

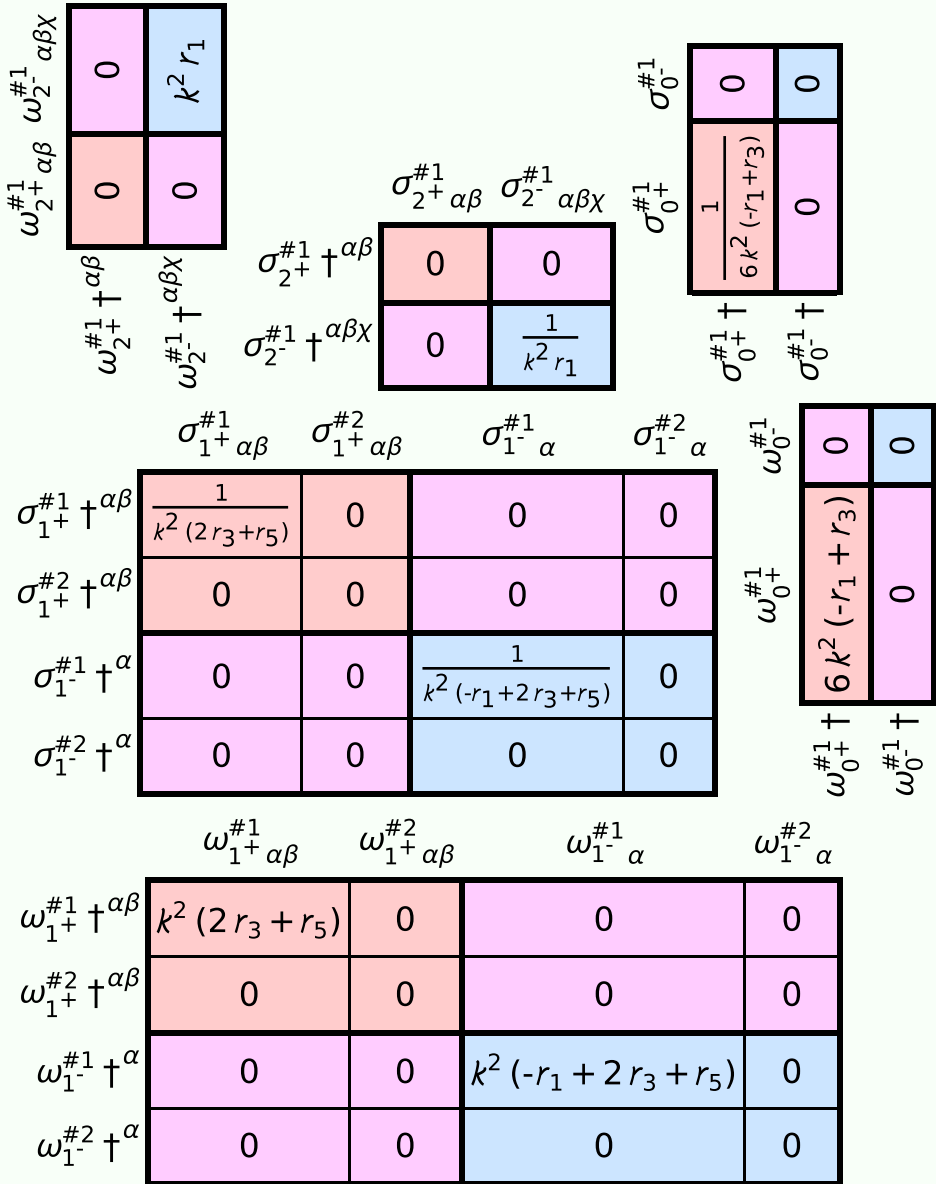
# Particle spectrograph

## Wave operator and propagator

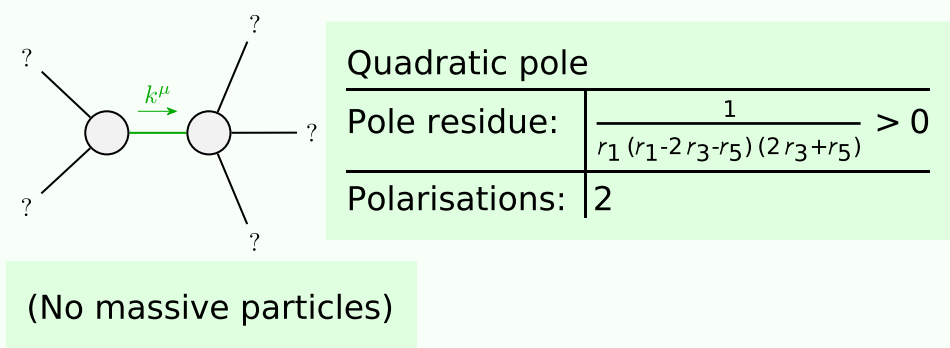
Quadratic (free) action

$$\begin{aligned}
 S = & \iiint (\omega^{\alpha\beta\chi} \sigma_{\alpha\beta\chi} - 2r_3 (\partial_\beta \omega_{,\theta}^\theta \partial' \omega_{\alpha\beta}^\alpha + \partial' \omega_{\beta\theta}^\theta \partial' \omega_{\alpha\beta}^\alpha + \\
 & \partial_\alpha \omega^{\alpha\beta\prime} \partial_\theta \omega_{\beta,\prime}^\theta - 2 \partial' \omega_{\beta,\prime}^{\alpha\beta} \partial_\theta \omega_{\beta,\prime}^\theta + \partial_\alpha \omega^{\alpha\beta\prime} \partial_\theta \omega_{\beta,\prime}^\theta - \\
 & 2 \partial' \omega_{\alpha\beta}^{\alpha\beta} \partial_\theta \omega_{,\beta}^\theta + 2 \partial_\beta \omega_{,\theta\alpha}^\theta \partial^\theta \omega^{\alpha\beta\prime}) + \\
 & \frac{2}{3} r_1 (3 \partial_\beta \omega_{,\theta}^\theta \partial' \omega_{\alpha\beta}^\alpha + 3 \partial' \omega_{\beta\theta}^\theta \partial' \omega_{\alpha\beta}^\alpha + 3 \partial_\alpha \omega^{\alpha\beta\prime} \partial_\theta \omega_{\beta,\prime}^\theta - \\
 & 6 \partial' \omega_{\alpha\beta}^{\alpha\beta} \partial_\theta \omega_{\beta,\prime}^\theta + 3 \partial_\alpha \omega^{\alpha\beta\prime} \partial_\theta \omega_{\beta,\prime}^\theta - 6 \partial' \omega_{\beta,\prime}^{\alpha\beta} \partial_\theta \omega_{\beta,\prime}^\theta - \\
 & 2 \partial_\beta \omega_{\alpha\prime\theta}^\theta \partial^\theta \omega^{\alpha\beta\prime} + \partial_\beta \omega_{\alpha\theta\prime}^\theta \partial^\theta \omega^{\alpha\beta\prime} + 2 \partial_\beta \omega_{,\theta\alpha}^\theta \partial^\theta \omega^{\alpha\beta\prime} - \\
 & \partial' \omega_{\alpha\beta\theta}^\theta \partial^\theta \omega^{\alpha\beta\prime} + \partial_\theta \omega_{\alpha\beta\prime}^\theta \partial^\theta \omega^{\alpha\beta\prime} + \partial_\theta \omega_{\alpha\beta\prime}^\theta \partial^\theta \omega^{\alpha\beta\prime}) + \\
 & r_5 (\partial' \omega_{\theta\kappa}^\kappa \partial^\theta \omega_{\alpha\prime}^{\alpha\prime} - \partial_\theta \omega_{,\kappa}^\kappa \partial^\theta \omega_{\alpha\prime}^{\alpha\prime} - (\partial_\alpha \omega^{\alpha\prime\theta} - 2 \partial^\theta \omega^{\alpha\prime}{}_\alpha) \\
 & (\partial_\kappa \omega_{,\theta}^\kappa - \partial_\kappa \omega_{\theta,\prime}^\kappa))) [t, x, y, z] dz dy dx dt
 \end{aligned}$$

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
$\sigma_{1-}^{\#2\alpha} == 0$	$\partial_\chi \partial_\beta \sigma^{\alpha\beta\chi} == 0$	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
$\sigma_{2+}^{\#1\alpha\beta} == 0$	$3 \partial_\delta \partial_\chi \partial^\alpha \sigma^{\beta\chi\delta} + 3 \partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\chi\delta} + 2 \eta^{\alpha\beta} \partial_\epsilon \partial^\epsilon \partial_\delta \sigma^{\chi\delta} =$ $2 \partial_\delta \partial^\beta \partial^\alpha \sigma^{\chi\delta} + 3 (\partial_\delta \partial^\delta \partial_\chi \sigma^{\alpha\chi\beta} + \partial_\delta \partial^\delta \partial_\chi \sigma^{\beta\chi\alpha})$	5
Total constraints/gauge generators:		12



## Massive and massless spectra



## Unitarity conditions

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