

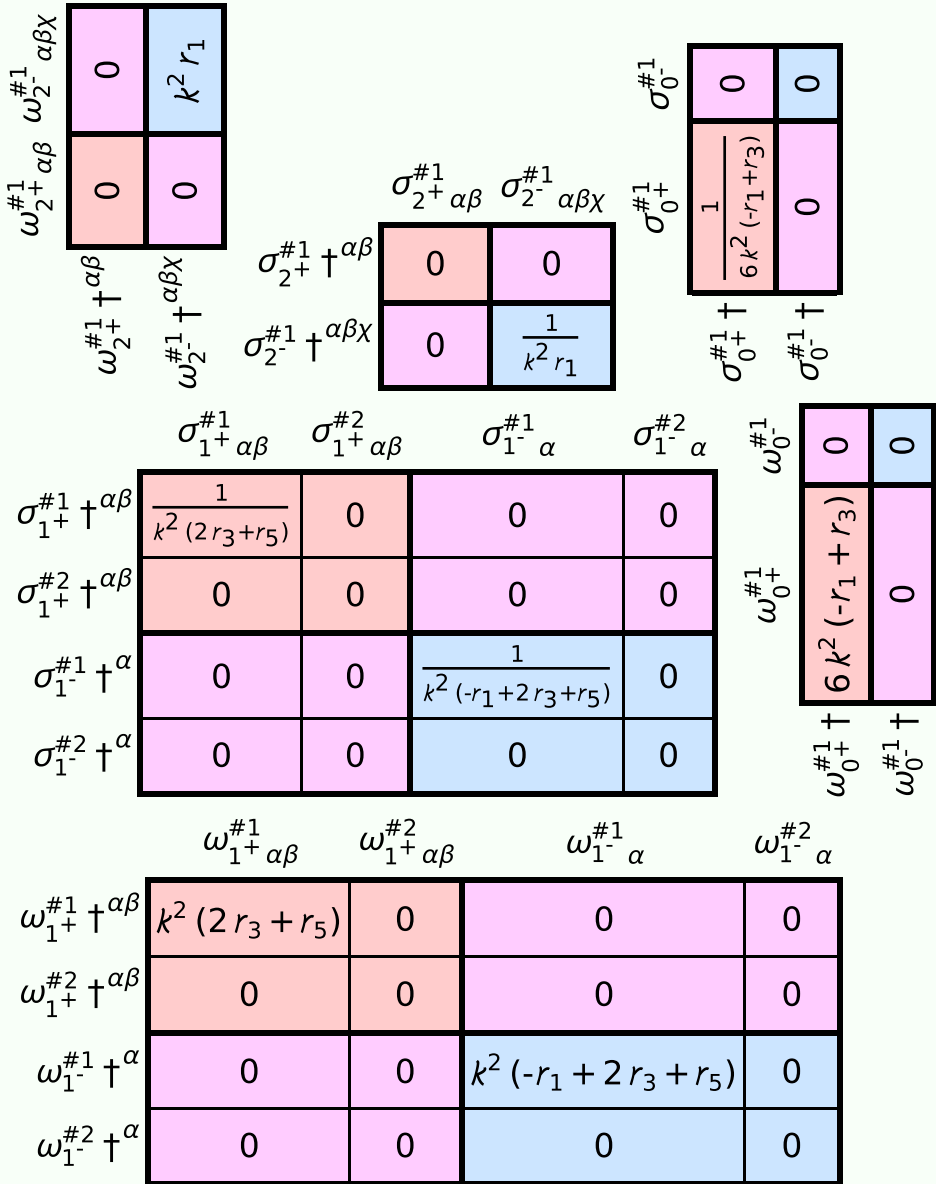
Particle spectrograph

Wave operator and propagator

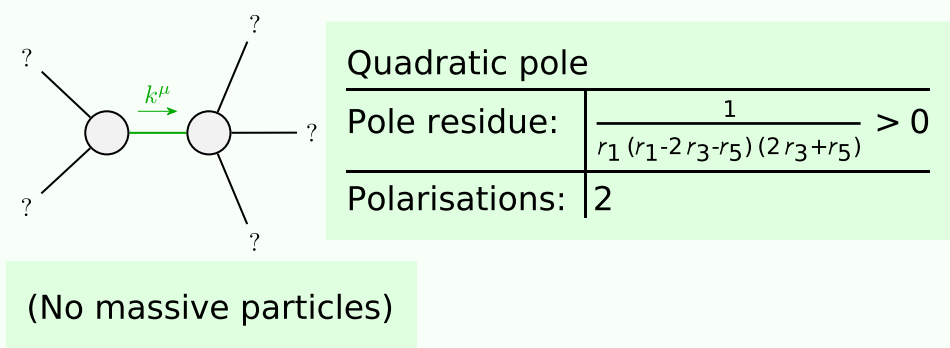
Quadratic (free) action

$$\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_\gamma \omega_{\beta\theta}^\theta \partial' \omega_{\alpha\beta}^\alpha + \\
 & \partial_\alpha \omega^{\alpha\beta\gamma} \partial_\theta \omega_{\beta,\gamma}^\theta - 2 \partial' \omega_{\beta,\gamma}^{\alpha\beta} \partial_\theta \omega_{\gamma,\beta}^\theta + \partial_\alpha \omega^{\alpha\beta\gamma} \partial_\theta \omega_{\gamma,\beta}^\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\gamma}) + \\
 & \frac{2}{3} r_1 (3 \partial_\beta \omega_{,\theta}^\theta \partial' \omega_{\alpha\beta}^\alpha + 3 \partial_\gamma \omega_{\beta\theta}^\theta \partial' \omega_{\alpha\beta}^\alpha + 3 \partial_\alpha \omega^{\alpha\beta\gamma} \partial_\theta \omega_{\gamma,\beta}^\theta - \\
 & 6 \partial' \omega_{\alpha\beta}^{\alpha\beta} \partial_\theta \omega_{\beta,\gamma}^\theta + 3 \partial_\alpha \omega^{\alpha\beta\gamma} \partial_\theta \omega_{\gamma,\beta}^\theta - 6 \partial' \omega_{\beta,\gamma}^{\alpha\beta} \partial_\theta \omega_{\gamma,\beta}^\theta - \\
 & 2 \partial_\beta \omega_{\alpha\gamma\theta}^\theta \partial^\theta \omega^{\alpha\beta\gamma} + \partial_\beta \omega_{\alpha\theta\gamma}^\theta \partial^\theta \omega^{\alpha\beta\gamma} + 2 \partial_\beta \omega_{,\theta\alpha}^\theta \partial^\theta \omega^{\alpha\beta\gamma} - \\
 & \partial_\gamma \omega_{\alpha\beta\theta}^\theta \partial^\theta \omega^{\alpha\beta\gamma} + \partial_\theta \omega_{\alpha\beta\gamma}^\theta \partial^\theta \omega^{\alpha\beta\gamma} + \partial_\theta \omega_{\alpha\beta\gamma}^\theta \partial^\theta \omega^{\alpha\beta\gamma}) + \\
 & r_5 (\partial_\gamma \omega_{\theta\kappa}^\kappa \partial^\theta \omega_{\alpha\gamma}^{\alpha\gamma} - \partial_\theta \omega_{,\gamma\kappa}^\kappa \partial^\theta \omega_{\alpha\gamma}^{\alpha\gamma} - (\partial_\alpha \omega^{\alpha\gamma\theta} - 2 \partial^\theta \omega^{\alpha\gamma})_\alpha \\
 & (\partial_\kappa \omega_{,\theta}^\kappa - \partial_\kappa \omega_{\theta,\gamma}^\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 |
| $\sigma_{2+}^{\#1\alpha\beta} == 0$ | $3 \partial_\delta \partial_\chi \partial^\alpha \sigma^{\beta\chi\delta} + 3 \partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\chi\delta} + 2 \eta^{\alpha\beta} \partial_\epsilon \partial^\epsilon \partial_\delta \sigma^{\chi\delta} == \partial_\chi \partial^\epsilon \partial_\delta \sigma^{\beta\chi\alpha}$ | 5 |
| Total constraints/gauge generators: | | 12 |



Massive and massless spectra



Unitarity conditions

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