

Particle spectrograph

Wave operator and propagator

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

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

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

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

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

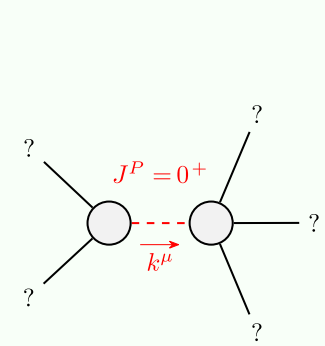
Source constraints/gauge generators	Multiplicities
$\tau_{0+}^{\#2} == 0$	1
$\tau_{1-}^{\#2\alpha} + 2ik\sigma_{1+}^{\#2\alpha} == 0$	3
$\tau_{1-}^{\#1\alpha} == 0$	3
$\tau_{1+}^{\#1\alpha\beta} + ik\sigma_{1+}^{\#2\alpha\beta} == 0$	3
Total constraints:	10

Quadratic (free) Lagrangian density

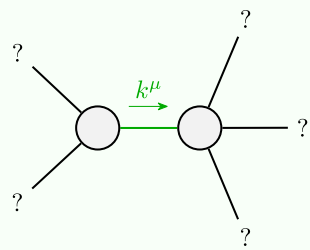
$$-\frac{1}{2}\alpha_0\omega_{\alpha\chi\beta}\omega^{\alpha\beta\chi}-\frac{1}{2}\alpha_0\omega^{\alpha\beta}\omega_{\beta\chi}^{\chi}+2\beta_1\omega_{\alpha}^{\alpha\beta}\omega_{\beta\chi}^{\chi}-2\beta_1\omega_{\alpha}^{\chi\delta}\omega_{\chi\delta}^{\alpha}+f^{\alpha\beta}\tau_{\alpha\beta}+\omega^{\alpha\beta\chi}\sigma_{\alpha\beta\chi}-2\beta_1\omega_{\alpha}^{\chi}\omega_{\chi}^{\alpha\beta}\partial_{\beta}f^{\alpha}-2\beta_1\omega_{\alpha}^{\delta}\partial_{\delta}f^{\alpha\beta}-\alpha_0f^{\alpha\beta}\partial_{\beta}\omega_{\alpha}^{\alpha\beta}+2\beta_1\omega_{\beta\chi}^{\chi}\partial^{\beta}f_{\alpha}^{\alpha}+2\beta_1\omega_{\beta\delta}^{\delta}\partial^{\beta}f_{\alpha}^{\alpha}-2\beta_1\partial_{\beta}f_{\alpha}^{\chi}\partial^{\beta}f_{\alpha}^{\beta}+\alpha_0f^{\alpha\beta}\partial_{\chi}\omega_{\alpha}^{\chi}\omega_{\beta}^{\alpha}-\alpha_0f_{\alpha}^{\alpha}\partial_{\chi}\omega_{\beta}^{\beta\chi}+4\beta_1\omega_{\alpha\chi\beta}\partial^{\chi}f_{\beta}^{\alpha\beta}+\beta_1\partial_{\chi}f_{\beta}^{\delta}\partial^{\chi}f_{\delta}^{\beta}+\beta_1\partial_{\chi}f_{\delta}^{\beta}\partial^{\chi}f_{\delta}^{\alpha}+\alpha_6\omega_{\alpha}^{\alpha\beta}\partial_{\delta}\omega_{\beta}^{\chi\delta}-\beta_1\partial_{\chi}f_{\delta}^{\beta}\partial^{\chi}f_{\beta\chi}-\beta_1\partial^{\chi}f_{\zeta}^{\beta}\partial^{\zeta}f_{\chi\beta}+\beta_1\partial^{\chi}f_{\delta\zeta}^{\delta}\partial^{\zeta}f_{\chi}^{\delta}-\beta_1\partial^{\chi}f_{\zeta\delta}^{\delta}\partial^{\zeta}f_{\chi}^{\delta}$$

$\omega_{0+}^{\#1}$	$f_{0+}^{\#1}$	$f_{0+}^{\#2}$	$\omega_{0-}^{\#1}$
$\frac{\alpha_0}{2}-2\beta_1+\alpha_6 k^2$	$-\frac{i(\alpha_0-4\beta_1)k}{\sqrt{2}}$	0	0
$\frac{i(\alpha_0-4\beta_1)k}{\sqrt{2}}$	$-4\beta_1 k^2$	0	0
0	0	0	0
0	0	0	$\frac{1}{2}(\alpha_0-4\beta_1)$

Massive and massless spectra



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



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

Unitarity conditions

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