Particle spectrograph

Wave operator and propagator

Quadratic (free) action

$S_F ==$

$$\iiiint\Big(\tfrac{1}{2}\big(-2\lambda\,\omega^{\iota\theta}{}_{\iota}\,\omega_{\theta}{}^{\kappa}{}_{\kappa}-2\lambda\,\omega^{\alpha\iota}{}_{\iota}\,\omega_{\kappa\alpha}{}^{\kappa}-2\lambda\,\omega^{\kappa\zeta}{}_{\iota}\,\omega_{\kappa\zeta}{}^{\iota}+2\,f^{\alpha\beta}\,\tau_{\alpha\beta}+2\,\omega^{\alpha\beta\chi}$$

$$\sigma_{\alpha\beta\chi}-4\lambda\,f^{\iota\theta}\,\partial_{\theta}\omega_{\iota}{}^{\kappa}{}_{\kappa}+4\lambda\,\partial_{\theta}\omega^{\iota\theta}{}_{\iota}+4\lambda\,f^{\iota\theta}\,\partial_{\kappa}\omega_{\iota}{}^{\kappa}{}_{\theta}-4\lambda\,f^{\iota}{}_{\iota}\,\partial_{\kappa}\omega^{\theta\kappa}{}_{\theta}-$$

$$\lambda\partial^{\alpha}f_{\theta\kappa}\partial^{\kappa}f_{\alpha}{}^{\theta}-\lambda\partial^{\alpha}f_{\kappa\theta}\partial^{\kappa}f_{\alpha}{}^{\theta}-\lambda\partial^{\alpha}f^{\zeta}{}_{\kappa}\partial^{\kappa}f_{\alpha\zeta}+2\lambda\,\omega_{\kappa\alpha}{}^{\alpha}\,\partial^{\kappa}f^{\iota}{}_{\iota}+$$

$$2\lambda\,\omega_{\kappa\zeta}{}^{\zeta}\,\partial^{\kappa}f^{\iota}{}_{\iota}+4\lambda\partial^{\alpha}f_{\kappa\alpha}\partial^{\kappa}f^{\iota}{}_{\iota}-2\lambda\partial_{\kappa}f^{\zeta}{}_{\zeta}\partial^{\kappa}f^{\iota}{}_{\iota}-2\lambda\,\omega_{\iota\kappa\theta}\,(\omega^{\iota\theta\kappa}-2\,\partial^{\kappa}f^{\iota\theta})-$$

$$2\lambda\,\omega_{\iota\alpha}{}^{\alpha}\,\partial^{\kappa}f^{\iota}{}_{\kappa}-2\lambda\,\omega_{\iota\zeta}{}^{\zeta}\,\partial^{\kappa}f^{\iota}{}_{\kappa}+\lambda\partial^{\alpha}f^{\zeta}{}_{\kappa}\partial^{\kappa}f_{\zeta\alpha}+\lambda\partial_{\kappa}f_{\theta}{}^{\zeta}\partial^{\kappa}f_{\zeta}{}^{\theta}+$$

$$\lambda\partial_{\kappa}f^{\zeta}{}_{\theta}\partial^{\kappa}f_{\zeta}{}^{\theta}-2\lambda\partial^{\alpha}f^{\zeta}{}_{\alpha}\partial^{\kappa}f_{\zeta\kappa}\big)\Big)[t,x,y,z]\,dz\,dy\,dx\,dt$$

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\sigma^{\#1}_{0^-} == 0$	1
$\tau^{\#2}_{0^+} == 0$	1
$\sigma^{\#1}_{0^+} == 0$	1
$\tau^{\#2}_{1^-}{}^{\alpha} == 0$	3
$\tau^{\#1}_{1^-}{}^{\alpha} == 0$	3
$\sigma^{\#2}_{1^-}{}^{\alpha} == 0$	3
$\sigma^{\#1}_{1^-}{}^{\alpha} == 0$	3
$\tau^{\#1}_{1^+}{}^{\alpha\beta} == 0$	3
$\sigma^{\#2}_{1^+}{}^{\alpha\beta} == 0$	3
$\sigma^{\#1}_{1^+}{}^{\alpha\beta} == 0$	3
$\sigma^{\#1}_{2^-}{}^{\alpha\beta\chi} == 0$	5
$\sigma^{\#1}_{2^+}{}^{\alpha\beta} == 0$	5
Total constraints:	34

	$\omega^{\#1}_{2^+\alpha\beta}$	$f^{\#1}_{2^+\alpha\beta}$	$\omega^{\#1}_{2^-\alpha\beta\chi}$
$\omega^{\#1}_{2^+}\dagger^{\alpha\beta}$	0	0	0
$f^{\#1}_{2^+}\dagger^{\alpha\beta}$	0	$k^2\lambda$	0
$\omega^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$	0	0	0

	$\omega^{\#1}_{0^+}\dagger$	$f^{\#1}_{0^+}\dagger$	$f^{\#2}_{0^+}\dagger$	$\omega^{\#1}_{0^-}\dagger$
$\omega^{\#1}_{0^-}$	0	0	0	0
$f^{\#2}_{0^+}$	0	0	0	0
$f^{\#1}_{0^+}$	0	$-2k^2\lambda$	0	0
$\omega^{\#1}_{0^+}$	0	0	0	0

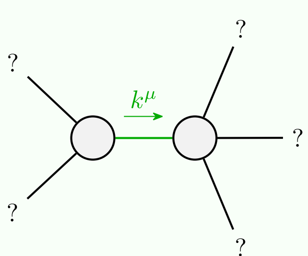
	$\sigma^{\#1}_{2^+}\dagger^{\alpha\beta}$	$\tau^{\#1}_{2^+}\dagger^{\alpha\beta}$	$\sigma^{\#1}_{2^-}\dagger^{\alpha\beta\chi}$
$\sigma^{\#1}_{2^-\alpha\beta\chi}$	0	0	0
$\tau^{\#1}_{2^+\alpha\beta}$	0	$\frac{1}{k^2\lambda}$	0
$\sigma^{\#1}_{2^+\alpha\beta}$	0	0	0

	$\sigma^{\#1}_{0^+}\dagger$	$\tau^{\#1}_{0^+}\dagger$	$\tau^{\#2}_{0^+}\dagger$	$\sigma^{\#1}_{0^-}\dagger$
$\sigma^{\#1}_{0^-}$	0	0	0	0
$\tau^{\#2}_{0^+}$	0	0	0	0
$\tau^{\#1}_{0^+}$	0	$-\frac{1}{2k^2\lambda}$	0	0
$\sigma^{\#1}_{0^+}$	0	0	0	0

	$\omega^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\omega^{\#2}_{1^+}\dagger^{\alpha\beta}$	$f^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\omega^{\#1}_{1^-}\dagger^{\alpha}$	$\omega^{\#2}_{1^-}\dagger^{\alpha}$	$f^{\#1}_{1^-}\dagger^{\alpha}$	$f^{\#2}_{1^-}\dagger^{\alpha}$
$f^{\#2}_{1^-\alpha}$	0	0	0	0	0	0	0
$f^{\#1}_{1^-\alpha}$	0	0	0	0	0	0	0
$\omega^{\#2}_{1^-\alpha}$	0	0	0	0	0	0	0
$\omega^{\#1}_{1^-\alpha}$	0	0	0	0	0	0	0
$f^{\#1}_{1^+\alpha\beta}$	0	0	0	0	0	0	0
$\omega^{\#2}_{1^+\alpha\beta}$	0	0	0	0	0	0	0
$\omega^{\#1}_{1^+\alpha\beta}$	0	0	0	0	0	0	0

	$\sigma^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\sigma^{\#2}_{1^+}\dagger^{\alpha\beta}$	$\tau^{\#1}_{1^+}\dagger^{\alpha\beta}$	$\sigma^{\#1}_{1^-}\dagger^{\alpha}$	$\sigma^{\#2}_{1^-}\dagger^{\alpha}$	$\tau^{\#1}_{1^-}\dagger^{\alpha}$	$\tau^{\#2}_{1^-}\dagger^{\alpha}$
$\tau^{\#2}_{1^-\alpha}$	0	0	0	0	0	0	0
$\tau^{\#1}_{1^-\alpha}$	0	0	0	0	0	0	0
$\sigma^{\#2}_{1^-\alpha}$	0	0	0	0	0	0	0
$\sigma^{\#1}_{1^-\alpha}$	0	0	0	0	0	0	0
$\tau^{\#1}_{1^+\alpha\beta}$	0	0	0	0	0	0	0
$\sigma^{\#2}_{1^+\alpha\beta}$	0	0	0	0	0	0	0
$\sigma^{\#1}_{1^+\alpha\beta}$	0	0	0	0	0	0	0

Massive and massless spectra



Quadratic pole

Pole residue:	$\frac{1}{\lambda} > 0$
Polarisations:	2

(No massive particles)

Unitarity conditions

$\lambda > 0$