Particle spectrograph

Wave operator and propagator

Quadratic (free) Lagrangian density

$$\omega^{\alpha\beta\chi}\ \sigma_{\alpha\beta\chi} + 2\,r_1\,\partial_\iota\omega^{\kappa\lambda}{}_\kappa\,\partial^\iota\omega_\lambda{}^\alpha{}_\alpha - 2\,r_3\,\partial_\iota\omega^{\kappa\lambda}{}_\kappa\,\partial^\iota\omega_\lambda{}^\alpha{}_\alpha -$$
$$r_5\,\partial_\iota\omega^{\kappa\lambda}{}_\kappa\,\partial^\iota\omega_\lambda{}^\alpha{}_\alpha - \frac{2}{3}\,r_1\,\partial^\beta\omega^{\theta\alpha}{}_\kappa\,\partial_\theta\omega_{\alpha\beta}{}^\kappa - \frac{2}{3}\,r_1\,\partial_\theta\omega_{\alpha\beta}{}^\kappa\,\partial_\kappa\omega^{\alpha\beta\theta} +$$
$$\frac{2}{3}\,r_1\,\partial_\theta\omega_{\alpha\beta}{}^\kappa\,\partial_\kappa\omega^{\theta\alpha\beta} - 2\,r_1\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial_\kappa\omega^{\theta\kappa\lambda} + 2\,r_3\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial_\kappa\omega^{\theta\kappa\lambda} -$$
$$r_5\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial_\kappa\omega^{\theta\kappa\lambda} + 2\,r_1\,\partial_\theta\omega_\lambda{}^\alpha{}_\alpha\,\partial_\kappa\omega^{\theta\kappa\lambda} - 2\,r_3\,\partial_\theta\omega_\lambda{}^\alpha{}_\alpha\,\partial_\kappa\omega^{\theta\kappa\lambda} +$$
$$r_5\,\partial_\theta\omega_\lambda{}^\alpha{}_\alpha\,\partial_\kappa\omega^{\theta\kappa\lambda} + 2\,r_1\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial_\kappa\omega^{\kappa\lambda\theta} - 2\,r_3\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial_\kappa\omega^{\kappa\lambda\theta} -$$
$$r_5\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial_\kappa\omega^{\kappa\lambda\theta} - 4\,r_1\,\partial_\theta\omega_\lambda{}^\alpha{}_\alpha\,\partial_\kappa\omega^{\kappa\lambda\theta} + 4\,r_3\,\partial_\theta\omega_\lambda{}^\alpha{}_\alpha\,\partial_\kappa\omega^{\kappa\lambda\theta} +$$
$$2\,r_5\,\partial_\theta\omega_\lambda{}^\alpha{}_\alpha\,\partial_\kappa\omega^{\kappa\lambda\theta} + \frac{2}{3}\,r_1\,\partial_\kappa\omega^{\alpha\beta\theta}\,\partial^\kappa\omega_{\alpha\beta\theta} - \frac{2}{3}\,r_1\,\partial_\kappa\omega^{\theta\alpha\beta}\,\partial^\kappa\omega_{\alpha\beta\theta} +$$
$$\frac{2}{3}\,r_1\,\partial^\beta\omega_\iota{}^{\alpha\lambda}\,\partial_\lambda\omega_{\alpha\beta}{}' + \frac{4}{3}\,r_1\,\partial^\beta\omega_\iota{}^{\lambda\alpha}\,\partial_\lambda\omega_{\alpha\beta}{}' - 4\,r_3\,\partial^\beta\omega_\iota{}^{\lambda\alpha}\,\partial_\lambda\omega_{\alpha\beta}{}' +$$
$$2\,r_1\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial^\lambda\omega^{\theta\kappa}{}_\kappa + r_5\,\partial_\alpha\omega_\lambda{}^\alpha{}_\theta\,\partial^\lambda\omega^{\theta\kappa}{}_\kappa -$$
$$2\,r_1\,\partial_\theta\omega_\lambda{}^\alpha{}_\alpha\,\partial^\lambda\omega^{\theta\kappa}{}_\kappa + 2\,r_3\,\partial_\theta\omega_\lambda{}^\alpha{}_\alpha\,\partial^\lambda\omega^{\theta\kappa}{}_\kappa - r_5\,\partial_\theta\omega_\lambda{}^\alpha{}_\alpha\,\partial^\lambda\omega^{\theta\kappa}{}_\kappa$$

	$\sigma_{2^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{2^-}^{\#1}{}_{\alpha\beta\chi}$
$\sigma_{2^+}^{\#1}{}^{\dagger\alpha\beta}$	0	0
$\sigma_{2^-}^{\#1}{}^{\dagger\alpha\beta\chi}$	0	$\frac{1}{k^2\,r_1}$

	$\omega_{2^+}^{\#1}{}_{\alpha\beta}$	$\omega_{2^-}^{\#1}{}_{\alpha\beta\chi}$
$\omega_{2^+}^{\#1}{}^{\dagger\alpha\beta}$	0	0
$\omega_{2^-}^{\#1}{}^{\dagger\alpha\beta\chi}$	0	$k^2\,r_1$

	$\omega_{1^+}^{\#1}{}_{\alpha\beta}$	$\omega_{1^+}^{\#2}{}_{\alpha\beta}$	$\omega_{1^-}^{\#1}{}_{\alpha}$	$\omega_{1^-}^{\#2}{}_{\alpha}$
$\omega_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$k^2\,(2\,r_3+r_5)$	0	0	0
$\omega_{1^+}^{\#2}{}^{\dagger\alpha\beta}$	0	0	0	0
$\omega_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	$k^2\,(-r_1+2\,r_3+r_5)$	0
$\omega_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	0

	$\sigma_{1^+}^{\#1}{}_{\alpha\beta}$	$\sigma_{1^+}^{\#2}{}_{\alpha\beta}$	$\sigma_{1^-}^{\#1}{}_{\alpha}$	$\sigma_{1^-}^{\#2}{}_{\alpha}$
$\sigma_{1^+}^{\#1}{}^{\dagger\alpha\beta}$	$\frac{1}{k^2\,(2\,r_3+r_5)}$	0	0	0
$\sigma_{1^+}^{\#2}{}^{\dagger\alpha\beta}$	0	0	0	0
$\sigma_{1^-}^{\#1}{}^{\dagger\alpha}$	0	0	$\frac{1}{k^2\,(-r_1+2\,r_3+r_5)}$	0
$\sigma_{1^-}^{\#2}{}^{\dagger\alpha}$	0	0	0	0

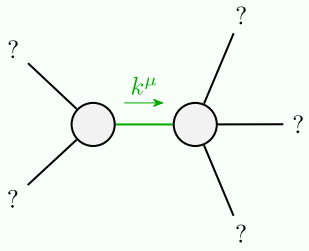
	$\sigma_{0^+}^{\#1}$	$\sigma_{0^-}^{\#1}$
$\sigma_{0^+}^{\#1}{}^{\dagger}$	$\frac{1}{6\,k^2\,(-r_1+r_3)}$	0
$\sigma_{0^-}^{\#1}{}^{\dagger}$	0	0

	$\omega_{0^+}^{\#1}$	$\omega_{0^-}^{\#1}$
$\omega_{0^+}^{\#1}{}^{\dagger}$	$6\,k^2\,(-r_1+r_3)$	0
$\omega_{0^-}^{\#1}{}^{\dagger}$	0	0

Source constraints/gauge generators

SO(3) irreps	Multiplicities
$\sigma_{0^-}^{\#1} == 0$	1
$\sigma_{1^-}^{\#2\,\alpha} == 0$	3
$\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	3
$\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	5
Total constraints:	12

Massive and massless spectra



Quadratic pole

Pole residue:	$\frac{1}{r_1\,(r_1-2\,r_3-r_5)\,(2\,r_3+r_5)} > 0$
Polarisations:	2

(No massive particles)

Unitarity conditions

$$r_1 < 0\ \&\&\ (r_5 < r_1 - 2\,r_3\ ||\ r_5 > -2\,r_3) \parallel r_1 > 0\ \&\&\ -2\,r_3 < r_5 < r_1 - 2\,r_3$$