

Particle spectrograph

Wave operator and propagator

	$\sigma_{1^+}^{\#1} \alpha\beta$	$\sigma_{1^+}^{\#2} \alpha\beta$	$\tau_{1^+}^{\#1} \alpha\beta$	$\sigma_{1^+}^{\#1} \alpha$	$\sigma_{1^+}^{\#2} \alpha$	$\tau_{1^+}^{\#1} \alpha$	$\tau_{1^+}^{\#2} \alpha$
$\sigma_{1^+}^{\#1} \alpha\beta$	0	$\frac{2\sqrt{2}}{(\alpha_0-4\beta_1)(1+k^2)}$	$-\frac{2i\sqrt{2}k}{(\alpha_0-4\beta_1)(1+k^2)}$	0	0	0	0
$\sigma_{1^+}^{\#2} \alpha\beta$	$\frac{2\sqrt{2}}{(\alpha_0-4\beta_1)(1+k^2)}$	$-\frac{2}{(\alpha_0-4\beta_1)(1+k^2)^2}$	$-\frac{2ik}{(\alpha_0-4\beta_1)(1+k^2)^2}$	0	0	0	0
$\tau_{1^+}^{\#1} \alpha\beta$	$-\frac{2i\sqrt{2}k}{(\alpha_0-4\beta_1)(1+k^2)}$	$\frac{2ik}{(\alpha_0-4\beta_1)(1+k^2)^2}$	$-\frac{2k^2}{(\alpha_0-4\beta_1)(1+k^2)^2}$	0	0	0	0
$\sigma_{1^+}^{\#1} \alpha$	0	0	0	0	$-\frac{2\sqrt{2}}{(\alpha_0-4\beta_1)(1+2k^2)}$	$-\frac{4ik}{(\alpha_0-4\beta_1)(1+2k^2)}$	$-\frac{4ik}{(\alpha_0-4\beta_1)(1+2k^2)}$
$\sigma_{1^+}^{\#2} \alpha$	0	0	0	0	$-\frac{2\sqrt{2}}{(\alpha_0-4\beta_1)(1+2k^2)}$	$-\frac{2i\sqrt{2}k}{(\alpha_0-4\beta_1)(1+2k^2)^2}$	$-\frac{2i\sqrt{2}k}{(\alpha_0-4\beta_1)(1+2k^2)^2}$
$\tau_{1^+}^{\#1} \alpha$	0	0	0	0	0	0	0
$\tau_{1^+}^{\#2} \alpha$	0	0	0	0	$\frac{4ik}{(\alpha_0-4\beta_1)(1+2k^2)}$	$\frac{2i\sqrt{2}k}{(\alpha_0-4\beta_1)(1+2k^2)^2}$	$\frac{4k^2}{(\alpha_0-4\beta_1)(1+2k^2)^2}$

	$\sigma_{0^+}^{\#1}$	$\tau_{0^+}^{\#1}$	$\tau_{0^+}^{\#2}$	$\sigma_{0^+}^{\#1}$
$\sigma_{0^+}^{\#1} \dagger$	$\frac{8\beta_1}{\alpha_0^2-4\alpha_0\beta_1+8\alpha_6\beta_1k^2}$	$-\frac{i\sqrt{2}(\alpha_0-4\beta_1)}{\alpha_0(\alpha_0-4\beta_1)k+8\alpha_6\beta_1k^3}$	0	0
$\tau_{0^+}^{\#1} \dagger$	$\frac{i\sqrt{2}(\alpha_0-4\beta_1)}{\alpha_0(\alpha_0-4\beta_1)k+8\alpha_6\beta_1k^3}$	$-\frac{\alpha_0-4\beta_1+2\alpha_6k^2}{k^2(\alpha_0^2-4\alpha_0\beta_1+8\alpha_6\beta_1k^2)}$	0	0
$\tau_{0^+}^{\#2} \dagger$	0	0	0	0
$\sigma_{0^+}^{\#1} \dagger$	0	0	0	$\frac{2}{\alpha_0-4\beta_1}$

	$\omega_{0^+}^{\#1}$	$f_{0^+}^{\#1}$	$f_{0^+}^{\#2}$	$\omega_{0^+}^{\#1}$
$\omega_{0^+}^{\#1} \dagger$	$\frac{\alpha_0}{2}-2\beta_1+\alpha_6k^2$	$-\frac{i(\alpha_0-4\beta_1)k}{\sqrt{2}}$	0	0
$f_{0^+}^{\#1} \dagger$	$\frac{i(\alpha_0-4\beta_1)k}{\sqrt{2}}$	$-4\beta_1k^2$	0	0
$f_{0^+}^{\#2} \dagger$	0	0	0	0
$\omega_{0^+}^{\#1} \dagger$	0	0	0	$\frac{1}{2}(\alpha_0-4\beta_1)$

Source constraints/gauge generators	
SO(3) irreps	Multiplicities
$\tau_{0^+}^{\#2} == 0$	1
$\tau_{1^+}^{\#2\alpha} + 2ik\sigma_{1^+}^{\#2\alpha} == 0$	3
$\tau_{1^+}^{\#1\alpha} == 0$	3
$\tau_{1^+}^{\#1\alpha\beta} + ik\sigma_{1^+}^{\#2\alpha\beta} == 0$	3
Total constraints:	10

	$\omega_{2^+}^{\#1} \alpha\beta$	$f_{2^+}^{\#1} \alpha\beta$	$\omega_{2^+}^{\#1} \alpha\beta_X$
$\omega_{2^+}^{\#1} \alpha\beta$	$-\frac{\alpha_0}{4} + \beta_1$	$\frac{i(\alpha_0-4\beta_1)k}{2\sqrt{2}}$	0
$f_{2^+}^{\#1} \alpha\beta$	$-\frac{i(\alpha_0-4\beta_1)k}{2\sqrt{2}}$	$2\beta_1k^2$	0
$\omega_{2^+}^{\#1} \alpha\beta_X$	0	0	$-\frac{\alpha_0}{4} + \beta_1$

	$\sigma_{2^+}^{\#1} \alpha\beta$	$\tau_{2^+}^{\#1} \alpha\beta$	$\sigma_{2^+}^{\#1} \alpha\beta_X$
$\sigma_{2^+}^{\#1} \alpha\beta$	$-\frac{16\beta_1}{\alpha_0^2-4\alpha_0\beta_1}$	$\frac{2i\sqrt{2}}{\alpha_0k}$	0
$\tau_{2^+}^{\#1} \alpha\beta$	$-\frac{2i\sqrt{2}}{\alpha_0k}$	$\frac{2}{\alpha_0k^2}$	0
$\sigma_{2^+}^{\#1} \alpha\beta_X$	0	0	$\frac{1}{-\frac{\alpha_0}{4} + \beta_1}$

Massive and massless spectra

	<table><tr><th colspan="2">Massive particle</th></tr><tr><td>Pole residue:</td><td>$\frac{1}{\alpha_0} + \frac{1}{\alpha_6} - \frac{1}{4\beta_1} > 0$</td></tr><tr><td>Polarisations:</td><td>1</td></tr><tr><td>Square mass:</td><td>$-\frac{\alpha_0(\alpha_0-4\beta_1)}{8\alpha_6\beta_1} > 0$</td></tr><tr><td>Spin:</td><td>0</td></tr><tr><td>Parity:</td><td>Even</td></tr></table>	Massive particle		Pole residue:	$\frac{1}{\alpha_0} + \frac{1}{\alpha_6} - \frac{1}{4\beta_1} > 0$	Polarisations:	1	Square mass:	$-\frac{\alpha_0(\alpha_0-4\beta_1)}{8\alpha_6\beta_1} > 0$	Spin:	0	Parity:	Even
Massive particle													
Pole residue:	$\frac{1}{\alpha_0} + \frac{1}{\alpha_6} - \frac{1}{4\beta_1} > 0$												
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	<table><tr><th colspan="2">Quadratic pole</th></tr><tr><td>Pole residue:</td><td>$\frac{1}{\alpha_0} > 0$</td></tr><tr><td>Polarisations:</td><td>2</td></tr></table>	Quadratic pole		Pole residue:	$\frac{1}{\alpha_0} > 0$	Polarisations:	2						
Quadratic pole													
Pole residue:	$\frac{1}{\alpha_0} > 0$												
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Unitarity conditions

$\alpha_0 > 0 \ \&\& \ \alpha_6 > 0 \ \&\& \ \beta_1 < 0 \ || \ \beta_1 > \frac{\alpha_0}{4}$