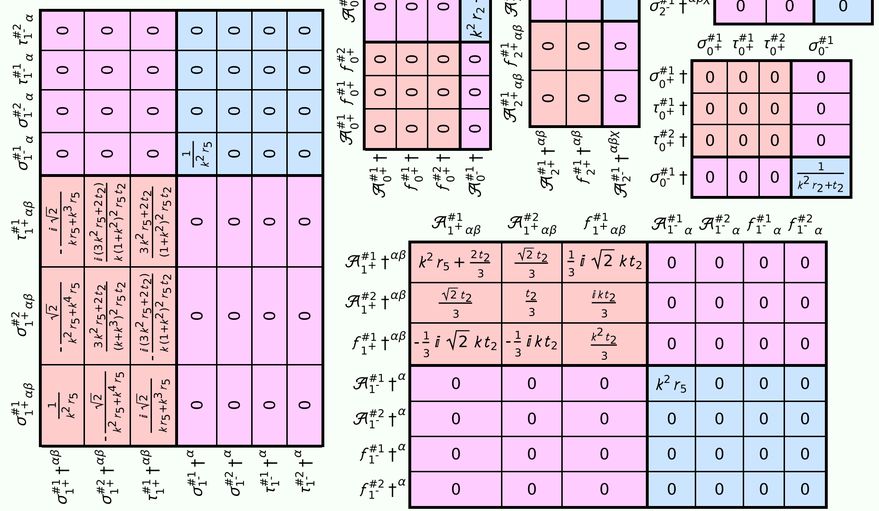
Particle spectrograph

Wave operator and propagator

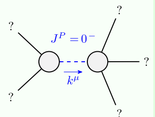
Source constraints		Multiplicities
SO(3) irreps	Fundamental fields	
$\tau_{0^+}^{\#2} == 0$	$\partial_\beta \partial_\alpha \tau^{\alpha\beta} == 0$	1
$\tau_{0^+}^{\#1} == 0$	$\partial_\beta \partial_\alpha \tau^{\alpha\beta} == \partial_\beta \partial^\beta \tau_\alpha{}^\alpha$	1
$\sigma_{0^+}^{\#1} == 0$	$\partial_\mu \partial^{\alpha\beta} \sigma_{\alpha\beta} == 0$	1
$\tau_1^{\#2\,\alpha} == 0$	$\partial_\chi \partial_\beta \partial^\alpha \tau^{\beta\chi} == \partial_\chi \partial^\chi \partial_\beta \tau^{\beta\alpha}$	3
$\tau_1^{\#1\,\alpha} == 0$	$\partial_\chi \partial_\beta \partial^\alpha \tau^{\beta\chi} == \partial_\chi \partial^\chi \partial_\beta \tau^{\beta\alpha}$	3
$\sigma_1^{\#2\,\alpha} == 0$	$\partial_\chi \partial_\beta \sigma^{\alpha\beta\chi} == 0$	3
$\tau_{1^+}^{\#1\,\alpha\beta} + i\,k\,\sigma_{1^+}^{\#2\,\alpha\beta} == 0$	$\partial_\chi \partial^\alpha \tau^{\beta\chi} + \partial_\chi \partial^\beta \tau^{\chi\alpha} + \partial_\chi \partial^\chi \tau^{\alpha\beta} + 2\,\partial_\alpha \partial_\beta \sigma^{\alpha\chi\delta} + 2\,\partial_\alpha \partial^\alpha \sigma^{\beta\chi\delta} + 2\,\partial_\alpha \partial^\delta \sigma^{\beta\chi\alpha} + \partial_\chi \partial^\alpha \tau^{\chi\beta} + \partial_\chi \partial^\beta \tau^{\chi\alpha} + 2\,\partial_\alpha \partial_\chi \partial^\beta \sigma^{\alpha\chi\delta} + \partial_\chi \partial^\chi \tau^{\beta\alpha} + 2\,\partial_\alpha \partial_\chi \partial^\delta \sigma^{\beta\chi\alpha} == 0$	3
$\sigma_2^{\#1\,\alpha\beta\chi} == 0$	$3\,\partial_\varepsilon \partial_\delta \partial^\varepsilon \sigma^{\alpha\beta\delta} + 3\,\partial_\varepsilon \partial^\varepsilon \partial^\chi \sigma^{\alpha\beta}{}_\delta + 2\,\partial_\varepsilon \partial^\varepsilon \partial^\alpha \sigma^{\beta\chi\delta} + 4\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \partial^\beta \sigma^{\alpha\delta\chi} + 4\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \partial^\chi \sigma^{\alpha\beta\delta} + 2\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \partial^\delta \sigma^{\alpha\beta\chi} + 3\,\eta^{\beta\chi}\,\partial_\varepsilon \partial^\alpha \sigma^{\varepsilon\delta}{}_\delta + 3\,\eta^{\alpha\chi}\,\partial_\varepsilon \partial^\beta \sigma^{\varepsilon\delta}{}_\delta + 3\,\eta^{\beta\chi}\,\partial_\varepsilon \partial^\varepsilon \sigma^{\alpha\delta}{}_\delta == 3\,\partial_\varepsilon \partial_\delta \partial^\varepsilon \sigma^{\alpha\beta\chi\delta} + 3\,\partial_\varepsilon \partial^\varepsilon \partial^\chi \sigma^{\alpha\beta}{}_\delta + 2\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \partial^\alpha \sigma^{\beta\chi\delta} + 4\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \partial^\delta \sigma^{\alpha\beta\chi} + 3\,\eta^{\alpha\chi}\,\partial_\varepsilon \partial^\beta \sigma^{\varepsilon\delta}{}_\delta + 3\,\eta^{\beta\chi}\,\partial_\varepsilon \partial^\varepsilon \sigma^{\alpha\delta}{}_\delta + 3\,\eta^{\alpha\chi}\,\partial_\varepsilon \partial^\varepsilon \sigma^{\beta\delta}{}_\delta$	5
$\tau_{2^+}^{\#1\,\alpha\beta} == 0$	$4\,\partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\tau\chi\delta} + 2\,\partial_\delta \partial^\beta \partial^\alpha \tau^\chi{}_\chi + 3\,\partial_\delta \partial^\delta \partial_\chi \tau^{\alpha\beta} + 3\,\partial_\delta \partial^\delta \partial_\chi \tau^{\beta\alpha} + 2\,\eta^{\alpha\beta}\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \tau^{\chi\delta}{}_\chi == 3\,\partial_\delta \partial^\alpha \partial_\chi \tau^{\beta\chi} + 3\,\partial_\delta \partial^\beta \partial_\chi \tau^{\alpha\chi} + 3\,\partial_\delta \partial^\delta \partial_\chi \tau^{\alpha\beta}{}_\chi + 2\,\eta^{\alpha\beta}\,\partial_\varepsilon \partial^\varepsilon \partial_\delta \partial^\delta \tau^\chi{}_\chi$	5
$\sigma_{2^+}^{\#1\,\alpha\beta} == 0$	$3\,\partial_\delta \partial_\chi \partial^\alpha \sigma^{\beta\chi\delta} + 3\,\partial_\delta \partial_\chi \partial^\beta \sigma^{\alpha\chi\delta} + 2\,\eta^{\alpha\beta}\,\partial_\varepsilon \partial^\varepsilon \partial^\chi \sigma^{\delta\varepsilon}{}_{\chi\delta} + 3\,(\partial_\delta \partial^\varepsilon \partial_\chi \sigma^{\alpha\chi\beta} + \partial_\delta \partial^\varepsilon \partial_\chi \sigma^{\beta\chi\alpha})$	5
	Total constraints/gauge generators:	30

Quadratic (free) action

$$S == \int\int\int \frac{1}{6} (6\, r^{\alpha\beta}\ \tau_{\alpha\beta} + 6\, \mathcal{A}^{\alpha\beta\chi}\ \sigma_{\alpha\beta\chi} + 4\, t_2\ \mathcal{A}_{1\theta\alpha}\ \partial^\theta f^{\alpha\iota} + 2\, t_2\ \partial_\alpha f_{\iota\theta}\ \partial^\theta f^{\alpha\iota} - t_2\ \partial_\alpha f_{\theta\iota}\ \partial^\theta f^{\alpha\iota} - t_2\ \partial_\theta f_{\alpha\iota}\ \partial^\theta f^{\alpha\iota} - 4\, t_2\ \mathcal{A}_{\alpha\theta\iota}\ (\mathcal{A}^{\alpha\iota\theta} + \partial^\theta f^{\alpha\iota}) + 2\, t_2\ \mathcal{A}_{\alpha\iota\theta}\ (\mathcal{A}^{\alpha\iota\theta} + 2\,\partial^\theta f^{\alpha\iota}) + 8\, r_2\ \partial_\beta \mathcal{A}_{\alpha\iota\theta}\ \partial^\theta \mathcal{A}^{\alpha\beta\iota} - 4\, r_2\ \partial_\beta \mathcal{A}_{\alpha\theta\iota}\ \partial^\theta \mathcal{A}^{\alpha\beta\iota} + 4\, r_2\ \partial_\beta \mathcal{A}_{\iota\theta\alpha}\ \partial^\theta \mathcal{A}^{\alpha\beta\iota} - 2\, r_2\ \partial_\alpha \mathcal{A}_{\beta\theta\iota}\ \partial^\theta \mathcal{A}^{\alpha\beta\iota} + 2\, r_2\ \partial_\theta \mathcal{A}_{\alpha\beta\iota}\ \partial^\theta \mathcal{A}^{\alpha\beta\iota} - 4\, r_2\ \partial_\theta \mathcal{A}_{\alpha\iota\beta}\ \partial^\theta \mathcal{A}^{\alpha\beta\iota} + 6\, r_5\ \partial_\theta \mathcal{A}^\kappa{}_{\iota\kappa}\ \partial^\theta \mathcal{A}^{\alpha\iota}{}_\alpha - 6\, r_5\ \partial_\alpha \mathcal{A}^{\alpha\iota\theta}\ \partial_\kappa \mathcal{A}^\kappa{}_{\iota\theta} + 12\, r_5\ \partial^\theta \mathcal{A}^{\alpha\iota}{}_\alpha\ \partial_\kappa \mathcal{A}^\kappa{}_{\iota\theta} - 12\, r_5\ \partial^\theta \mathcal{A}^{\alpha\iota}{}_\alpha\ \partial_\kappa \mathcal{A}^\kappa{}_{\theta\iota}))(t, x, y, z]\, dz\, dy\, dx\, dt$$



Massive and massless spectra



Massive particle	
Pole residue:	$-\frac{1}{r_2} > 0$
Polarisations:	1
Square mass:	$-\frac{t_2}{r_2} > 0$
Spin:	0
Parity:	Odd

(No massless particles)

Unitarity conditions

$r_2 < 0 \;\&\&\; t_2 > 0$