Particle spectrograph

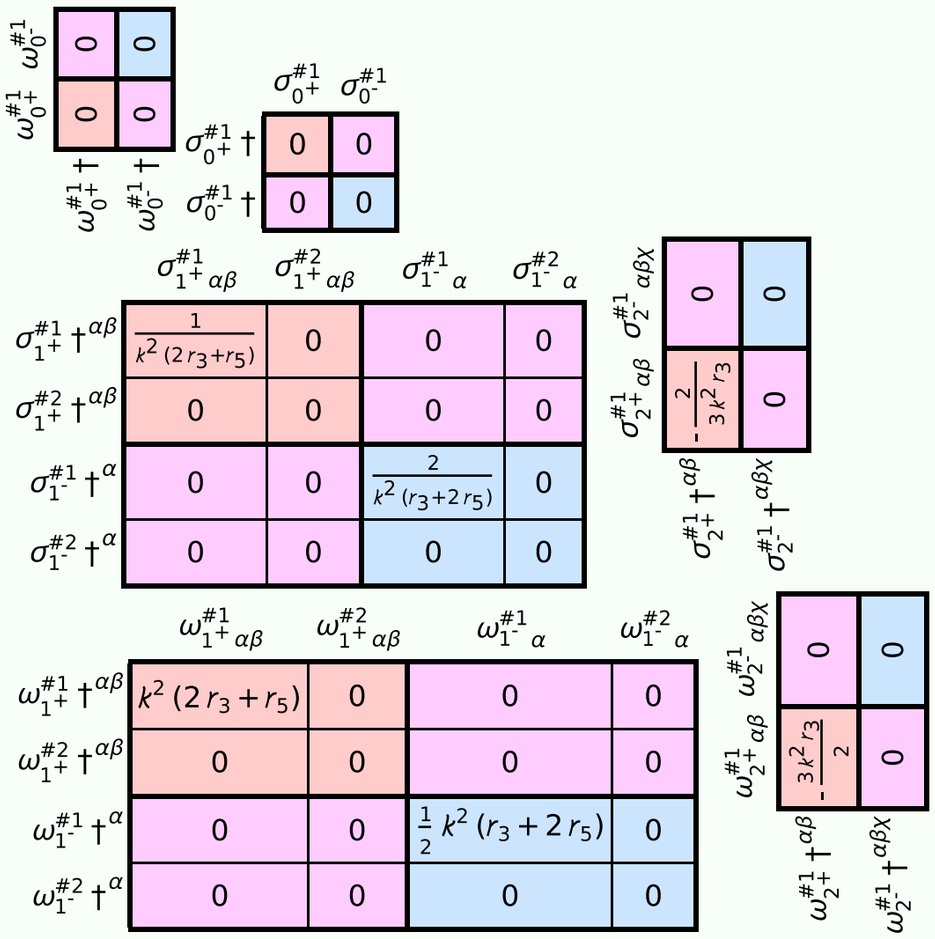
Wave operator and propagator

Source constraints

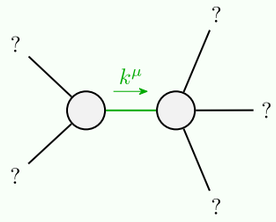
SO(3) irreps	Fundamental fields	Multiplicities
$\sigma_{0^-}^{\#1} == 0$	$\epsilon \eta_{\alpha\beta\chi\delta} \partial^\delta \sigma^{\alpha\beta\chi} == 0$	1
$\sigma_{0^+}^{\#1} == 0$	$\partial_\beta \sigma^{\alpha\beta}{}_\alpha == 0$	1
$\sigma_{1^-}^{\#2\,\alpha} == 0$	$\partial_\chi \partial_\beta \sigma^{\alpha\beta\chi} == 0$	3
$\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	$\partial_\delta \partial_\chi \partial^\alpha \sigma^{\beta\chi\delta} + \partial_\delta \partial^\delta \partial_\chi \sigma^{\alpha\beta\chi} == \partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\chi\delta}$	3
$\sigma_{2^-}^{\#1\,\alpha\beta\chi} == 0$	$3\,\partial_\epsilon \partial_\delta \partial^\chi \partial^\alpha \sigma^{\beta\delta\epsilon} + 3\,\partial_\epsilon \partial^\epsilon \partial^\chi \partial^\alpha \sigma^{\beta\delta}{}_\delta +$ $2\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\beta \sigma^{\alpha\chi\delta} + 4\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\beta \sigma^{\alpha\delta\chi} +$ $2\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\beta \sigma^{\chi\delta\alpha} + 4\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\chi \sigma^{\alpha\beta\delta} +$ $2\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\chi \sigma^{\alpha\delta\beta} + 2\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\delta \sigma^{\beta\chi\alpha} +$ $3\,\eta^{\beta\chi}\,\partial_\phi \partial^\phi \partial_\epsilon \partial^\alpha \sigma^{\delta\epsilon}{}_\delta + 3\,\eta^{\alpha\chi}\,\partial_\phi \partial^\phi \partial_\epsilon \partial_\delta \sigma^{\beta\delta\epsilon} +$ $3\,\eta^{\beta\chi}\,\partial_\phi \partial^\phi \partial_\epsilon \partial^\epsilon \sigma^{\alpha\delta}{}_\delta == 3\,\partial_\epsilon \partial_\delta \partial^\chi \partial^\beta \sigma^{\alpha\delta\epsilon} +$ $3\,\partial_\epsilon \partial^\epsilon \partial^\chi \partial^\beta \sigma^{\alpha\delta}{}_\delta + 2\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\alpha \sigma^{\beta\chi\delta} +$ $4\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\alpha \sigma^{\beta\delta\chi} + 2\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\alpha \sigma^{\chi\delta\beta} +$ $2\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\chi \sigma^{\beta\delta\alpha} + 4\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\delta \sigma^{\alpha\beta\chi} +$ $2\,\partial_\epsilon \partial^\epsilon \partial_\delta \partial^\delta \sigma^{\alpha\chi\beta} + 3\,\eta^{\alpha\chi}\,\partial_\phi \partial^\phi \partial_\epsilon \partial^\beta \sigma^{\delta\epsilon}{}_\delta +$ $3\,\eta^{\beta\chi}\,\partial_\phi \partial^\phi \partial_\epsilon \partial_\delta \sigma^{\alpha\delta\epsilon} + 3\,\eta^{\alpha\chi}\,\partial_\phi \partial^\phi \partial_\epsilon \partial^\epsilon \sigma^{\beta\delta}{}_\delta$	5
Total constraints/gauge generators:		13

Quadratic (free) action

$$S == \int\int\int\int (\omega^{\alpha\beta\chi}\ \sigma_{\alpha\beta\chi} - \frac{1}{2} r_3\,(\partial_\beta \omega_\iota{}^\theta{}_\theta\, \partial^\iota \omega^{\alpha\beta}{}_\alpha + \partial_\iota \omega_\beta{}^\theta{}_\theta\, \partial^\iota \omega^{\alpha\beta}{}_\alpha + \partial_\alpha \omega^{\alpha\beta\iota}\, \partial_\theta \omega_\beta{}^\theta{}_\iota - 2\,\partial^\iota \omega^{\alpha\beta}{}_\alpha\, \partial_\theta \omega_\beta{}^\theta{}_\iota + \partial_\alpha \omega^{\alpha\beta\iota}\, \partial_\theta \omega_\iota{}^\theta{}_\beta - 2\,\partial^\iota \omega^{\alpha\beta}{}_\alpha\, \partial_\theta \omega_\iota{}^\theta{}_\beta + 8\,\partial_\theta \omega_{\iota\theta\alpha}\, \partial^\theta \omega^{\alpha\beta\iota}) + \frac{1}{2} r_5\,(\partial_\iota \omega_\theta{}^\kappa{}_\kappa\, \partial^\theta \omega^{\alpha\iota}{}_\alpha - \partial_\theta \omega_\iota{}^\kappa{}_\kappa\, \partial^\theta \omega^{\alpha\iota}{}_\alpha - (\partial_\alpha \omega^{\alpha\iota\theta} - 2\,\partial^\theta \omega^{\alpha\iota}{}_\alpha)\,(\partial_\kappa \omega_\iota{}^\kappa{}_\theta - \partial_\kappa \omega_\theta{}^\kappa{}_\iota)))[t, x, y, z]\,dl z\,dl y\,dl x\,dl t$$



Massive and massless spectra



Quadratic pole

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

(No massive particles)

Unitarity conditions

$$r_3 < 0 \,\&\&\, (r_5 < -\frac{r_3}{2} \,||\, r_5 > -2\,r_3) \,\|\, r_3 > 0 \,\&\&\, -2\,r_3 < r_5 < -\frac{r_3}{2}$$