^2 + (2r_{\frac{1}{2}} - 2r_{\frac{3}{2}} + r_{\frac{5}{2}})z + \lambda_{\frac{1}{2}}(4r_{\frac{1}{2}} - 4r_{\frac{3}{2}} + 2r_{\frac{5}{2}} + \frac{t_{\frac{1}{2}}}{1})}{\lambda_{\frac{1}{2}}(2r_{\frac{1}{2}} - 2r_{\frac{3}{2}} + r_{\frac{5}{2}})(\lambda_{\frac{1}{2}} + \frac{t_{\frac{1}{2}}}{1})} > 0$
Square mass:	$\frac{\lambda_{\frac{1}{2}}(2\lambda_{\frac{1}{2}} + \frac{t_{\frac{1}{2}}}{1})}{2(r_{\frac{1}{2}} - 2r_{\frac{3}{2}} + r_{\frac{5}{2}})(\lambda_{\frac{1}{2}} + \frac{t_{\frac{1}{2}}}{1})} > 0$
Spin:	2
Parity:	Even

## Unitarity conditions

(Timeout after 10 seconds)