Particle spectrograph

Wave operator and propagator

	$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	$\tau_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$	$\tau_{1^-}^{\#1}{}_{\alpha}$	$\tau_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}\dagger^{\alpha\beta}$	$\frac{1}{-\frac{3(\alpha_0-4\beta_1)(\alpha_0+8\beta_3)}{16(\beta_1+2\beta_3)}+(\alpha_2+\alpha_5)k^2}$	$-\frac{2\sqrt{2}(3\alpha_0-4\beta_1+16\beta_3)}{(1+k^2)(-3(\alpha_0-4\beta_1)(\alpha_0+8\beta_3)+16(\alpha_2+\alpha_5)(\beta_1+2\beta_3)k^2)}$	$-\frac{2i\sqrt{2}(3\alpha_0-4\beta_1+16\beta_3)k}{(1+k^2)(-3(\alpha_0-4\beta_1)(\alpha_0+8\beta_3)+16(\alpha_2+\alpha_5)(\beta_1+2\beta_3)k^2)}$	0	0	0	0
$\sigma_{1^+}^{\#2}\dagger^{\alpha\beta}$	$-\frac{2\sqrt{2}(3\alpha_0-4\beta_1+16\beta_3)}{(1+k^2)(-3(\alpha_0-4\beta_1)(\alpha_0+8\beta_3)+16(\alpha_2+\alpha_5)(\beta_1+2\beta_3)k^2)}$	$\frac{6\alpha_0+8(\beta_1+8\beta_3+3(\alpha_2+\alpha_5)k^2)}{(1+k^2)^2(-3(\alpha_0-4\beta_1)(\alpha_0+8\beta_3)+16(\alpha_2+\alpha_5)(\beta_1+2\beta_3)k^2)}$	$\frac{2ik(3\alpha_0+4(\beta_1+8\beta_3+3(\alpha_2+\alpha_5)k^2))}{(1+k^2)^2(-3(\alpha_0-4\beta_1)(\alpha_0+8\beta_3)+16(\alpha_2+\alpha_5)(\beta_1+2\beta_3)k^2)}$	0	0	0	0
$\tau_{1^+}^{\#1}\dagger^{\alpha\beta}$	$\frac{2i\sqrt{2}(3\alpha_0-4\beta_1+16\beta_3)k}{(1+k^2)(-3(\alpha_0-4\beta_1)(\alpha_0+8\beta_3)+16(\alpha_2+\alpha_5)(\beta_1+2\beta_3)k^2)}$	$-\frac{2ik(3\alpha_0+4(\beta_1+8\beta_3+3(\alpha_2+\alpha_5)k^2))}{(1+k^2)^2(-3(\alpha_0-4\beta_1)(\alpha_0+8\beta_3)+16(\alpha_2+\alpha_5)(\beta_1+2\beta_3)k^2)}$	$\frac{2k^2(3\alpha_0+4(\beta_1+8\beta_3+3(\alpha_2+\alpha_5)k^2))}{(1+k^2)^2(-3(\alpha_0-4\beta_1)(\alpha_0+8\beta_3)+16(\alpha_2+\alpha_5)(\beta_1+2\beta_3)k^2)}$	0	0	0	0
$\sigma_{1^-}^{\#1}\dagger^{\alpha}$	0	0	0	$\frac{1}{-\frac{3(\alpha_0-4\beta_1)(\alpha_0+2\beta_2)}{8(2\beta_1+\beta_2)}+(\alpha_4+\alpha_5)k^2}$	$\frac{2\sqrt{2}(3\alpha_0-4\beta_1+4\beta_2)}{(1+2k^2)(-3(\alpha_0-4\beta_1)(\alpha_0+2\beta_2)+8(\alpha_4+\alpha_5)(2\beta_1+\beta_2)k^2)}$	0	$\frac{4i(3\alpha_0-4\beta_1+4\beta_2)k}{(1+2k^2)(-3(\alpha_0-4\beta_1)(\alpha_0+2\beta_2)+8(\alpha_4+\alpha_5)(2\beta_1+\beta_2)k^2)}$
$\sigma_{1^-}^{\#2}\dagger^{\alpha}$	0	0	0	$\frac{2\sqrt{2}(3\alpha_0-4\beta_1+4\beta_2)}{(1+2k^2)(-3(\alpha_0-4\beta_1)(\alpha_0+2\beta_2)+8(\alpha_4+\alpha_5)(2\beta_1+\beta_2)k^2)}$	$\frac{6\alpha_0+8(\beta_1+2\beta_2+3(\alpha_4+\alpha_5)k^2)}{(1+2k^2)^2(-3(\alpha_0-4\beta_1)(\alpha_0+2\beta_2)+8(\alpha_4+\alpha_5)(2\beta_1+\beta_2)k^2)}$	0	$\frac{2i\sqrt{2}k(3\alpha_0+4(\beta_1+2\beta_2+3(\alpha_4+\alpha_5)k^2))}{(1+2k^2)^2(-3(\alpha_0-4\beta_1)(\alpha_0+2\beta_2)+8(\alpha_4+\alpha_5)(2\beta_1+\beta_2)k^2)}$
$\tau_{1^-}^{\#1}\dagger^{\alpha}$	0	0	0	0	0	0	0
$\tau_{1^-}^{\#2}\dagger^{\alpha}$	0	0	0	$-\frac{4i(3\alpha_0-4\beta_1+4\beta_2)k}{(1+2k^2)(-3(\alpha_0-4\beta_1)(\alpha_0+2\beta_2)+8(\alpha_4+\alpha_5)(2\beta_1+\beta_2)k^2)}$	$-\frac{2i\sqrt{2}k(3\alpha_0+4(\beta_1+2\beta_2+3(\alpha_4+\alpha_5)k^2))}{(1+2k^2)^2(-3(\alpha_0-4\beta_1)(\alpha_0+2\beta_2)+8(\alpha_4+\alpha_5)(2\beta_1+\beta_2)k^2)}$	0	$\frac{4k^2(3\alpha_0+4(\beta_1+2\beta_2+3(\alpha_4+\alpha_5)k^2))}{(1+2k^2)^2(-3(\alpha_0-4\beta_1)(\alpha_0+2\beta_2)+8(\alpha_4+\alpha_5)(2\beta_1+\beta_2)k^2)}$

Quadratic (free) action

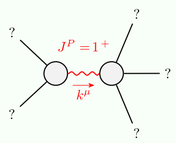
$$S == \iiint\int(\tfrac{1}{6}(-3\,\alpha_0\,\omega_{\alpha}^{\alpha\beta}\,\omega_{\beta}^{\chi}{}_{\chi}^{\alpha} + 4\,\beta_1\,\omega_{\alpha}^{\alpha\beta}\,\omega_{\beta}^{\chi}{}_{\chi}^{\alpha} - 4\,\beta_2\,\omega_{\alpha}^{\alpha\beta}\,\omega_{\beta}^{\chi}{}_{\chi}^{\alpha} + 6\,f^{\alpha\beta}\,\tau_{\alpha\beta} + 6\,\omega^{\alpha\beta\chi}\,\sigma_{\alpha\beta\chi} - 8\,\beta_1\,\omega_{\alpha}^{\chi}{}_{\chi}^{\alpha}\,\partial_{\beta}f^{\alpha\beta}{}_{\alpha} + 8\,\beta_1\,\omega_{\beta}^{\chi}{}_{\chi}^{\alpha}\,\partial_{\beta}f^{\alpha}{}_{\alpha} + 8\,\beta_2\,\omega_{\alpha}^{\chi}{}_{\chi}^{\alpha}\,\partial_{\beta}f^{\alpha}{}_{\alpha} - 4\,\beta_1\,\partial_{\beta}f^{\chi}{}_{\chi}^{\alpha}\,\partial^{\beta}f^{\alpha}{}_{\alpha} + 4\,\beta_2\,\partial_{\beta}f^{\chi}{}_{\chi}^{\alpha}\,\partial^{\beta}f^{\alpha}{}_{\alpha} - 8\,\beta_1\,\partial^{\beta}f^{\alpha}{}_{\alpha}\,\partial_{\chi}f^{\chi}{}_{\beta} - 8\,\beta_2\,\partial^{\beta}f^{\alpha}{}_{\alpha}\,\partial_{\chi}f^{\chi}{}_{\beta} + 6\,\alpha_0\,f^{\alpha\beta}\,\partial_{\chi}\omega_{\alpha}^{\chi}{}_{\beta} + 6\,\alpha_0\,f^{\alpha}{}_{\alpha}\,\partial_{\chi}\omega^{\beta\chi}{}_{\beta} + 8\,\beta_1\,\omega_{\beta\chi\alpha}\,\partial^{\chi}f^{\alpha\beta} + 16\,\beta_3\,\omega_{\beta\chi\alpha}\,\partial^{\chi}f^{\alpha\beta} - 8\,\beta_1\,\partial_{\alpha}f_{\beta\chi}\,\partial^{\chi}f^{\alpha\beta} - 8\,\beta_3\,\partial_{\alpha}f_{\beta\chi}\,\partial^{\chi}f^{\alpha\beta} + 4\,\beta_1\,\partial_{\beta}f_{\alpha\chi}\,\partial^{\chi}f^{\alpha\beta} - 4\,\beta_3\,\partial_{\beta}f_{\alpha\chi}\,\partial^{\chi}f^{\alpha\beta} + 8\,\beta_1\,\partial_{\chi}f_{\alpha\beta}\,\partial^{\chi}f^{\alpha\beta} + 4\,\beta_3\,\partial_{\chi}f_{\alpha\beta}\,\partial^{\chi}f^{\alpha\beta} + 4\,\beta_1\,\partial_{\chi}f_{\beta\alpha}\,\partial^{\chi}f^{\alpha\beta} - 4\,\beta_3\,\partial_{\chi}f_{\beta\alpha}\,\partial^{\chi}f^{\alpha\beta} + 4\,(\beta_1+2\beta_3)\,\omega_{\alpha\beta\chi}\,(\omega^{\alpha\beta\chi} + 2\,\partial^{\chi}f^{\alpha\beta}) + \omega_{\alpha\chi\beta}\,((-3\,\alpha_0+4\,\beta_1-16\,\beta_3)\,\omega^{\alpha\beta\chi} + 16\,(\beta_1-\beta_3)\,\partial^{\chi}f^{\alpha\beta}) + 6\,\alpha_1\,\partial_{\beta}\omega_{\chi}{}^{\delta}{}_{\delta}\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha} - 6\,\alpha_2\,\partial_{\beta}\omega_{\chi}{}^{\delta}{}_{\delta}\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha} + 6\,\alpha_4\,\partial_{\beta}\omega_{\chi}{}^{\delta}{}_{\delta}\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha} + 6\,\alpha_5\,\partial_{\beta}\omega_{\chi}{}^{\delta}{}_{\delta}\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha} + 6\,\alpha_1\,\partial_{\chi}\omega_{\beta}{}^{\delta}{}_{\delta}\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha} + 6\,\alpha_2\,\partial_{\chi}\omega_{\beta}{}^{\delta}{}_{\delta}\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha} - 6\,\alpha_4\,\partial_{\chi}\omega_{\beta}{}^{\delta}{}_{\delta}\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha} - 6\,\alpha_5\,\partial_{\chi}\omega_{\beta}{}^{\delta}{}_{\delta}\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha} + 6\,\alpha_1\,\partial_{\alpha}\omega^{\alpha\beta\chi}{}_{\delta}\,\partial_{\delta}\omega_{\chi}{}^{\delta}{}_{\beta} - 6\,\alpha_5\,\partial_{\alpha}\omega^{\alpha\beta\chi}{}_{\delta}\,\partial_{\delta}\omega_{\chi}{}^{\delta}{}_{\beta} + 12\,\alpha_2\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\delta}\omega_{\chi}{}^{\delta}{}_{\beta} - 12\,\alpha_4\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\delta}\omega_{\chi}{}^{\delta}{}_{\beta} + 12\,\alpha_5\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\delta}\omega_{\chi}{}^{\delta}{}_{\beta} + 6\,\alpha_4\,\partial_{\beta}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\delta}\omega_{\chi}{}^{\delta}{}_{\chi} - 6\,\alpha_5\,\partial_{\beta}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\delta}\omega_{\chi}{}^{\delta}{}_{\chi} + 12\,\alpha_1\,\partial_{\chi}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\delta}\omega_{\beta}{}^{\delta}{}_{\chi} - 12\,\alpha_2\,\partial_{\chi}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\delta}\omega_{\beta}{}^{\delta}{}_{\chi} + 12\,\alpha_4\,\partial^{\chi}\omega^{\alpha\beta}{}_{\alpha}\,\partial_{\delta}\omega_{\beta}{}^{\delta}{}_{\chi} + 8\,\alpha_1\,\partial_{\beta}\omega_{\alpha\chi}{}^{\delta}\,\partial_{\delta}\omega^{\alpha\beta\chi} - 4\,\alpha_3\,\partial_{\beta}\omega_{\alpha\chi}{}^{\delta}\,\partial_{\delta}\omega^{\alpha\beta\chi} + 8\,\alpha_1\,\partial_{\beta}\omega_{\chi\alpha}{}^{\delta}\,\partial_{\delta}\omega^{\alpha\beta\chi} - 4\,\alpha_3\,\partial_{\beta}\omega_{\chi\alpha}{}^{\delta}\,\partial_{\delta}\omega^{\alpha\beta\chi} + 6\,\alpha_2\,\partial_{\chi}\omega_{\alpha\beta}{}^{\delta}\,\partial_{\delta}\omega^{\alpha\beta\chi} - 4\,\alpha_1\,\partial_{\chi}\omega_{\alpha\beta\delta}\,\partial^{\delta}\omega^{\alpha\beta\chi} - 2\,\alpha_3\,\partial_{\chi}\omega_{\alpha\beta\delta}\,\partial^{\delta}\omega^{\alpha\beta\chi} + 4\,\alpha_1\,\partial_{\delta}\omega_{\alpha\beta\chi}\,\partial^{\delta}\omega^{\alpha\beta\chi} + 6\,\alpha_2\,\partial_{\delta}\omega_{\alpha\beta\chi}\,\partial^{\delta}\omega^{\alpha\beta\chi} + 4\,\alpha_3\,\partial_{\delta}\omega_{\alpha\beta\chi}\,\partial^{\delta}\omega^{\alpha\beta\chi})[t,x,y,z]\,dz\,dy\,dx\,dt$$

	$\omega_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^+}^{\#2}{}_{\alpha\beta}$	$f_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^-}^{\#1}{}_{\alpha}$	$\omega_{1^-}^{\#2}{}_{\alpha}$	$f_{1^-}^{\#1}{}_{\alpha}$	$f_{1^-}^{\#2}{}_{\alpha}$
$\omega_{1^+}^{\#1}\dagger^{\alpha\beta}$	$\frac{\alpha_0}{4}+\frac{1}{3}(\beta_1+8\beta_3)+(\alpha_2+\alpha_5)k^2$	$\frac{3\alpha_0-4\beta_1+16\beta_3}{6\sqrt{2}}$	$\frac{i(3\alpha_0-4\beta_1+16\beta_3)k}{6\sqrt{2}}$	0	0	0	0
$\omega_{1^+}^{\#2}\dagger^{\alpha\beta}$	$\frac{3\alpha_0-4\beta_1+16\beta_3}{6\sqrt{2}}$	$\frac{2}{3}(\beta_1+2\beta_3)$	$\frac{2}{3}i(\beta_1+2\beta_3)k$	0	0	0	0
$f_{1^+}^{\#1}\dagger^{\alpha\beta}$	$-\frac{i(3\alpha_0-4\beta_1+16\beta_3)k}{6\sqrt{2}}$	$-\frac{2}{3}i(\beta_1+2\beta_3)k$	$\frac{2}{3}(\beta_1+2\beta_3)k^2$	0	0	0	0
$\omega_{1^-}^{\#1}\dagger^{\alpha}$	0	0	0	$\frac{\alpha_0}{4}+\frac{1}{3}(\beta_1+2\beta_2)+(\alpha_4+\alpha_5)k^2$	$-\frac{3\alpha_0-4\beta_1+4\beta_2}{6\sqrt{2}}$	0	$-\frac{1}{6}i(3\alpha_0-4\beta_1+4\beta_2)k$
$\omega_{1^-}^{\#2}\dagger^{\alpha}$	0	0	0	$-\frac{3\alpha_0-4\beta_1+4\beta_2}{6\sqrt{2}}$	$\frac{1}{3}(2\beta_1+\beta_2)$	0	$\frac{1}{3}i\sqrt{2}(2\beta_1+\beta_2)k$
$f_{1^-}^{\#1}\dagger^{\alpha}$	0	0	0	0	0	0	0
$f_{1^-}^{\#2}\dagger^{\alpha}$	0	0	0	$\frac{1}{6}i(3\alpha_0-4\beta_1+4\beta_2)k$	$-\frac{1}{3}i\sqrt{2}(2\beta_1+\beta_2)k$	0	$\frac{2}{3}(2\beta_1+\beta_2)k^2$

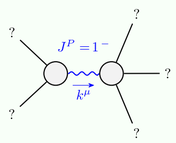
Source constraints

SO(3) irreps	Fundamental fields	Multiplicities
$\tau_{0^+}^{\#2} == 0$	$\partial_\beta\partial_\alpha\tau^{\alpha\beta} == 0$	1
$\tau_{1^-}^{\#2\,\alpha} + 2\,i\,k\,\sigma_{1^-}^{\#2\,\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau^{\alpha\beta} + 2\,\partial_\delta\partial^\delta\partial_\chi\partial_\beta\sigma^{\alpha\beta\chi}$	3
$\tau_{1^-}^{\#1\,\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\tau^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau^{\beta\alpha}$	3
$\tau_{1^+}^{\#1\,\alpha\beta} + i\,i\,k\,\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	$\partial_\chi\partial^\alpha\tau^{\beta\chi} + \partial_\chi\partial^\beta\tau^{\chi\alpha} + \partial_\chi\partial^\chi\tau^{\alpha\beta} + 2\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\beta\chi\delta} + 2\,\partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\beta\chi} == \partial_\chi\partial^\alpha\tau^{\chi\beta} + \partial_\chi\partial^\beta\tau^{\alpha\chi} + \partial_\chi\partial^\chi\tau^{\beta\alpha} + 2\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\alpha\chi\delta}$	3
Total constraints/gauge generators:		10

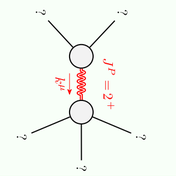
Massive and massless spectra



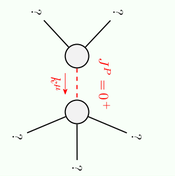
Massive particle	
Pole residue:	$(3(\alpha_0{}^2(3\alpha_2+3\alpha_5+2\beta_1+4\beta_3)-8\alpha_0(\beta_1{}^2+\alpha_2(\beta_1-4\beta_3)+\alpha_5(\beta_1-4\beta_3)-4\beta_3{}^2)+16(-4\beta_1\beta_3(\beta_1+2\beta_3)+\alpha_2(\beta_1{}^2+8\beta_3{}^2)+\alpha_5(\beta_1{}^2+8\beta_3{}^2))))/((2(\alpha_2+\alpha_5)(\beta_1+2\beta_3)(3\alpha_0{}^2-12\alpha_0(\beta_1-2\beta_3)+16(\alpha_5\beta_1+2\alpha_5\beta_3-6\beta_1\beta_3+\alpha_2(\beta_1+2\beta_3))))) > 0$
Polarisations:	3
Square mass:	$\frac{3(\alpha_0-4\beta_1)(\alpha_0+8\beta_3)}{16(\alpha_2+\alpha_5)(\beta_1+2\beta_3)} > 0$
Spin:	1
Parity:	Even



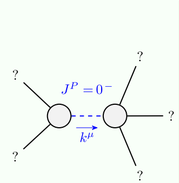
Massive particle	
Pole residue:	$-((3(\alpha_0{}^2(3\alpha_4+3\alpha_5+4\beta_1+2\beta_2)+4\alpha_0(-2\alpha_4\beta_1-2\alpha_5\beta_1-4\beta_1{}^2+2\alpha_4\beta_2+2\alpha_5\beta_2+\beta_2{}^2)+8(-2\beta_1\beta_2(2\beta_1+\beta_2)+\alpha_4(2\beta_1{}^2+\beta_2{}^2)+\alpha_5(2\beta_1{}^2+\beta_2{}^2))))/((2(\alpha_4+\alpha_5)(2\beta_1+\beta_2)(3\alpha_0{}^2+6\alpha_0(-2\beta_1+\beta_2)+4(2\alpha_5\beta_1+\alpha_5\beta_2-6\beta_1\beta_2+\alpha_4(2\beta_1+\beta_2))))) > 0$
Polarisations:	3
Square mass:	$\frac{3(\alpha_0-4\beta_1)(\alpha_0+2\beta_2)}{8(\alpha_4+\alpha_5)(2\beta_1+\beta_2)} > 0$
Spin:	1
Parity:	Odd



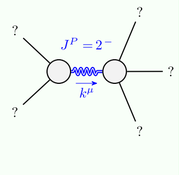
Massive particle	
Pole residue:	$-\frac{2}{\alpha_0}+\frac{\alpha_1+\alpha_4+2\beta_1}{2\alpha_1\beta_1+2\alpha_4\beta_1} > 0$
Polarisations:	5
Square mass:	$\frac{\alpha_0(\alpha_0-4\beta_1)}{16(\alpha_1+\alpha_4)\beta_1} > 0$
Spin:	2
Parity:	Even



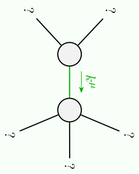
Massive particle	
Pole residue:	$\frac{1}{\alpha_0}+\frac{\alpha_4+\alpha_6+2\beta_2}{2\alpha_4\beta_2+2\alpha_6\beta_2} > 0$
Polarisations:	1
Square mass:	$\frac{\alpha_0(\alpha_0+2\beta_2)}{4(\alpha_4+\alpha_6)\beta_2} > 0$
Spin:	0
Parity:	Even



Massive particle	
Pole residue:	$-\frac{1}{\alpha_2+\alpha_3} > 0$
Polarisations:	1
Square mass:	$-\frac{\alpha_0+8\beta_3}{2(\alpha_2+\alpha_3)} > 0$
Spin:	0
Parity:	Odd



Massive particle	
Pole residue:	$-\frac{1}{\alpha_1+\alpha_2} > 0$
Polarisations:	5
Square mass:	$\frac{\alpha_0-4\beta_1}{4(\alpha_1+\alpha_2)} > 0$
Spin:	2
Parity:	Odd



Quadratic pole	
Pole residue:	$\frac{1}{\alpha_0} > 0$
Polarisations:	2

Unitarity conditions

(Unitarity is demonstrably impossible)