

Particle spectrograph

Wave operator and propagator

	$\sigma_{0+}^{\#1}$	$\tau_{0+}^{\#1}$	$\tau_{0+}^{\#2}$	$\sigma_{0+}^{\#1}$
$\sigma_{0+}^{\#1} \dagger$	$-\frac{1}{(1+2\,k^2)^2\,t_1}$	$-\frac{i\,\sqrt{2}\,k}{(1+2\,k^2)^2\,t_1}$	0	0
$\tau_{0+}^{\#1} \dagger$	$-\frac{i\,\sqrt{2}\,k}{(1+2\,k^2)^2\,t_1}$	$-\frac{2\,k^2}{(1+2\,k^2)^2\,t_1}$	0	0
$\tau_{0+}^{\#2} \dagger$	0	0	0	0
$\sigma_{0+}^{\#1} \dagger$	0	0	0	$\frac{1}{k^2\,r_2+t_2}$

	$\sigma_{2+}^{\#1}\,\alpha\beta$	$\tau_{2+}^{\#1}\,\alpha\beta$	$\sigma_{2+}^{\#1}\,\alpha\beta\chi$
$\sigma_{2+}^{\#1} \dagger^{\alpha\beta}$	$\frac{2}{(1+2\,k^2)^2\,t_1}$	$-\frac{2\,i\,\sqrt{2}\,k}{(1+2\,k^2)^2\,t_1}$	0
$\tau_{2+}^{\#1} \dagger^{\alpha\beta}$	$\frac{2\,i\,\sqrt{2}\,k}{(1+2\,k^2)^2\,t_1}$	$\frac{4\,k^2}{(1+2\,k^2)^2\,t_1}$	0
$\sigma_{2+}^{\#1} \dagger^{\alpha\beta\chi}$	0	0	$\frac{2}{t_1}$

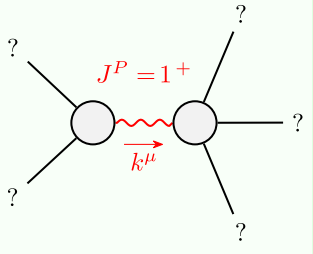
	$\mathcal{A}_{0+}^{\#1}$	$f_{0+}^{\#1}$	$f_{0+}^{\#2}$	$\mathcal{A}_{0+}^{\#1}$
$\mathcal{A}_{0+}^{\#1} \dagger$	$-t_1$	$i\,\sqrt{2}\,k\,t_1$	0	0
$f_{0+}^{\#1} \dagger$	$-i\,\sqrt{2}\,k\,t_1$	$-2\,k^2\,t_1$	0	0
$f_{0+}^{\#2} \dagger$	0	0	0	0
$\mathcal{A}_{0+}^{\#1} \dagger$	0	0	0	$k^2\,r_2+t_2$

	$\sigma_{1+}^{\#1}\,\alpha$	$\tau_{1+}^{\#2}\,\alpha$	$\sigma_{1+}^{\#2}\,\alpha$	$\sigma_{1+}^{\#1}\,\alpha$	$\tau_{1+}^{\#1}\,\alpha\beta$	$\sigma_{1+}^{\#2}\,\alpha\beta$	$\sigma_{1+}^{\#1}\,\alpha\beta$
$\sigma_{1+}^{\#1} \dagger^{\alpha}$	0	0	0	0	$\frac{i\,\sqrt{2}\,k\,(t_1-2\,t_2)}{(1+k^2)\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$\frac{\sqrt{2}\,(t_1-2\,t_2)}{(1+k^2)\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$\frac{2\,(t_1+t_2)}{3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2)}$
$\sigma_{1+}^{\#2} \dagger^{\alpha}$	0	0	0	0	$\frac{i\,k\,(6\,k^2\,r_5+t_1+4\,t_2)}{(1+k^2)^2\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$\frac{6\,k^2\,r_5+t_1+4\,t_2}{(1+k^2)^2\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$\frac{\sqrt{2}\,(t_1-2\,t_2)}{(1+k^2)\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$
$\tau_{1+}^{\#1} \dagger^{\alpha\beta}$	0	0	0	0	$-\frac{k^2\,(6\,k^2\,r_5+t_1+4\,t_2)}{(1+k^2)^2\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$-\frac{i\,k\,(6\,k^2\,r_5+t_1+4\,t_2)}{(1+k^2)^2\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$	$-\frac{i\,\sqrt{2}\,k\,(t_1-2\,t_2)}{(1+k^2)\,(3\,t_1\,t_2+2\,k^2\,r_5\,(t_1+t_2))}$
$\sigma_{1+}^{\#1} \dagger^{\alpha}$	0	0	0	0	0	0	0
$\sigma_{1+}^{\#2} \dagger^{\alpha}$	0	0	0	0	0	0	0
$\tau_{1+}^{\#1} \dagger^{\alpha}$	0	0	0	0	0	0	0
$\tau_{1+}^{\#2} \dagger^{\alpha}$	0	0	0	0	0	0	0

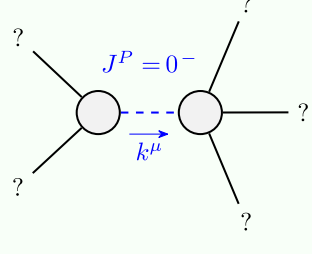
	$\mathcal{A}_{1+}^{\#1}\,\alpha\beta$	$\mathcal{A}_{1+}^{\#2}\,\alpha\beta$	$f_{1+}^{\#1}\,\alpha\beta$	$\mathcal{A}_{1+}^{\#1}\,\alpha$	$\mathcal{A}_{1+}^{\#2}\,\alpha$	$f_{1+}^{\#1}\,\alpha$	$f_{1+}^{\#2}\,\alpha$
$\mathcal{A}_{1+}^{\#1} \dagger^{\alpha\beta}$	$\frac{1}{6}\,(6\,k^2\,r_5+t_1+4\,t_2)$	$-\frac{t_1-2\,t_2}{3\,\sqrt{2}}$	$-\frac{i\,k\,(t_1-2\,t_2)}{3\,\sqrt{2}}$	0	0	0	0
$\mathcal{A}_{1+}^{\#2} \dagger^{\alpha\beta}$	$-\frac{t_1-2\,t_2}{3\,\sqrt{2}}$	$\frac{t_1+t_2}{3}$	$\frac{1}{3}\,i\,k\,(t_1+t_2)$	0	0	0	0
$f_{1+}^{\#1} \dagger^{\alpha\beta}$	$\frac{i\,k\,(t_1-2\,t_2)}{3\,\sqrt{2}}$	$-\frac{1}{3}\,i\,k\,(t_1+t_2)$	$\frac{1}{3}\,k^2\,(t_1+t_2)$	0	0	0	0
$\mathcal{A}_{1+}^{\#1} \dagger^{\alpha}$	0	0	0	$k^2\,r_5-\frac{t_1}{2}$	$\frac{t_1}{\sqrt{2}}$	0	$i\,k\,t_1$
$\mathcal{A}_{1+}^{\#2} \dagger^{\alpha}$	0	0	0	$\frac{t_1}{\sqrt{2}}$	0	0	0
$f_{1+}^{\#1} \dagger^{\alpha}$	0	0	0	0	0	0	0
$f_{1+}^{\#2} \dagger^{\alpha}$	0	0	0	$-i\,k\,t_1$	0	0	0

Quadratic (free) action
$S==\iiint\!\!\!\int\!(\frac{1}{6}\,(6\,t_1\,\mathcal{A}_{\,\,\,\alpha}^{\alpha i}\,\mathcal{A}_{\,\,\,\theta}^{\theta}\,\tau_{\alpha\beta}^{\beta}+6\,f^{\alpha\beta}\,\tau_{\alpha\beta}+6\,\mathcal{A}^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi}-12\,t_1\,\mathcal{A}_{\,\,\,\theta}^{\theta}\,\partial_{\,\,\,i}f^{\alpha i}+12\,t_1\,\mathcal{A}_{\,\,\,\theta}^{\theta}\,\partial^{\,\,\prime}f_{\,\,\,\alpha}^{\alpha}-6\,t_1\,\partial_{\,\,\,i}f_{\,\,\,\theta}^{\theta}\,\partial^{\,\,\prime}f_{\,\,\,\alpha}^{\alpha}-6\,t_1\,\partial_{\,\,\,i}f^{\alpha i}\,\partial_{\theta}f_{\,\,\,\alpha}^{\theta}+12\,t_1\,\partial^{\,\,\prime}f_{\,\,\,\alpha}^{\alpha}\,\partial_{\theta}f_{\,\,\,\theta}^{\theta}+4\,t_1\,\mathcal{A}_{\,\,\,\theta\alpha}\,\partial^{\theta}f^{\alpha i}+4\,t_2\,\mathcal{A}_{\,\,\,\theta\alpha}\,\partial^{\theta}f^{\alpha i}-4\,t_1\,\partial_{\alpha}f_{\,\,\,\theta}\,\partial^{\theta}f^{\alpha i}+2\,t_2\,\partial_{\alpha}f_{\,\,\,\theta}\,\partial^{\theta}f^{\alpha i}-4\,t_1\,\partial_{\alpha}f_{\,\,\,\theta i}\,\partial^{\theta}f^{\alpha i}-t_2\,\partial_{\alpha}f_{\,\,\,\theta i}\,\partial^{\theta}f^{\alpha i}+2\,t_1\,\partial_{\,\,\,i}f_{\alpha\theta}\,\partial^{\theta}f^{\alpha i}-t_2\,\partial_{\,\,\,i}f_{\alpha\theta}\,\partial^{\theta}f^{\alpha i}+4\,t_1\,\partial_{\theta}f_{\alpha i}\,\partial^{\theta}f^{\alpha i}+t_2\,\partial_{\theta}f_{\alpha i}\,\partial^{\theta}f^{\alpha i}+2\,t_1\,\partial_{\theta}f_{\,\,\,\alpha}\,\partial^{\theta}f^{\alpha i}-t_2\,\partial_{\theta}f_{\,\,\,\alpha}\,\partial^{\theta}f^{\alpha i}+2\,(t_1+t_2)\,\mathcal{A}_{\alpha i\theta}\,(\mathcal{A}^{\alpha i\theta}+2\,\partial^{\theta}f^{\alpha i})+2\,\mathcal{A}_{\alpha\theta i}\,((t_1-2\,t_2)\,\mathcal{A}^{\alpha i\theta}+2\,(2\,t_1-t_2)\,\partial^{\theta}f^{\alpha i})+8\,r_2\,\partial_{\beta}\mathcal{A}_{\alpha i\theta}\,\partial^{\theta}\mathcal{A}^{\alpha\beta i}-4\,r_2\,\partial_{\beta}\mathcal{A}_{\alpha\theta i}\,\partial^{\theta}\mathcal{A}^{\alpha\beta i}+4\,r_2\,\partial_{\beta}\mathcal{A}_{\,\,\,\theta\alpha}\,\partial^{\theta}\mathcal{A}^{\alpha\beta i}-2\,r_2\,\partial_{\,\,\,i}\mathcal{A}_{\alpha\beta\theta}\,\partial^{\theta}\mathcal{A}^{\alpha\beta i}+2\,r_2\,\partial_{\theta}\mathcal{A}_{\alpha\beta i}\,\partial^{\theta}\mathcal{A}^{\alpha\beta i}-4\,r_2\,\partial_{\theta}\mathcal{A}_{\alpha i\beta}\,\partial^{\theta}\mathcal{A}^{\alpha\beta i}+6\,r_5\,\partial_{\,\,\,i}\mathcal{A}_{\theta}^{\kappa}\,\partial^{\theta}\mathcal{A}_{\,\,\,\alpha}^{\alpha i}-6\,r_5\,\partial_{\theta}\mathcal{A}_{\,\,\,\kappa}^{\kappa}\,\partial^{\theta}\mathcal{A}_{\,\,\,\alpha}^{\alpha i}-6\,r_5\,\partial_{\alpha}\mathcal{A}^{\alpha i\theta}\,\partial_{\kappa}\mathcal{A}_{\,\,\,\theta}^{\kappa}+12\,r_5\,\partial^{\theta}\mathcal{A}_{\,\,\,\alpha}^{\alpha i}\,\partial_{\kappa}\mathcal{A}_{\,\,\,\theta}^{\kappa}+6\,r_5\,\partial_{\alpha}\mathcal{A}^{\alpha i\theta}\,\partial_{\kappa}\mathcal{A}_{\theta}^{\kappa}-12\,r_5\,\partial^{\theta}\mathcal{A}_{\,\,\,\alpha}^{\alpha i}\,\partial_{\kappa}\mathcal{A}_{\theta}^{\kappa}))\,[t,\,x,\,y,\,z]\,dz\,dy\,dx\,dt$

Massive and massless spectra



Massive particle	
Pole residue:	$\frac{-3\,t_1\,t_2\,(t_1+t_2)+3\,r_5\,(t_1^2+2\,t_2^2)}{r_5\,(t_1+t_2)\,(-3\,t_1\,t_2+2\,r_5\,(t_1+t_2))} > 0$
Polarisations:	3
Square mass:	$-\frac{3\,t_1\,t_2}{2\,r_5\,t_1+2\,r_5\,t_2} > 0$
Spin:	1
Parity:	Even



Massive particle	
Pole residue:	$-\frac{1}{r_2} > 0$
Polarisations:	1
Square mass:	$-\frac{t_2}{r_2} > 0$
Spin:	0
Parity:	Odd

(No massless particles)

Unitarity conditions

$r_2 < 0 \ \&\& \ r_5 > 0 \ \&\& \ t_1 < 0 \ \&\& \ t_2 > -t_1$