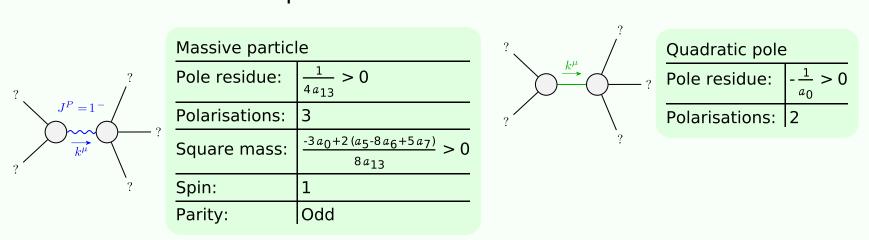
Particle spectrograph

Wave operator and propagator

_		$\Delta_{1}^{\#1}{}_{lphaeta}$		ı	$\Delta_{1}^{\#2}{}_{lphaeta}$	$\Delta_{1}^{\#3}{}_{lphaeta}$	$\Delta_{1-lpha}^{\#1}$	$\Delta_{1-lpha}^{\#2}$	$\Delta_{1}^{\#3}{}_{lpha}$	$\Delta_{1-lpha}^{\#4}$	$\Delta_{1-\alpha}^{\#5}$	$\Delta_{1^{-}lpha}^{\#6}$ $\mathcal{T}_{1^{-}}^{\#1}$	½1 . α
$\Delta_{1}^{\#1}\dagger^{lphaeta}$	$\frac{4}{3}\left(-\frac{1}{a_0+4a_1-4a_2}+\frac{1}{2(2a_1+a_2)(a_1+a_2)}\right)$	$-\frac{1}{a_0+4a_1-4a_2}+\frac{2a_1+a_2-2a_5-6a_7+2a_9}{2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9)}) \frac{2}{3}\sqrt{2}\left(-\frac{1}{a_0+4a_1-4a_2}-\frac{2(2a_1+a_2-2a_5-6a_7+2a_9)}{2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9)}\right)$		$\frac{2 (2 a_1 + a_2 - 2 a_5 - 6 a_7 + 2 a_9)}{(a_5 + 3 a_7) + a_9^2 + a_0 (2 a_1 + a_2 - 2 a_5 - 6 a_7 + 2 a_9)})$	$-\frac{4(2a_1+a_2+a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	0	0	0	0	0	0 0)	
$\Delta_{1}^{\#2}$ † lphaeta	$\frac{2}{2}\sqrt{2}(-\frac{1}{2})$	$\frac{1}{2}\left(-\frac{1}{2} - \frac{2(2a_1+a_2-2a_5-6a_7+2a_9)}{2}\right) - \frac{2}{2} + \frac{8(2a_1+a_2-2a_5-6a_7+2a_9)}{2}$			$\frac{4\sqrt{2}(2a_1+a_2+a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	0	0	0	0	0	0 0	5	
$\Delta_{1}^{#3}$ † lphaeta	4	$\frac{4(2a_1+a_2+a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))} \frac{4\sqrt{2}(2a_1+a_2+a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$		$-\frac{4(a_0-2a_1-a_2)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	0	0	0	0	0	0 0	5		
$\Delta_{1}^{#1} \dagger^{lpha}$	<u> </u>	0			0	0	$\frac{4 (2 a_1 + a_2 - 2 a_5 - 6 a_7 + 2 a_9)}{3 (2 (2 a_1 + a_2) (a_5 + 3 a_7) + a_9^2 + a_0 (2 a_1 + a_2 - 2 a_5 - 6 a_7 + 2 a_9))}$	$\frac{4\sqrt{2}(2a_1+a_2-2a_5-6a_7+2a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	0	0	$-\frac{4\sqrt{\frac{2}{3}}(2a_1+a_2+a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	$\frac{4(2a_1+a_2+a_9)}{3\sqrt{3}(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	5
$\Delta_1^{\#2} \uparrow^{\alpha}$		0			0	0	$\frac{4\sqrt{2}(2a_1+a_2-2a_5-6a_7+2a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	$\frac{8(2a_1+a_2-2a_5-6a_7+2a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	0	0	$-\frac{8(2a_1+a_2+a_9)}{3\sqrt{3}(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	$\frac{4\sqrt{\frac{2}{3}}(2a_1+a_2+a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$)
$\Delta_1^{#3} \dagger^{\alpha}$		0			0	0	0	0	$-\frac{10}{9(a_0+2a_5-6a_7)}-\frac{1}{6(3a_0-2(a_5-8a_6+5a_7-4a_{13}k^2))}$	$\frac{1}{18} \sqrt{5} \left(\frac{4}{a_0 + 2a_5 - 6a_7} - \frac{3}{3a_0 - 2a_5 + 16a_6 - 10a_7 + 8a_{13}k^2} \right)$	$-\frac{1}{\sqrt{2} (9 a_0 - 6 (a_5 - 8 a_6 + 5 a_7 - 4 a_{13} k^2))}$	$-\frac{1}{9 a_0 - 6 (a_5 - 8 a_6 + 5 a_7 - 4 a_{13} k^2)}$)
$\Delta_1^{\#4} \uparrow^{lpha}$		0			0	0	0	0	$\frac{1}{18} \sqrt{5} \left(\frac{4}{a_0 + 2a_5 - 6a_7} - \frac{3}{3a_0 - 2a_5 + 16a_6 - 10a_7 + 8a_{13}k^2} \right)$	$-\frac{2}{9(a_0+2a_5-6a_7)}-\frac{5}{6(3a_0-2(a_5-8a_6+5a_7-4a_{13}k^2))}$	$-\frac{\sqrt{\frac{5}{2}}}{9a_0-6(a_5-8a_6+5a_7-4a_{13}k^2)}$	$-\frac{\sqrt{5}}{9 a_0 - 6 (a_5 - 8 a_6 + 5 a_7 - 4 a_{13} k^2)}$	5
$\Delta_1^{\#5} \dagger^{lpha}$		0			0	0	$-\frac{4\sqrt{\frac{2}{3}}(2a_1+a_2+a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	$-\frac{8(2a_1+a_2+a_9)}{3\sqrt{3}(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	$-\frac{1}{\sqrt{2} (9 a_0 - 6 (a_5 - 8 a_6 + 5 a_7 - 4 a_{13} k^2))}$	<u> </u> 5	$\frac{8(-a_0+2a_1+a_2)}{9(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))} - \frac{1}{9a_0-6(a_5-8a_6+5a_7-4a_{13}k^2)}$	$(\sqrt{2} (12 a_0^2 - 3 a_9^2 - a_0 (30 a_1 + 15 a_2 + 2 a_5 - 64 a_6 + 22 a_7 + 6 a_9 - 32 a_{13} k^2) +$)
$\Delta_1^{\#6}\dagger^{lpha}$		0			0	$\frac{4(2a_1+a_2+a_9)}{3\sqrt{3}(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	$\frac{4\sqrt{\frac{2}{3}}(2a_1+a_2+a_9)}{3(2(2a_1+a_2)(a_5+3a_7)+a_9^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9))}$	$-\frac{1}{9 a_0 - 6 (a_5 - 8 a_6 + 5 a_7 - 4 a_{13} k^2)}$	$-\frac{\sqrt{5}}{9 a_0 - 6 (a_5 - 8 a_6 + 5 a_7 - 4 a_{13} k^2)}$	$(\sqrt{2} (12a_0^2 - 3a_9^2 - a_0 (30a_1 + 15a_2 + 2a_5 - 64a_6 + 22a_7 + 6a_9 - 32a_{13}k^2) + 2(2a_1 + a_2)(a_5 - 32a_6 + 11a_7 - 16a_{13}k^2)))/$ $(9(2(2a_1 + a_2)(a_5 + 3a_7) + a_9^2 + a_0(2a_1 + a_2 - 2a_5 - 6a_7 + 2a_9))$ $(3a_0 - 2(a_5 - 8a_6 + 5a_7 - 4a_{13}k^2)))$	$\frac{\frac{-4 a_0 + 8 a_1 + 4 a_2}{9 (2 (2 a_1 + a_2) (a_5 + 3 a_7) + a_9^2 + a_0 (2 a_1 + a_2 - 2 a_5 - 6 a_7 + 2 a_9))} - \frac{2}{9 a_0 - 6 (a_5 - 8 a_6 + 5 a_7 - 4 a_{13} k^2)} $)	
$\mathcal{T}_1^{\sharp 1} \dagger^{lpha}$				0	0	0	0	0	0	0	0 0)	
$\Gamma_{1+}^{\#1} + \alpha \beta = \frac{1}{4} (-a_0)$ $\Gamma_{1+}^{\#2} + \alpha \beta = -\frac{a}{4}$	$ \Gamma_{1}^{\#1} \alpha \beta \qquad \Gamma_{1}^{\#2} \alpha \beta \\ 0 - 6 a_1 + 5 a_2) \qquad -\frac{a_0 + 2 a_1 - 3 a_2}{2 \sqrt{2}} \\ \frac{a_0 + 2 a_1 - 3 a_2}{2 \sqrt{2}} \qquad \frac{1}{2} \left(-2 a_1 + a_2 \right) \\ 2 a_1 - a_2 - a_9) \qquad \frac{2 a_1 + a_2 + a_9}{2 \sqrt{2}} \\ 0 \qquad 0 \qquad 0 $	$\frac{2a_1+a_2+a_9}{2\sqrt{2}}$ $-\frac{3}{4}(2a_1+a_2-2a_5-6a_7+2a_9)$	$\frac{1}{12} (a_0 - 2 a_1 - a_2)$ $\frac{a_0 - 2 a_1 - a_2}{6 \sqrt{2}} \qquad \frac{1}{6} (a_0 - 2 a_1 - a_2)$ 0 0 0 $-\frac{2a_1 + a_2 + a_9}{2 \sqrt{6}}$	$ \begin{array}{c c} 0 \\ -\frac{2a_1+a_2+a_9}{2\sqrt{3}} \end{array} $	$\Gamma_{1-\alpha}^{\#3}$ 0 0 0 0 0 0 0 1 2 (-9 a ₀ - 14 a ₅ - 8 a ₆ + 50 a ₇ - 4 a ₁₃ k ²) $\frac{1}{3} \sqrt{5} (a_5 - 2 a_6 - a_7 - a_{13} k^2)$ $\frac{-3a_0 + 2(a_5 - 8a_6 + 5a_7 - 4a_{13} k^2)}{12 \sqrt{2}}$ $-\frac{a_0}{4} + \frac{1}{6} (a_5 - 8 a_6 + 5 a_7 - 4 a_{13} k^2)$ 0	$\frac{1}{12} \left(-9 a_0 + 2 a_5 - 40 a_6 + 34 a_7 - 20 a_{13} k^2 \right)$	$\Gamma_{1}^{\#5}{}_{\alpha}$ 0 0 $-\frac{2a_{1}+a_{2}+a_{9}}{2\sqrt{6}}$ $-\frac{2a_{1}+a_{2}+a_{9}}{2\sqrt{3}}$ $-\frac{3a_{0}+2(a_{5}\cdot8a_{6}+5a_{7}\cdot4a_{13}k^{2})}{12\sqrt{2}}$ $\frac{1}{12}\sqrt{\frac{5}{2}}\left(-3a_{0}+2\left(a_{5}\cdot8a_{6}+5a_{7}\cdot4a_{13}k^{2}\right)\right)$ $\frac{1}{12}\left(-3a_{0}-2\left(6a_{1}+3a_{2}-7a_{5}+8a_{6}-23a_{7}+6a_{9}+a_{13}k^{2}\right)\right)$ $-\frac{3a_{0}\cdot6a_{1}\cdot3a_{2}+4a_{5}+16a_{6}+8a_{7}\cdot6a_{9}+8a_{13}k^{2}}{6\sqrt{2}}$ 0	$-\frac{3a_0-6a_1-3a_2+4a_5+16a_6+8a_7-6a_9-6a_9-6a_1}{6\sqrt{2}}$ $\frac{1}{12}\left(-6a_0-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+10a_5-32a_6+38a_9-6a_9-6a_1-3a_2+3a_9-6a_9-6a_1-3a_2+3a_9-6a_9-6a_1-3a_9-6a_1$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{split} \int \int \int \int \int \frac{1}{2^4} \left(4 \left(-2 a_0 + 2 a_1 + a_2 - 12 a_6 + 2 a_9 \right) \Gamma_{\alpha \mu}^{\ \ \mu} \Gamma^{\alpha \beta}_{\ \ \beta} - 3 (a_0 + 8 a_2 - 2) (a_5 + 9 a_7 - 2 a_9) \right) \Gamma_{\alpha \mu \beta} \Gamma^{\alpha \beta \mu}_{\ \ \beta} - 3 (a_0 + 8 a_2 - 2) (a_5 + 9 a_7 - 2 a_9) \Gamma_{\alpha \mu \beta} \Gamma^{\alpha \beta \mu}_{\ \ \beta \mu \beta} \Gamma^{\alpha \beta \mu}_{\ \ \beta \mu \beta} - 3 (a_0 + 8 a_2 - 2) (a_5 + 9 a_7 - 2 a_9) \Gamma^{\alpha \mu \beta}_{\ \ \beta \mu \beta} \Gamma^{\alpha \beta \mu}_{\ \ \beta \mu \beta} + 12 (a_0 + 6 a_5 + 6 a_7 - 6 a_9) \Gamma^{\alpha \beta}_{\ \ \alpha} \Gamma^{\mu}_{\ \ \mu} + 2 (a_0 + 6 a_5 + 6 a_7 - 6 a_9) \Gamma^{\alpha \beta}_{\ \ \alpha} \Gamma^{\mu}_{\ \ \beta \mu} + 2 (a_0 + 6 a_5 + 6 a_7 + a_9) \Gamma^{\alpha \beta}_{\ \ \mu} + 2 (a_0 + 6 a_7 + a_9) \Gamma^{\alpha \beta}_{\ \ \alpha} \Gamma^{\mu}_{\ \ \beta \mu} + 12 (2 a_1 - a_5 + a_9) \Gamma^{\alpha \beta \mu}_{\ \ \alpha} + 4 (a_0 - 6 a_7 + a_9) \Gamma^{\alpha \beta}_{\ \ \alpha} \Gamma^{\mu}_{\ \ \beta} + 24 h^{\alpha \beta}_{\ \ \beta}_{\ \ \alpha} 12 a_7 \Gamma^{\alpha \beta}_{\ \ \alpha} \Gamma^{\mu}_{\ \ \beta} + 24 h^{\alpha \beta}_{\ \ \beta}_{\ \ \alpha}_{\ \ \beta}_{\ \ \alpha} \Gamma^{\mu}_{\ \ \beta} + 4 (2 a_1 + a_2 - 3 a_7 + a_9) \Gamma^{\alpha \beta}_{\ \ \alpha}_{\ \ \beta}_{\ \ \beta}_{\ \ \beta}_{\ \ \beta}_{\ \ \beta}_{\ \ \alpha}_{\ \ \beta}_{\ \ \beta}_{\ $	The second state of the s	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
$\Delta_{2}^{\#2} + \alpha^{\beta}$ $\Delta_{2}^{\#3} + \alpha^{\beta} = -$	$\Delta_{2}^{\#1}{}_{\alpha\beta}$ $4(2a_{1}+a_{2}-2a_{5}-6a_{7}+2a_{9})$ $a_{1}+a_{2})(a_{5}+3a_{7})+a_{9}^{2}+a_{0}(2a_{1}+a_{2}-2a_{5}-6a_{7}+2a_{9})$ 0 $4(2a_{1}+a_{2}+a_{9})$ $(2a_{1}+a_{2})(a_{5}+3a_{7})+a_{9}^{2}+a_{0}(2a_{1}+a_{2}-2a_{5}$	$-\frac{4}{3(a_0+2a_5-6a_7)}$	$\frac{4(2)}{\sqrt{3}(2(2a_1+a_2)(a_5+3a_7)+4a_7)}$	0 a ₀ -2a ₁ -a ₂)	$ \begin{array}{c c} 0 \\ \hline a_{5}-6a_{7}+2a_{9})) & 0 \\ -\frac{8}{a_{0}k^{2}} \\ 0 & \frac{4}{2(2a_{1}+a_{2})(a_{5}+1)} \end{array} $	4(2a ₁ +a ₂ +a ₉)	$\begin{array}{c} \Delta_2^{\#2} \alpha \beta \chi \\ \\ 0 \\ \\ 0 \\ \\ 0 \\ \\ 0 \\ \\ 4(2a_1+a_2+a_9) \\ \\ \hline (a_5+3a_7)+a_9{}^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9)) \\ \\ 4(a_0-2a_1-a_2) \\ \hline a_5+3a_7)+a_9{}^2+a_0(2a_1+a_2-2a_5-6a_7+2a_9)) \\ \end{array}$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\Delta_{3}^{\#1} \times \frac{1}{3(a_0 + 2a_5 - 6a_7)}$	$0 \qquad -\frac{3}{4} \left(a_0 + 2 a_5 - 6 a_7 \right)$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	

Massive and massless spectra



Unitarity conditions

 $a_0 < 0 \&\& a_7 > \frac{1}{10} (3 a_0 - 2 a_5 + 16 a_6) \&\& a_{13} > 0$