In[3]:=
```
CloseKernels[];
Get@FileNameJoin@{NotebookDirectory[], "CalibrationWGTE.m"};
```

Package xAct`xPlain` version 1.0.0-developer, {2023, 8, 8}

PSALTer Calibration for the WGTE cases based on Lin's draft

About xPlain and formatting

Welcome to the calibration file for the PSALTer package. Commentary is provided in this green text throughout by virtue of the xPlain package.

Key observation: Occasionally, more important points will be highlighted in boxes like this.

The xPlain package is not part of PSALTer, so the output from PSALTer itself will contrast with this formatting and be quite distinctive.

The structure of this file

The calibration file runs PSALTer on a very long list of theories, whose particle spectra are already known.

The first step is to load the PSALTer package.

Package xAct`PSALTer` version 1.0.0-developer, {2024, 1, 11}

These packages come with ABSOLUTELY NO WARRANTY; for details type Disclaimer[]. This
is free software, and you are welcome to redistribute it under certain conditions. See the General Public License for details.

Great, so PSALTer is now loaded and we can start to do some science.

Weyl gauge theory extended (eWGT)

Key observation: We will test the WeylGaugeTheoryExtended module. This is an extension to test eWGT [Lasenby and Hobson 2016].

Key observation: This section is still under development by Zhiyuan.

Preamble: setting out the fields

We present the tetrad,

ValidateSymbol: Symbol WeylTetrad is already used as a tensor.

$$h_{\alpha}{}^{\chi} \tag{1}$$

and the inverse tetrad.

ValidateSymbol: Symbol WeylInvTetrad is already used as a tensor.

$$b^{\alpha}{}_{\chi} \tag{2}$$

We present the tetrad in terms of perturbation tetrad f,

$$\delta_{\alpha}{}^{\chi} + f_{\alpha}{}^{\chi} \tag{3}$$

and the inverse tetrad in terms of perturbation tetrad f.

$$\delta^{\alpha}{}_{\chi} + f^{\alpha\beta}\, f_{\beta\chi} - f_{\chi}{}^{\alpha} \tag{4}$$

ValidateSymbol: Symbol WeylDaggerA is already used as a tensor.

General: Further output of ValidateSymbol::used will be suppressed during this calculation.

We present and expand the eWGT (dagger) field strengths:

T+:

$$\mathcal{T}^{\alpha}{}_{\beta\chi} - \frac{1}{3}\,\delta^{\alpha}{}_{\chi}\,\mathcal{T}^{\delta}{}_{\beta\delta} + \frac{1}{3}\,\delta^{\alpha}{}_{\beta}\,\mathcal{T}^{\delta}{}_{\chi\delta} \tag{5}$$

H+:

$$-\frac{1}{3}\,\partial_{\alpha}\mathcal{T}^{\chi}{}_{\beta\chi} + \frac{1}{3}\,\partial_{\beta}\mathcal{T}^{\chi}{}_{\alpha\chi} + h_{\alpha}{}^{\chi}\, h_{\beta}{}^{\delta}\,\partial_{\chi}\mathcal{B}_{\delta} - h_{\alpha}{}^{\chi}\, h_{\beta}{}^{\delta}\,\partial_{\delta}\mathcal{B}_{\chi} \tag{6}$$

CovD+(Phi):

$$\frac{1}{3}\,\phi\,\mathcal{T}^{\beta}{}_{\alpha\beta}\, b^{\alpha}{}_{i} - \phi\,\mathcal{B}_{i} + \partial_{i}\phi \tag{7}$$

R+:

$$\mathcal{A}^{\dagger\alpha\gamma}{}_{\phi}\,\mathcal{A}^{\dagger\beta}{}_{\gamma\chi}\, h_{\delta}{}^{\chi}\, h_{\epsilon}{}^{\phi} - \mathcal{A}^{\dagger\alpha\gamma}{}_{\chi}\,\mathcal{A}^{\dagger\beta}{}_{\gamma\phi}\, h_{\delta}{}^{\chi}\, h_{\epsilon}{}^{\phi} + h_{\delta}{}^{\chi}\, h_{\epsilon}{}^{\phi}\,\partial_{\chi}\mathcal{A}^{\dagger\alpha\beta}{}_{\phi} - h_{\delta}{}^{\chi}\, h_{\epsilon}{}^{\phi}\,\partial_{\phi}\mathcal{A}^{\dagger\alpha\beta}{}_{\chi} \tag{8}$$

```
I want to check the outputs for Einstein Gauge expansion
```

$$\underset{0}{\phi.} \tag{9}$$

Here is the non-linear expansion of A+ to level of perturbation field f:

$$\mathcal{A}^{\alpha\beta}{}_{\theta} - \delta^{\beta}{}_{\theta}\,\mathcal{B}^{\alpha} - f^{\beta\chi}\, f_{\chi\theta}\,\mathcal{B}^{\alpha} + f_{\theta}{}^{\beta}\,\mathcal{B}^{\alpha} + \delta^{\alpha}{}_{\theta}\,\mathcal{B}^{\beta} + f^{\alpha\chi}\, f_{\chi\theta}\,\mathcal{B}^{\beta} - f_{\theta}{}^{\alpha}\,\mathcal{B}^{\beta} + \delta^{\beta}{}_{\theta}\, f^{\chi\alpha}\,\mathcal{B}_{\chi} - \delta^{\alpha}{}_{\theta}\, f^{\chi\beta}\,\mathcal{B}_{\chi} + f^{\chi\beta}\, f_{\theta}{}^{\alpha}\,\mathcal{B}_{\chi} - f^{\chi\alpha}\, f_{\theta}{}^{\beta}\,\mathcal{B}_{\chi} - \delta^{\beta}{}_{\theta}\, f^{\alpha\chi}\, f_{\chi}{}^{\delta}\,\mathcal{B}_{\delta} + \delta^{\alpha}{}_{\theta}\, f^{\beta\chi}\, f_{\chi}{}^{\delta}\,\mathcal{B}_{\delta} + f^{\beta\chi}\, f_{\chi\theta}\, f^{\delta\alpha}\,\mathcal{B}_{\delta} - f^{\alpha\chi}\, f_{\chi\theta}\, f^{\delta\beta}\,\mathcal{B}_{\delta} - f^{\beta\chi}\, f_{\chi}{}^{\delta}\, f_{\theta}{}^{\alpha}\,\mathcal{B}_{\delta} + f^{\alpha\chi}\, f_{\chi}{}^{\delta}\, f_{\theta}{}^{\beta}\,\mathcal{B}_{\delta} + f^{\alpha\chi}\, f^{\beta\delta}\, f_{\chi\theta}\, f_{\delta}{}^{\epsilon}\,\mathcal{B}_{\epsilon} - f^{\alpha\chi}\, f^{\beta\delta}\, f_{\chi}{}^{\epsilon}\, f_{\delta\theta}\,\mathcal{B}_{\epsilon} \tag{10}$$

Here is the linearised expansion:

$$\mathcal{A}^{\alpha\beta}{}_{\theta} - \delta^{\beta}{}_{\theta}\,\mathcal{B}^{\alpha} + \delta^{\alpha}{}_{\theta}\,\mathcal{B}^{\beta} \tag{11}$$

We present and expand A+ and T into PGT field strengths:

```
A+:
```

$$\mathcal{A}^{\alpha\beta}{}_{\theta} - \delta^{\beta}{}_{\theta}\,\mathcal{B}^{\alpha} + \delta^{\alpha}{}_{\theta}\,\mathcal{B}^{\beta} \tag{12}$$

```
T:
```

$$\mathcal{A}^{\alpha}{}_{\chi\delta}\, h_{\beta}{}^{\delta} - \mathcal{A}^{\alpha}{}_{\beta\delta}\, h_{\chi}{}^{\delta} + h_{\beta}{}^{\delta}\, h_{\chi}{}^{\epsilon}\,\partial_{\delta} b^{\alpha}{}_{\epsilon} - h_{\beta}{}^{\delta}\, h_{\chi}{}^{\epsilon}\,\partial_{\epsilon} b^{\alpha}{}_{\delta} \tag{13}$$

```
Check two expressions for A+ are the same:
```

Here is the non-linear expansion of A+ to level of perturbation field f:

$$\mathcal{A}^{\alpha\beta}{}_{\theta} - \delta^{\beta}{}_{\theta}\,\mathcal{B}^{\alpha} - f^{\beta\chi}\, f_{\chi\theta}\,\mathcal{B}^{\alpha} + f_{\theta}{}^{\beta}\,\mathcal{B}^{\alpha} + \delta^{\alpha}{}_{\theta}\,\mathcal{B}^{\beta} + f^{\alpha\chi}\, f_{\chi\theta}\,\mathcal{B}^{\beta} - f_{\theta}{}^{\alpha}\,\mathcal{B}^{\beta} + \delta^{\beta}{}_{\theta}\, f^{\chi\alpha}\,\mathcal{B}_{\chi} - \delta^{\alpha}{}_{\theta}\, f^{\chi\beta}\,\mathcal{B}_{\chi} + f^{\chi\beta}\, f_{\theta}{}^{\alpha}\,\mathcal{B}_{\chi} - f^{\chi\alpha}\, f_{\theta}{}^{\beta}\,\mathcal{B}_{\chi} - \delta^{\beta}{}_{\theta}\, f^{\alpha\chi}\, f_{\chi}{}^{\delta}\,\mathcal{B}_{\delta} + \delta^{\alpha}{}_{\theta}\, f^{\beta\chi}\, f_{\chi}{}^{\delta}\,\mathcal{B}_{\delta} + f^{\beta\chi}\, f_{\chi\theta}\, f^{\delta\alpha}\,\mathcal{B}_{\delta} - f^{\alpha\chi}\, f_{\chi\theta}\, f^{\delta\beta}\,\mathcal{B}_{\delta} - f^{\beta\chi}\, f_{\chi}{}^{\delta}\, f_{\theta}{}^{\alpha}\,\mathcal{B}_{\delta} + f^{\alpha\chi}\, f_{\chi}{}^{\delta}\, f_{\theta}{}^{\beta}\,\mathcal{B}_{\delta} + f^{\alpha\chi}\, f^{\beta\delta}\, f_{\chi\theta}\, f_{\delta}{}^{\epsilon}\,\mathcal{B}_{\epsilon} - f^{\alpha\chi}\, f^{\beta\delta}\, f_{\chi}{}^{\epsilon}\, f_{\delta\theta}\,\mathcal{B}_{\epsilon} \tag{14}$$

Here is the linearised expansion:

$$\mathcal{A}^{\alpha\beta}{}_{\theta} - \delta^{\beta}{}_{\theta}\,\mathcal{B}^{\alpha} + \delta^{\alpha}{}_{\theta}\,\mathcal{B}^{\beta} \tag{15}$$

$$0 \tag{16}$$

Key observation: Now we have defined all the fields we need.

In eqn 15 of Lin's draft, we check that the T+ contraction = 0. Here we expand T+ to PGT T.

$$0 \tag{17}$$

In Eq. (18) this is the non-linear Lagrangian as given in eqn 13 of Lin's draft paper.

$$\frac{1}{2}\,\underset{\cdot}{v.}\,\mathcal{D}^{\dagger}\phi_{\prime}\,\mathcal{D}^{\dagger}\phi^{\prime} + \underset{\cdot}{\xi.}\,\mathcal{H}^{\dagger}{}_{\alpha\beta}\,\mathcal{H}^{\dagger\,\alpha\beta} + \underset{\cdot}{\lambda.}\,\phi^{2}\,\mathcal{R}^{\dagger\,\alpha\beta}{}_{\alpha\beta} + \left(\frac{\underset{1}{r.}}{3} + \frac{\underset{2}{r.}}{6}\right)\mathcal{R}^{\dagger}{}_{\alpha\beta\chi\delta}\,\mathcal{R}^{\dagger\,\alpha\beta\chi\delta} + \left(\frac{2\,\underset{1}{r.}}{3} - \frac{2\,\underset{2}{r.}}{3}\right)\mathcal{R}^{\dagger}{}_{\alpha\chi\beta\delta}\,\mathcal{R}^{\dagger\,\alpha\beta\chi\delta} - \underset{1}{c.}\,\mathcal{H}^{\dagger}{}_{\alpha\beta}\,\mathcal{R}^{\dagger\,\alpha\chi\beta}{}_{\chi} + \tag{18}$$

$$\left(\underset{\cdot}{r}_{4}+\underset{\cdot}{r}_{5}\right) \mathcal{R}^{\dagger}{}_{\alpha\delta\beta}{}^{\delta}\, \mathcal{R}^{\dagger\alpha\chi\beta}{}_{\chi}+\left(\underset{\cdot}{r}_{4}-\underset{\cdot}{r}_{5}\right) \mathcal{R}^{\dagger\alpha\chi\beta}{}_{\chi}\, \mathcal{R}^{\dagger}{}_{\beta\delta\alpha}{}^{\delta}+\left(\frac{\underset{\cdot}{r}_{1}}{3}+\frac{\underset{\cdot}{r}_{2}}{6}-\underset{\cdot}{r}_{3}\right) \mathcal{R}^{\dagger\alpha\beta\chi\delta}\, \mathcal{R}^{\dagger}{}_{\chi\delta\alpha\beta}+\left(\frac{\underset{\cdot}{\lambda}}{4}+\frac{\underset{\cdot}{t}_{1}}{3}+\frac{\underset{\cdot}{t}_{2}}{12}\right) \phi^{2}\, \mathcal{T}^{\dagger}{}_{\alpha\beta\chi}\, \mathcal{T}^{\dagger\alpha\beta\chi}-\left(\underset{\cdot}{\lambda}+\frac{\underset{\cdot}{t}_{1}}{3}-\frac{2\underset{\cdot}{t}_{3}}{3}\right) \phi^{2}\, \mathcal{T}^{\dagger}{}_{\alpha}{}^{\chi\alpha}\, \mathcal{T}^{\dagger}{}_{\beta\chi}{}^{\beta}-\left(\frac{\underset{\cdot}{\lambda}}{2}+\frac{\underset{\cdot}{t}_{1}}{3}-\frac{\underset{\cdot}{t}_{2}}{6}\right) \phi^{2}\, \mathcal{T}^{\dagger\alpha\beta\chi}\, \mathcal{T}^{\dagger}{}_{\chi\alpha\beta}$$

Diagnostic: Now the non-linear Lagrangian has been expanded to PGT quantities. This is now stored for linearisation.

Test case 1: E--H action.

We test the case of the modified Einstein-Hilbert action, and the code will give only 2 propagating graviton modes.

$$\underset{\cdot}{\lambda}\, \phi^{2}\, \mathcal{R}^{\dagger\alpha\beta}{}_{\alpha\beta} \tag{19}$$

```
Here, we perform rescalings after application of Einstein Gauge: ϕ_0^2*λ -> λ, ϕ_0^2*ν -> ν, ϕ_0^2*t_i -> t_i. Also
  ϕ_0 -> 1, i.e. here I am making the compensator dimensionless, any possible masses order 1. I do this to prevent any denominators phi/phi0.
```

Here is the linearised Lagrangian before feeding into ParticleSpectrum[].

$$\underset{\cdot}{\lambda}\, \mathcal{A}_{\alpha\chi\beta}\, \mathcal{A}^{\alpha\beta\chi}+\underset{\cdot}{\lambda}\, \mathcal{A}^{\alpha\beta}{}_{\alpha}\, \mathcal{A}_{\beta}{}^{\chi}{}_{\chi}+4\underset{\cdot}{\lambda}\, \mathcal{A}_{\alpha}{}^{\beta}{}_{\beta}\, \mathcal{B}^{\alpha}-6\underset{\cdot}{\lambda}\, \mathcal{B}_{\alpha}\, \mathcal{B}^{\alpha}-6\underset{\cdot}{\lambda}\, \partial_{\alpha}\mathcal{B}^{\alpha}+2\underset{\cdot}{\lambda}\, f^{\alpha\beta}\, \partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}-2\underset{\cdot}{\lambda}\, \partial_{\beta}\mathcal{A}^{\alpha\beta}{}_{\alpha}-4\underset{\cdot}{\lambda}\, f^{\alpha\beta}\, \partial_{\beta}\mathcal{B}_{\alpha}+4\underset{\cdot}{\lambda}\, f^{\alpha}{}_{\alpha}\, \partial_{\beta}\mathcal{B}^{\beta}-2\underset{\cdot}{\lambda}\, f^{\alpha\beta}\, \partial_{\chi}\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta}+2\underset{\cdot}{\lambda}\, f^{\alpha}{}_{\alpha}\, \partial_{\chi}\mathcal{A}^{\beta\chi}{}_{\beta} \tag{20}$$

••• TaskRemove: A string or a TaskObject is expected instead of CellObject[58808c55-75f1-4216-8386-296cebfad10c].

PSALTer results panel

$$\mathcal{S}==\iiiint(\phi\,\rho+\sigma^{\alpha\beta\chi}\, \mathcal{A}_{\alpha\beta\chi}+\mathcal{J}^{\alpha\beta}\, f_{\alpha\beta}+\mathcal{J}^{\alpha}\, \mathcal{B}_{\alpha}+\underset{\cdot}{\lambda}.(\mathcal{A}_{\alpha\chi\beta}\, \mathcal{A}^{\alpha\beta\chi}+\mathcal{A}^{\alpha\beta}{}_{\alpha}\, \mathcal{A}_{\beta}{}^{\chi}{}_{\chi}+4\, \mathcal{A}_{\alpha}{}^{\beta}{}_{\beta}\, \mathcal{B}^{\alpha}-6\, \mathcal{B}_{\alpha}\, \mathcal{B}^{\alpha}-6\,\partial_{\alpha}\mathcal{B}^{\alpha}+2\, f^{\alpha\beta}\, \partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}-2\,\partial_{\beta}\mathcal{A}^{\alpha\beta}{}_{\alpha}-4\, f^{\alpha\beta}\, \partial_{\beta}\mathcal{B}_{\alpha}+4\, f^{\alpha}{}_{\alpha}\, \partial_{\beta}\mathcal{B}^{\beta}-2\, f^{\alpha\beta}\, \partial_{\chi}\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta}+2\, f^{\alpha}{}_{\alpha}\, \partial_{\chi}\mathcal{A}^{\beta\chi}{}_{\beta}))[t,x,y,z]\, dz\, dy\, dx\, dt$$

Wave operator

	${}^{0^+}\mathcal{B}$	${}^{0^+}\phi$	${}^{0^+}\mathcal{A}^{\parallel}$	${}^{0^+}f^{\parallel}$	${}^{0^+}f^{\perp}$	${}^{0^-}\mathcal{A}^{\parallel}$
${}^{0^+}\mathcal{B}\dagger$	$-6\lambda.$	0	$\sqrt{6}\,\lambda.$	$-2i\sqrt{3}\,k\lambda.$	0	0
${}^{0^+}\phi\dagger$	0	0	0	0	0	0
${}^{0^+}\mathcal{A}^{\parallel}\dagger$	$\sqrt{6}\,\lambda.$	0	$-\lambda.$	$i\sqrt{2}\,k\lambda.$	0	0
${}^{0^+}f^{\parallel}\dagger$	$2i\sqrt{3}\,k\lambda.$	0	$-i\sqrt{2}\,k\lambda.$	0	0	0
${}^{0^+}f^{\perp}\dagger$	0	0	0	0	0	0
${}^{0^-}\mathcal{A}^{\parallel}\dagger$	0	0	0	0	0	$-\lambda.$

	${}^{1^+}\mathcal{A}^{\parallel}{}_{\alpha\beta}$	${}^{1^+}\mathcal{A}^{\perp}{}_{\alpha\beta}$	${}^{1^+}f^{\parallel}{}_{\alpha\beta}$	${}^{1^-}\mathcal{B}_{\alpha}$	${}^{1^-}\mathcal{A}^{\parallel}{}_{\alpha}$	${}^{1^-}\mathcal{A}^{\perp}{}_{\alpha}$	${}^{1^-}f^{\parallel}{}_{\alpha}$	${}^{1^-}f^{\perp}{}_{\alpha}$
${}^{1^+}\mathcal{A}^{\parallel}\dagger^{\alpha\beta}$	$-\frac{\lambda.}{2}$	$-\frac{\lambda.}{\sqrt{2}}$	$-\frac{ik\lambda.}{\sqrt{2}}$	0	0	0	0	0
${}^{1^+}\mathcal{A}^{\perp}\dagger^{\alpha\beta}$	$-\frac{\lambda.}{\sqrt{2}}$	0	0	0	0	0	0	0
${}^{1^+}f^{\parallel}\dagger^{\alpha\beta}$	$\frac{ik\lambda.}{\sqrt{2}}$	0	0	0	0	0	0	0
${}^{1^-}\mathcal{B}\dagger^{\alpha}$	0	0	0	$-6\lambda.$	$-2\lambda.$	$\sqrt{2}\,\lambda.$	0	$2ik\lambda.$
${}^{1^-}\mathcal{A}^{\parallel}\dagger^{\alpha}$	0	0	0	$-2\lambda.$	$-\frac{\lambda.}{2}$	$\frac{\lambda.}{\sqrt{2}}$	0	$ik\lambda.$
${}^{1^-}\mathcal{A}^{\perp}\dagger^{\alpha}$	0	0	0	$\sqrt{2}\,\lambda.$	$\frac{\lambda.}{\sqrt{2}}$	0	0	0
${}^{1^-}f^{\parallel}\dagger^{\alpha}$	0	0	0	0	0	0	0	0
${}^{1^-}f^{\perp}\dagger^{\alpha}$	0	0	0	$-2ik\lambda.$	$-ik\lambda.$	0	0	0

	${}^{2^+}\mathcal{A}^{\parallel}{}_{\alpha\beta}$	${}^{2^+}f^{\parallel}{}_{\alpha\beta}$	${}^{2^-}\mathcal{A}^{\parallel}{}_{\alpha\beta\chi}$
${}^{2^+}\mathcal{A}^{\parallel}\dagger^{\alpha\beta}$	$\frac{\lambda.}{2}$	$-\frac{ik\lambda.}{\sqrt{2}}$	0
${}^{2^+}f^{\parallel}\dagger^{\alpha\beta}$	$\frac{ik\lambda.}{\sqrt{2}}$	0	0
${}^{2^-}\mathcal{A}^{\parallel}\dagger^{\alpha\beta\chi}$	0	0	$\frac{\lambda.}{2}$

Saturated propagator

	${}^{0^+}\mathcal{J}$	${}^{0^+}\rho$	${}^{0^+}\sigma^{\parallel}$	${}^{0^+}\tau^{\parallel}$	${}^{0^+}\tau^{\perp}$	${}^{0^-}\sigma^{\parallel}$
${}^{0^+}\mathcal{J}\,\dagger$	0	0	0	$-\frac{i\sqrt{3}}{7k\lambda.}$	0	0
${}^{0^+}\rho\,\dagger$	0	0	0	0	0	0
${}^{0^+}\sigma^{\parallel}\,\dagger$	0	0	0	$\frac{i}{7\sqrt{2}\,k\lambda.}$	0	0
${}^{0^+}\tau^{\parallel}\,\dagger$	$\frac{i\sqrt{3}}{7k\lambda.}$	0	$-\frac{i}{7\sqrt{2}\,k\lambda.}$	$\frac{1}{2k^2\lambda.}$	0	0
${}^{0^+}\tau^{\perp}\,\dagger$	0	0	0	0	0	0
${}^{0^-}\sigma^{\parallel}\,\dagger$	0	0	0	0	0	$-\frac{1}{\lambda.}$

	${}^{1^+}\sigma^{\parallel}{}_{\alpha\beta}$	${}^{1^+}\sigma^{\perp}{}_{\alpha\beta}$	${}^{1^+}\tau^{\parallel}{}_{\alpha\beta}$	${}^{1^-}\mathcal{J}_{\alpha}$	${}^{1^-}\sigma^{\parallel}{}_{\alpha}$	${}^{1^-}\sigma^{\perp}{}_{\alpha}$	${}^{1^-}\tau^{\parallel}{}_{\alpha}$	${}^{1^-}\tau^{\perp}{}_{\alpha}$
${}^{1^+}\sigma^{\parallel}\,\dagger^{\alpha\beta}$	0	$-\frac{\sqrt{2}}{\lambda.+k^2\lambda.}$	$-\frac{i\sqrt{2}\,k}{\lambda.+k^2\lambda.}$	0	0	0	0	0
${}^{1^+}\sigma^{\perp}\,\dagger^{\alpha\beta}$	$-\frac{\sqrt{2}}{\lambda.+k^2\lambda.}$	$\frac{1}{(1+k^2)^2\lambda.}$	$\frac{i k}{(1+k^2)^2\lambda.}$	0	0	0	0	0
${}^{1^+}\tau^{\parallel}\,\dagger^{\alpha\beta}$	$\frac{i\sqrt{2}\,k}{\lambda.+k^2\lambda.}$	$-\frac{i k}{(1+k^2)^2\lambda.}$	$\frac{k^2}{(1+k^2)^2\lambda.}$	0	0	0	0	0
${}^{1^-}\mathcal{J}\,\dagger^{\alpha}$	0	0	0	$-\frac{2(3+8k^2)}{(7+10k^2)^2\lambda.}$	$\frac{2(-1+6k^2)}{(7+10k^2)^2\lambda.}$	$\frac{\sqrt{2}(1+20k^2)}{(7+10k^2)^2\lambda.}$	0	$\frac{2i(k+20k^3)}{(7+10k^2)^2\lambda.}$
${}^{1^-}\sigma^{\parallel}\,\dagger^{\alpha}$	0	0	0	$\frac{2(-1+6k^2)}{(7+10k^2)^2\lambda.}$	$\frac{16(2+k^2)}{(7+10k^2)^2\lambda.}$	$\frac{\sqrt{2}(33+10k^2)}{(7+10k^2)^2\lambda.}$	0	$\frac{2ik(33+10k^2)}{(7+10k^2)^2\lambda.}$
${}^{1^-}\sigma^{\perp}\,\dagger^{\alpha}$	0	0	0	$\frac{\sqrt{2}(1+20k^2)}{(7+10k^2)^2\lambda.}$	$\frac{\sqrt{2}(33+10k^2)}{(7+10k^2)^2\lambda.}$	$\frac{65}{(7+10k^2)^2\lambda.}$	0	$\frac{65i\sqrt{2}\,k}{(7+10k^2)^2\lambda.}$
${}^{1^-}\tau^{\parallel}\,\dagger^{\alpha}$	0	0	0	0	0	0	0	0
${}^{1^-}\tau^{\perp}\,\dagger^{\alpha}$	0	0	0	$-\frac{2i(k+20k^3)}{(7+10k^2)^2\lambda.}$	$-\frac{2ik(33+10k^2)}{(7+10k^2)^2\lambda.}$	$-\frac{65i\sqrt{2}\,k}{(7+10k^2)^2\lambda.}$	0	$\frac{130k^2}{(7+10k^2)^2\lambda.}$

	${}^{2^+}\sigma^{\parallel}{}_{\alpha\beta}$	${}^{2^+}\tau^{\parallel}{}_{\alpha\beta}$	${}^{2^-}\sigma^{\parallel}{}_{\alpha\beta\chi}$
${}^{2^+}\sigma^{\parallel}\,\dagger^{\alpha\beta}$	0	$-\frac{i\sqrt{2}}{k\lambda.}$	0
${}^{2^+}\tau^{\parallel}\,\dagger^{\alpha\beta}$	$\frac{i\sqrt{2}}{k\lambda.}$	$-\frac{1}{k^2\lambda.}$	0
${}^{2^-}\sigma^{\parallel}\,\dagger^{\alpha\beta\chi}$	0	0	$\frac{2}{\lambda.}$

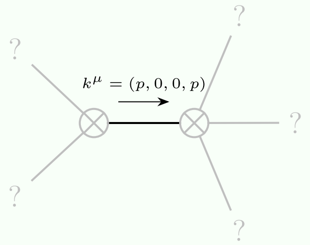
Source constraints

Spin-parity form	Covariant form	Multiplicities
${}^{0^+}\tau^{\perp} == 0$	$\partial_\beta\partial_\alpha\mathcal{J}^{\alpha\beta} == 0$	1
$2\,{}^{0^+}\sigma^{\parallel} + {}^{0^+}\mathcal{J} == 0$	$\partial_\alpha\mathcal{J}^{\alpha} == 2\,\partial_\beta\sigma^{\alpha}{}_{\alpha}{}^{\beta}$	1
${}^{0^+}\rho == 0$	$\rho == 0$	1
$2\,i\,k\;{}^{1^-}\sigma^{\parallel\alpha} + {}^{1^-}\tau^{\perp\alpha} - i\,k\;{}^{1^-}\mathcal{J}^{\alpha} == 0$	$\partial_\chi\partial^\chi\partial_\beta\mathcal{J}^{\alpha\beta} + \partial_\chi\partial^\chi\partial_\beta\partial^\alpha\mathcal{J}^{\beta} + 2\,\partial_\delta\partial^\delta\partial_\chi\partial_\beta\sigma^{\beta\alpha\chi} == \partial_\chi\partial_\beta\partial^\alpha\mathcal{J}^{\beta\chi} + \partial_\chi\partial^\chi\partial_\beta\partial^\beta\mathcal{J}^{\alpha} + 2\,(\partial_\delta\partial^\delta\partial_\chi\partial^\alpha\sigma^{\beta}{}_{\beta}{}^{\chi} + \partial_\delta\partial^\delta\partial_\chi\partial^\chi\sigma^{\beta\alpha}{}_{\beta})$	3
${}^{1^-}\tau^{\parallel\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\mathcal{J}^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\mathcal{J}^{\beta\alpha}$	3
$2\;{}^{1^-}\sigma^{\parallel\alpha} == 2\;{}^{1^-}\sigma^{\perp\alpha} + {}^{1^-}\mathcal{J}^{\alpha}$	$\partial_\beta\partial^\alpha\mathcal{J}^{\beta} == \partial_\beta\partial^\beta\mathcal{J}^{\alpha} + 2\,(\partial_\chi\partial^\alpha\sigma^{\beta}{}_{\beta}{}^{\chi} + \partial_\chi\partial^\chi\sigma^{\beta\alpha}{}_{\beta})$	3
$i\,k\;{}^{1^+}\sigma^{\perp\alpha\beta} + {}^{1^+}\tau^{\parallel\alpha\beta} == 0$	$\partial_\chi\partial^\alpha\mathcal{J}^{\beta\chi} + \partial_\chi\partial^\beta\mathcal{J}^{\chi\alpha} + \partial_\chi\partial^\chi\mathcal{J}^{\alpha\beta} + 2\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\chi\beta\delta} + 2\,\partial_\delta\partial^\delta\partial_\chi\sigma^{\chi\alpha\beta} == \partial_\chi\partial^\alpha\mathcal{J}^{\chi\beta} + \partial_\chi\partial^\beta\mathcal{J}^{\alpha\chi} + \partial_\chi\partial^\chi\mathcal{J}^{\beta\alpha} + 2\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\chi\alpha\delta}$	3
Total expected gauge generators:		15

Massive spectrum

(No particles)

Massless spectrum



Massless particle

Pole residue:	$-\frac{1}{\lambda.} > 0$
Polarisations:	2

Unitarity conditions

$\lambda. < 0$

Key observation: This marks the completion of the particle spectrum analysis for the modified E--H action.

Test case 2: E--H action with propagating compensator.

We test the case of the modified Einstein-Hilbert action, with propagating compensator.

$$\frac{1}{2} v.\, \mathcal{D}^\dagger \phi_\alpha \ \mathcal{D}^\dagger \phi^\alpha + \lambda.\, \phi^2 \ \mathcal{R}^{\dagger\alpha\beta}{}_{\alpha\beta} \tag{21}$$

```
Here, we perform rescalings after application of Einstein Gauge: ϕ_0^2*λ -> λ, ϕ_0^2*v -> v, ϕ_0^2*t_i -> t_i. Also
  ϕ_0 -> 1, i.e. here I am making the compensator dimensionless, any possible masses order 1. I do this to prevent any denominators phi/phi0.
```

Here is the linearised Lagrangian before feeding into ParticleSpectrum[].

$$\lambda.\, \mathcal{A}_{\alpha\chi\beta}\ \mathcal{A}^{\alpha\beta\chi} + \left(\lambda. - \frac{v.}{18}\right) \mathcal{A}^{\alpha\beta}{}_{\alpha}\ \mathcal{A}_{\beta}{}^{\chi}{}_{\chi} + \left(4\lambda. - \frac{v.}{3}\right) \mathcal{A}_{\alpha}{}^{\beta}{}_{\beta}\ \mathcal{B}^{\alpha} + \left(-6\lambda. + \frac{v.}{2}\right) \mathcal{B}_{\alpha}\ \mathcal{B}^{\alpha} + \frac{1}{3} v.\, \mathcal{B}^{\alpha}\ \partial_{\alpha} f^{\beta}{}_{\beta} - 6\lambda.\, \partial_{\alpha}\mathcal{B}^{\alpha} + 2\lambda.\, f^{\alpha\beta}\ \partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi} - 2\lambda.\, \partial_{\beta}\mathcal{A}^{\alpha\beta}{}_{\alpha} - \frac{1}{3} v.\, \mathcal{B}^{\alpha}\ \partial_{\beta} f_{\alpha}{}^{\beta} + \frac{1}{9} v.\, \mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\ \partial_{\beta} f^{\alpha\beta} - 4\lambda.\, f^{\alpha\beta}\ \partial_{\beta}\mathcal{B}_{\alpha} + 4\lambda.\, f^{\alpha}{}_{\alpha}\ \partial_{\beta}\mathcal{B}^{\beta} - \frac{1}{9} v.\, \mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\ \partial^{\beta} f^{\alpha}{}_{\alpha} + \frac{1}{18} v.\, \partial_{\beta} f^{\chi}{}_{\chi}\ \partial^{\beta} f^{\alpha}{}_{\alpha} - 2\lambda.\, f^{\alpha\beta}\ \partial_{\chi}\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta} + 2\lambda.\, f^{\alpha}{}_{\alpha}\ \partial_{\chi}\mathcal{A}^{\beta\chi}{}_{\beta} + \frac{1}{18} v.\, \partial_{\beta} f^{\alpha\beta}\ \partial_{\chi} f_{\alpha}{}^{\chi} - \frac{1}{9} v.\, \partial^{\beta} f^{\alpha}{}_{\alpha}\ \partial_{\chi} f_{\beta}{}^{\chi} \tag{22}$$

••• TaskRemove: A string or a TaskObject is expected instead of CellObject[411dc298-2bf7-4bef-8b28-04a82801708c].

PSALTer results panel

$$\mathcal{S} == \iiiint \Big(\phi\rho + \sigma^{\alpha\beta\chi}\ \mathcal{A}_{\alpha\beta\chi} + \mathcal{J}^{\alpha\beta}\ f_{\alpha\beta} + \mathcal{J}^{\alpha}\ \mathcal{B}_{\alpha} + \lambda.\big(\mathcal{A}_{\alpha\chi\beta}\ \mathcal{A}^{\alpha\beta\chi} + \mathcal{A}^{\alpha\beta}{}_{\alpha}\ \mathcal{A}_{\beta}{}^{\chi}{}_{\chi} + 4\ \mathcal{A}_{\alpha}{}^{\beta}{}_{\beta}\ \mathcal{B}^{\alpha} - 6\ \mathcal{B}_{\alpha}\ \mathcal{B}^{\alpha} - 6\,\partial_{\alpha}\mathcal{B}^{\alpha} + 2\ f^{\alpha\beta}\ \partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi} - 2\,\partial_{\beta}\mathcal{A}^{\alpha\beta}{}_{\alpha} - 4\ f^{\alpha\beta}\ \partial_{\beta}\mathcal{B}_{\alpha} + 4\ f^{\alpha}{}_{\alpha}\ \partial_{\beta}\mathcal{B}^{\beta} - 2\ f^{\alpha\beta}\ \partial_{\chi}\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta} + 2\ f^{\alpha}{}_{\alpha}\ \partial_{\chi}\mathcal{A}^{\beta\chi}{}_{\beta}\big) - \frac{1}{18}\ v.\big(\mathcal{A}^{\alpha\beta}{}_{\alpha}\ \mathcal{A}_{\beta}{}^{\chi}{}_{\chi} + 6\ \mathcal{A}_{\alpha}{}^{\beta}{}_{\beta}\ \mathcal{B}^{\alpha} - 9\ \mathcal{B}_{\alpha}\ \mathcal{B}^{\alpha} - 6\ \mathcal{B}^{\alpha}\ \partial_{\alpha}f^{\beta}{}_{\beta} + 6\ \mathcal{B}^{\alpha}\ \partial_{\beta}f_{\alpha}{}^{\beta} - 2\ \mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\ \partial_{\beta}f^{\alpha\beta} + 2\ \mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\ \partial^{\beta}f^{\alpha}{}_{\alpha} - \partial_{\beta}f^{\chi}{}_{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha} - \partial_{\beta}f^{\alpha\beta}\partial_{\chi}f_{\alpha}{}^{\chi} + 2\,\partial^{\beta}f^{\alpha}{}_{\alpha}\partial_{\chi}f_{\beta}{}^{\chi}\big)\Big)[t, x, y, z]\ dz\ dy\ dx\ dt$$

Wave operator

	$0^+\mathcal{B}$	$0^+\phi$	$0^+\mathcal{A}^{\parallel}$	$0^+f^{\parallel}$	$0^+f^{\perp}$	$0^-\mathcal{A}^{\parallel}$
$0^+\mathcal{B}\dagger$	$-6\lambda. + \frac{v.}{2}$	0	$\frac{12\lambda. - v.}{2\sqrt{6}}$	$-\frac{ik(12\lambda. - v.)}{2\sqrt{3}}$	0	0
$0^+\phi\dagger$	0	0	0	0	0	0
$0^+\mathcal{A}^{\parallel}\dagger$	$\frac{12\lambda. - v.}{2\sqrt{6}}$	0	$-\lambda. + \frac{v.}{12}$	$\frac{ik(12\lambda. - v.)}{6\sqrt{2}}$	0	0
$0^+f^{\parallel}\dagger$	$\frac{ik(12\lambda. - v.)}{2\sqrt{3}}$	0	$-\frac{ik(12\lambda. - v.)}{6\sqrt{2}}$	$\frac{k^2 v.}{6}$	0	0
$0^+f^{\perp}\dagger$	0	0	0	0	0	0
$0^-\mathcal{A}^{\parallel}\dagger$	0	0	0	0	0	$-\lambda.$

	$1^+\mathcal{A}^{\parallel}{}_{\alpha\beta}$	$1^+\mathcal{A}^{\perp}{}_{\alpha\beta}$	$1^+f^{\parallel}{}_{\alpha\beta}$	$1^-\mathcal{B}_{\alpha}$	$1^-\mathcal{A}^{\parallel}{}_{\alpha}$	$1^-\mathcal{A}^{\perp}{}_{\alpha}$	$1^-f^{\parallel}{}_{\alpha}$	$1^-f^{\perp}{}_{\alpha}$
$1^+\mathcal{A}^{\parallel}\dagger^{\alpha\beta}$	$-\frac{\lambda.}{2}$	$-\frac{\lambda.}{\sqrt{2}}$	$-\frac{ik\lambda.}{\sqrt{2}}$	0	0	0	0	0
$1^+\mathcal{A}^{\perp}\dagger^{\alpha\beta}$	$-\frac{\lambda.}{\sqrt{2}}$	0	0	0	0	0	0	0
$1^+f^{\parallel}\dagger^{\alpha\beta}$	$\frac{ik\lambda.}{\sqrt{2}}$	0	0	0	0	0	0	0
$1^-\mathcal{B}\dagger^{\alpha}$	0	0	0	$-6\lambda. + \frac{v.}{2}$	$-2\lambda. + \frac{v.}{6}$	$\frac{12\lambda. - v.}{6\sqrt{2}}$	0	$\frac{1}{6}ik(12\lambda. - v.)$
$1^-\mathcal{A}^{\parallel}\dagger^{\alpha}$	0	0	0	$-2\lambda. + \frac{v.}{6}$	$\frac{1}{18}(-9\lambda. + v.)$	$\frac{18\lambda. - v.}{18\sqrt{2}}$	0	$\frac{1}{18}ik(18\lambda. - v.)$
$1^-\mathcal{A}^{\perp}\dagger^{\alpha}$	0	0	0	$\frac{12\lambda. - v.}{6\sqrt{2}}$	$\frac{18\lambda. - v.}{18\sqrt{2}}$	$\frac{v.}{36}$	0	$\frac{ikv.}{18\sqrt{2}}$
$1^-f^{\parallel}\dagger^{\alpha}$	0	0	0	0	0	0	0	0
$1^-f^{\perp}\dagger^{\alpha}$	0	0	0	$k(-2i\lambda. + \frac{iv.}{6})$	$k(-i\lambda. + \frac{iv.}{18})$	$-\frac{ikv.}{18\sqrt{2}}$	0	$\frac{k^2 v.}{18}$

	$2^+\mathcal{A}^{\parallel}{}_{\alpha\beta}$	$2^+f^{\parallel}{}_{\alpha\beta}$	$2^-\mathcal{A}^{\parallel}{}_{\alpha\beta\chi}$
$2^+\mathcal{A}^{\parallel}\dagger^{\alpha\beta}$	$\frac{\lambda.}{2}$	$-\frac{ik\lambda.}{\sqrt{2}}$	0
$2^+f^{\parallel}\dagger^{\alpha\beta}$	$\frac{ik\lambda.}{\sqrt{2}}$	0	0
$2^-\mathcal{A}^{\parallel}\dagger^{\alpha\beta\chi}$	0	0	$\frac{\lambda.}{2}$

Saturated propagator

$$
\begin{array}{c|cccccc}
 & {}^{0^+}_{\cdot}\mathcal{J} & {}^{0^+}_{\cdot}\rho & {}^{0^+}_{\cdot}\sigma^{\parallel} & {}^{0^+}_{\cdot}\tau^{\parallel} & {}^{0^+}_{\cdot}\tau^{\perp} & {}^{0^-}_{\cdot}\sigma^{\parallel} \\
\hline
{}^{0^+}_{\cdot}\mathcal{J}\,\dagger & \frac{6\,\nu}{49\,\lambda\,(-12\,\lambda+\nu)} & 0 & \frac{\sqrt{6}\,\nu}{588\,\lambda^2-49\,\lambda\,\nu} & -\frac{i\,\sqrt{3}}{7\,k\,\lambda} & 0 & 0 \\
{}^{0^+}_{\cdot}\rho\,\dagger & 0 & 0 & 0 & 0 & 0 & 0 \\
{}^{0^+}_{\cdot}\sigma^{\parallel}\,\dagger & \frac{\sqrt{6}\,\nu}{588\,\lambda^2-49\,\lambda\,\nu} & 0 & \frac{\nu}{49\,\lambda\,(-12\,\lambda+\nu)} & \frac{i}{7\,\sqrt{2}\,k\,\lambda} & 0 & 0 \\
{}^{0^+}_{\cdot}\tau^{\parallel}\,\dagger & \frac{i\,\sqrt{3}}{7\,k\,\lambda} & 0 & -\frac{i}{7\,\sqrt{2}\,k\,\lambda} & \frac{1}{2\,k^2\,\lambda} & 0 & 0 \\
{}^{0^+}_{\cdot}\tau^{\perp}\,\dagger & 0 & 0 & 0 & 0 & 0 & 0 \\
{}^{0^-}_{\cdot}\sigma^{\parallel}\,\dagger & 0 & 0 & 0 & 0 & 0 & -\frac{1}{\lambda}
\end{array}
$$

$$
\begin{array}{c|cccccccc}
 & {}^{1^+}_{\cdot}\sigma^{\parallel}{}_{\alpha\beta} & {}^{1^+}_{\cdot}\sigma^{\perp}{}_{\alpha\beta} & {}^{1^+}_{\cdot}\tau^{\parallel}{}_{\alpha\beta} & {}^{1^-}_{\cdot}\mathcal{J}_{\alpha} & {}^{1^-}_{\cdot}\sigma^{\parallel}{}_{\alpha} & {}^{1^-}_{\cdot}\sigma^{\perp}{}_{\alpha} & {}^{1^-}_{\cdot}\tau^{\parallel}{}_{\alpha} & {}^{1^-}_{\cdot}\tau^{\perp}{}_{\alpha} \\
\hline
{}^{1^+}_{\cdot}\sigma^{\parallel}\,\dagger^{\alpha\beta} & 0 & -\frac{\sqrt{2}}{\lambda+k^2\,\lambda} & -\frac{i\,\sqrt{2}\,k}{\lambda+k^2\,\lambda} & 0 & 0 & 0 & 0 & 0 \\
{}^{1^+}_{\cdot}\sigma^{\perp}\,\dagger^{\alpha\beta} & -\frac{\sqrt{2}}{\lambda+k^2\,\lambda} & \frac{1}{(1+k^2)^2\,\lambda} & \frac{i\,k}{(1+k^2)^2\,\lambda} & 0 & 0 & 0 & 0 & 0 \\
{}^{1^+}_{\cdot}\tau^{\parallel}\,\dagger^{\alpha\beta} & \frac{i\,\sqrt{2}\,k}{\lambda+k^2\,\lambda} & -\frac{i\,k}{(1+k^2)^2\,\lambda} & \frac{k^2}{(1+k^2)^2\,\lambda} & 0 & 0 & 0 & 0 & 0 \\
{}^{1^-}_{\cdot}\mathcal{J}\,\dagger^{\alpha} & 0 & 0 & 0 & -\frac{8\,(9\,(3+8\,k^2)\,\lambda+4\,k^4\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & -\frac{8\,((9-54\,k^2)\,\lambda+k^2\,(7+2\,k^2)\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & \frac{4\,\sqrt{2}\,(9\,(1+20\,k^2)\,\lambda-14\,k^2\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & 0 & \frac{8\,i\,(9\,k\,\lambda+2\,k^3\,(90\,\lambda-7\,\nu))}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} \\
{}^{1^-}_{\cdot}\sigma^{\parallel}\,\dagger^{\alpha} & 0 & 0 & 0 & -\frac{8\,((9-54\,k^2)\,\lambda+k^2\,(7+2\,k^2)\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & \frac{576\,(2+k^2)\,\lambda-2\,(7+2\,k^2)^2\,\nu}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & \frac{2\,\sqrt{2}\,(18\,(33+10\,k^2)\,\lambda-7\,(7+2\,k^2)\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & 0 & \frac{4\,i\,k\,(18\,(33+10\,k^2)\,\lambda-7\,(7+2\,k^2)\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} \\
{}^{1^-}_{\cdot}\sigma^{\perp}\,\dagger^{\alpha} & 0 & 0 & 0 & \frac{4\,\sqrt{2}\,(9\,(1+20\,k^2)\,\lambda-14\,k^2\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & \frac{2\,\sqrt{2}\,(18\,(33+10\,k^2)\,\lambda-7\,(7+2\,k^2)\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & \frac{4\,(585\,\lambda-49\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & 0 & \frac{4\,i\,\sqrt{2}\,k\,(585\,\lambda-49\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} \\
{}^{1^-}_{\cdot}\tau^{\parallel}\,\dagger^{\alpha} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
{}^{1^-}_{\cdot}\tau^{\perp}\,\dagger^{\alpha} & 0 & 0 & 0 & -\frac{8\,i\,(9\,k\,\lambda+2\,k^3\,(90\,\lambda-7\,\nu))}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & -\frac{4\,i\,k\,(18\,(33+10\,k^2)\,\lambda-7\,(7+2\,k^2)\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & -\frac{4\,i\,\sqrt{2}\,k\,(585\,\lambda-49\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)} & 0 & \frac{8\,k^2\,(585\,\lambda-49\,\nu)}{3\,(7+10\,k^2)^2\,\lambda\,(12\,\lambda-\nu)}
\end{array}
$$

$$
\begin{array}{c|ccc}
 & {}^{2^+}_{\cdot}\sigma^{\parallel}{}_{\alpha\beta} & {}^{2^+}_{\cdot}\tau^{\parallel}{}_{\alpha\beta} & {}^{2^-}_{\cdot}\sigma^{\parallel}{}_{\alpha\beta\chi} \\
\hline
{}^{2^+}_{\cdot}\sigma^{\parallel}\,\dagger^{\alpha\beta} & 0 & -\frac{i\,\sqrt{2}}{k\,\lambda} & 0 \\
{}^{2^+}_{\cdot}\tau^{\parallel}\,\dagger^{\alpha\beta} & \frac{i\,\sqrt{2}}{k\,\lambda} & -\frac{1}{k^2\,\lambda} & 0 \\
{}^{2^-}_{\cdot}\sigma^{\parallel}\,\dagger^{\alpha\beta\chi} & 0 & 0 & \frac{2}{\lambda}
\end{array}
$$

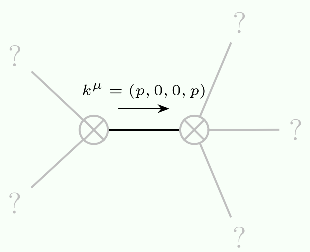
Source constraints

Spin-parity form	Covariant form	Multiplicities
${}^{0^+}_{\cdot}\tau^{\perp} == 0$	$\partial_\beta\partial_\alpha\mathcal{T}^{\alpha\beta} == 0$	1
$2\,{}^{0^+}_{\cdot}\sigma^{\parallel} + {}^{0^+}_{\cdot}\mathcal{T} == 0$	$\partial_\alpha\mathcal{T}^{\alpha} == 2\,\partial_\beta\sigma^{\alpha}{}_{\alpha}{}^{\beta}$	1
${}^{0^+}_{\cdot}\rho == 0$	$\rho == 0$	1
$2\,i\,k\;{}^{1^-}_{\cdot}\sigma^{\parallel\alpha} + {}^{1^-}_{\cdot}\tau^{\perp\alpha} - i\,k\;{}^{1^-}_{\cdot}\mathcal{T}^{\alpha} == 0$	$\partial_\chi\partial^\chi\partial_\beta\mathcal{T}^{\alpha\beta} + \partial_\chi\partial^\chi\partial_\beta\partial^\alpha\mathcal{T}^{\beta} + 2\,\partial_\delta\partial^\delta\partial_\chi\partial_\beta\sigma^{\beta\alpha\chi} == \partial_\chi\partial_\beta\partial^\alpha\mathcal{T}^{\beta\chi} + \partial_\chi\partial^\chi\partial_\beta\partial^\beta\mathcal{T}^{\alpha} + 2\,(\partial_\delta\partial^\delta\partial_\chi\partial^\alpha\sigma^{\beta}{}_{\beta}{}^{\chi} + \partial_\delta\partial^\delta\partial_\chi\partial^\chi\sigma^{\beta\alpha}{}_{\beta})$	3
${}^{1^-}_{\cdot}\tau^{\parallel\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\mathcal{T}^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\mathcal{T}^{\beta\alpha}$	3
$2\;{}^{1^-}_{\cdot}\sigma^{\parallel\alpha} == 2\;{}^{1^-}_{\cdot}\sigma^{\perp\alpha} + {}^{1^-}_{\cdot}\mathcal{T}^{\alpha}$	$\partial_\beta\partial^\alpha\mathcal{T}^{\beta} == \partial_\beta\partial^\beta\mathcal{T}^{\alpha} + 2\,(\partial_\chi\partial^\alpha\sigma^{\beta}{}_{\beta}{}^{\chi} + \partial_\chi\partial^\chi\sigma^{\beta\alpha}{}_{\beta})$	3
$i\,k\;{}^{1^+}_{\cdot}\sigma^{\perp\alpha\beta} + {}^{1^+}_{\cdot}\tau^{\parallel\alpha\beta} == 0$	$\partial_\chi\partial^\alpha\mathcal{T}^{\beta\chi} + \partial_\chi\partial^\beta\mathcal{T}^{\chi\alpha} + \partial_\chi\partial^\chi\mathcal{T}^{\alpha\beta} + 2\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\chi\beta\delta} + 2\,\partial_\delta\partial^\delta\partial_\chi\sigma^{\chi\alpha\beta} == \partial_\chi\partial^\alpha\mathcal{T}^{\chi\beta} + \partial_\chi\partial^\beta\mathcal{T}^{\alpha\chi} + \partial_\chi\partial^\chi\mathcal{T}^{\beta\alpha} + 2\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\chi\alpha\delta}$	3
Total expected gauge generators:		15

Massive spectrum

(No particles)

Massless spectrum



Massless particle

Pole residue:	$-\frac{1}{\underset{\cdot}{\lambda.}} > 0$
Polarisations:	2

Unitarity conditions

$\underset{\cdot}{\lambda.} < 0$

Key observation: This marks the completion of the particle spectrum analysis for the modified E--H action with propagating compensator.

Test case 3: E--H action with propagating compensator and vector.

We test the case of the modified Einstein-Hilbert action, with propagating compensator and vector B.

$$\frac{1}{2}\underset{\cdot}{v.}\,\mathcal{D}^{\dagger}\phi_{\alpha}\;\mathcal{D}^{\dagger}\phi^{\alpha} + \underset{\cdot}{\xi.}\,\mathcal{H}^{\dagger}{}_{\alpha\beta}\;\mathcal{H}^{\dagger\alpha\beta} - \underset{1}{c.}\,\mathcal{H}^{\dagger\alpha\beta}\;\mathcal{R}^{\dagger}{}_{\alpha}{}^{\chi}{}_{\beta\chi} + \underset{\cdot}{\lambda.}\,\phi^{2}\;\mathcal{R}^{\dagger\alpha\beta}{}_{\alpha\beta} \tag{23}$$

```
Here, we perform rescalings after application of Einstein Gauge: ϕ_0^2*λ -> λ, ϕ_0^2*ν -> ν, ϕ_0^2*t_i -> t_i. Also
  ϕ_0 -> 1, i.e. here I am making the compensator dimensionless, any possible masses order 1. I do this to prevent any denominators phi/phi0.
```

Here is the linearised Lagrangian before feeding into ParticleSpectrum[].

$$\begin{aligned}&\lambda\,\mathcal{A}_{\alpha\chi\beta}\mathcal{A}^{\alpha\beta\chi}+\left(\lambda-\frac{\nu}{18}\right)\mathcal{A}^{\alpha\beta}{}_{\alpha}\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}+\left(4\lambda-\frac{\nu}{3}\right)\mathcal{A}_{\alpha}{}^{\beta}{}_{\beta}\mathcal{B}^{\alpha}+\left(-6\lambda+\frac{\nu}{2}\right)\mathcal{B}_{\alpha}\mathcal{B}^{\alpha}+\frac{1}{3}\nu\,\mathcal{B}^{\alpha}\partial_{\alpha}f^{\beta}{}_{\beta}-6\lambda\,\partial_{\alpha}\mathcal{B}^{\alpha}+2\lambda\,f^{\alpha\beta}\partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}-2\lambda\,\partial_{\beta}\mathcal{A}^{\alpha\beta}{}_{\alpha}-\frac{1}{3}\nu\,\mathcal{B}^{\alpha}\partial_{\beta}f_{\alpha}{}^{\beta}+\frac{1}{9}\nu\,\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\partial_{\beta}f^{\alpha\beta}-4\lambda\,f^{\alpha\beta}\partial_{\beta}\mathcal{B}_{\alpha}+4\lambda\,f^{\alpha}{}_{\alpha}\partial_{\beta}\mathcal{B}^{\beta}-\frac{1}{9}\nu\,\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}+\\&\frac{1}{18}\nu\,\partial_{\beta}f^{\chi}{}_{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}+\frac{1}{3}\left(-5c_{1}+4\xi\right)\partial_{\alpha}\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\partial^{\beta}\mathcal{B}^{\alpha}+2\left(c_{1}-\xi\right)\partial_{\alpha}\mathcal{B}_{\beta}\partial^{\beta}\mathcal{B}^{\alpha}+\frac{1}{3}\left(5c_{1}-4\xi\right)\partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\partial^{\beta}\mathcal{B}^{\alpha}+\left(-2c_{1}+2\xi\right)\partial_{\beta}\mathcal{B}_{\alpha}\partial^{\beta}\mathcal{B}^{\alpha}-2\lambda\,f^{\alpha\beta}\partial_{\chi}\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta}-c_{1}\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta}+c_{1}\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\mathcal{A}_{\beta}{}^{\chi}{}_{\alpha}+2\lambda\,f^{\alpha}{}_{\alpha}\partial_{\chi}\mathcal{A}^{\beta\chi}{}_{\beta}+\frac{1}{18}\nu\,\partial_{\beta}f^{\alpha\beta}\partial_{\chi}f_{\alpha}{}^{\chi}-\frac{1}{9}\nu\,\partial^{\beta}f^{\alpha}{}_{\alpha}\partial_{\chi}f_{\beta}{}^{\chi}-\\&\frac{2}{3}\left(c_{1}-2\xi\right)\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\partial_{\alpha}f_{\beta}{}^{\chi}+\frac{2}{3}\left(c_{1}-2\xi\right)\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\partial_{\beta}f_{\alpha}{}^{\chi}+\frac{1}{9}\left(-3c_{1}+2\xi\right)\partial_{\beta}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}+\frac{1}{9}\left(3c_{1}-2\xi\right)\partial_{\chi}\mathcal{A}_{\beta}{}^{\delta}{}_{\delta}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}+\frac{1}{9}\left(3c_{1}-4\xi\right)\partial_{\alpha}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}+\frac{1}{9}\left(-3c_{1}+4\xi\right)\partial_{\chi}\mathcal{A}_{\alpha}{}^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}-\frac{2}{9}\xi\,\partial_{\chi}\partial_{\alpha}f^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}+\frac{1}{9}\left(-3c_{1}+4\xi\right)\partial_{\beta}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}+\\&\frac{1}{9}\left(3c_{1}-4\xi\right)\partial_{\chi}\mathcal{A}_{\beta}{}^{\delta}{}_{\delta}\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}+\frac{1}{3}c_{1}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}\partial_{\delta}\mathcal{A}_{\alpha}{}^{\delta}{}_{\chi}-\frac{1}{3}c_{1}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}\partial_{\delta}\mathcal{A}_{\beta}{}^{\delta}{}_{\chi}-\frac{1}{3}c_{1}\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}\partial_{\delta}\mathcal{A}_{\beta}{}^{\delta}{}_{\chi}-\frac{1}{3}c_{1}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}\partial_{\delta}\mathcal{A}_{\chi}{}^{\delta}{}_{\alpha}+\frac{1}{3}c_{1}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}\partial_{\delta}\mathcal{A}_{\chi}{}^{\delta}{}_{\beta}+\frac{1}{3}c_{1}\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}\partial_{\delta}\mathcal{A}_{\chi}{}^{\delta}{}_{\beta}-\frac{2}{9}\xi\,\partial^{\chi}\partial_{\beta}f^{\alpha\beta}\partial_{\delta}\partial_{\alpha}f_{\chi}{}^{\delta}+\frac{2}{9}\xi\,\partial^{\chi}\partial_{\beta}f^{\alpha\beta}\partial_{\delta}\partial_{\chi}f_{\alpha}{}^{\delta}+\frac{2}{9}\xi\,\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}\partial_{\delta}\partial_{\chi}f_{\beta}{}^{\delta}\end{aligned}\tag{24}$$

··· TaskRemove: A string or a TaskObject is expected instead of CellObject[a81ce6d8-135a-44cc-b090-d645fa78ed01].

··· General: Further output of TaskRemove::taskid will be suppressed during this calculation.

PSALTer results panel

$$\begin{aligned}S == \iiiint(&\phi\rho+\sigma^{\alpha\beta\chi}\mathcal{A}_{\alpha\beta\chi}+\mathcal{T}^{\alpha\beta}f_{\alpha\beta}+\mathcal{J}^{\alpha}\mathcal{B}_{\alpha}+\lambda(\mathcal{A}_{\alpha\chi\beta}\mathcal{A}^{\alpha\beta\chi}+\mathcal{A}^{\alpha\beta}{}_{\alpha}\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}+4\mathcal{A}_{\alpha}{}^{\beta}{}_{\beta}\mathcal{B}^{\alpha}-6\mathcal{B}_{\alpha}\mathcal{B}^{\alpha}-6\partial_{\alpha}\mathcal{B}^{\alpha}+2f^{\alpha\beta}\partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}-2\partial_{\beta}\mathcal{A}^{\alpha\beta}{}_{\alpha}-4f^{\alpha\beta}\partial_{\beta}\mathcal{B}_{\alpha}+4f^{\alpha}{}_{\alpha}\partial_{\beta}\mathcal{B}^{\beta}-2f^{\alpha\beta}\partial_{\chi}\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta}+2f^{\alpha}\\&\frac{1}{3}c_{1}(5\partial_{\alpha}\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\partial^{\beta}\mathcal{B}^{\alpha}-6\partial_{\alpha}\mathcal{B}_{\beta}\partial^{\beta}\mathcal{B}^{\alpha}-5\partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\partial^{\beta}\mathcal{B}^{\alpha}+6\partial_{\beta}\mathcal{B}_{\alpha}\partial^{\beta}\mathcal{B}^{\alpha}+3\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\mathcal{A}_{\alpha}{}^{\chi}{}_{\beta}-3\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\mathcal{A}_{\beta}{}^{\chi}{}_{\alpha}+2\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\partial_{\alpha}f_{\beta}{}^{\chi}-2\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\partial_{\beta}f_{\alpha}{}^{\chi}+\partial_{\beta}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}-\partial_{\chi}\mathcal{A}_{\beta}{}^{\delta}{}_{\delta}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}-\partial_{\alpha}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\partial\\&\frac{2}{9}\xi(6\partial_{\alpha}\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\partial^{\beta}\mathcal{B}^{\alpha}-9\partial_{\alpha}\mathcal{B}_{\beta}\partial^{\beta}\mathcal{B}^{\alpha}-6\partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\partial^{\beta}\mathcal{B}^{\alpha}+9\partial_{\beta}\mathcal{B}_{\alpha}\partial^{\beta}\mathcal{B}^{\alpha}+6\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\partial_{\alpha}f_{\beta}{}^{\chi}-6\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\partial_{\beta}f_{\alpha}{}^{\chi}+\partial_{\beta}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}-\partial_{\chi}\mathcal{A}_{\beta}{}^{\delta}{}_{\delta}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}-2\partial_{\alpha}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}+2\partial_{\chi}\mathcal{A}_{\alpha}{}^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}-\partial_{\chi}\partial_{\alpha}f^{\delta}\end{aligned}$$

Wave operator

	$\overset{0^+}{\cdot}\mathcal{B}$	$\overset{0^+}{\cdot}\phi$	$\overset{0^+}{\cdot}\mathcal{A}^{\parallel}$	$\overset{0^+}{\cdot}f^{\parallel}$	$\overset{0^+}{\cdot}f^{\perp}$	$\overset{0^-}{\cdot}\mathcal{A}^{\parallel}$
$\overset{0^+}{\cdot}\mathcal{B}\dagger$	$-6\lambda. + \frac{v.}{2}$	0	$\frac{12\lambda.-v.}{2\sqrt{6}}$	$-\frac{i k (12\lambda.-v.)}{2\sqrt{3}}$	0	0
$\overset{0^+}{\cdot}\phi\dagger$	0	0	0	0	0	0
$\overset{0^+}{\cdot}\mathcal{A}^{\parallel}\dagger$	$\frac{12\lambda.-v.}{2\sqrt{6}}$	0	$-\lambda. + \frac{v.}{12}$	$\frac{i k (12\lambda.-v.)}{6\sqrt{2}}$	0	0
$\overset{0^+}{\cdot}f^{\parallel}\dagger$	$\frac{i k (12\lambda.-v.)}{2\sqrt{3}}$	0	$-\frac{i k (12\lambda.-v.)}{6\sqrt{2}}$	$\frac{k^2 v.}{6}$	0	0
$\overset{0^+}{\cdot}f^{\perp}\dagger$	0	0	0	0	0	0
$\overset{0^-}{\cdot}\mathcal{A}^{\parallel}\dagger$	0	0	0	0	0	$-\lambda.$

	$\overset{1^+}{\cdot}\mathcal{A}^{\parallel}{}_{\alpha\beta}$	$\overset{1^+}{\cdot}\mathcal{A}^{\perp}{}_{\alpha\beta}$	$\overset{1^+}{\cdot}f^{\parallel}{}_{\alpha\beta}$	$\overset{1^-}{\cdot}\mathcal{B}_{\alpha}$	$\overset{1^-}{\cdot}\mathcal{A}^{\parallel}{}_{\alpha}$	$\overset{1^-}{\cdot}\mathcal{A}^{\perp}{}_{\alpha}$	$\overset{1^-}{\cdot}f^{\parallel}{}_{\alpha}$	$\overset{1^-}{\cdot}f^{\perp}{}_{\alpha}$
$\overset{1^+}{\cdot}\mathcal{A}^{\parallel}\dagger^{\alpha\beta}$	$-\frac{\lambda.}{2}$	$-\frac{\lambda.}{\sqrt{2}}$	$-\frac{i k \lambda.}{\sqrt{2}}$	0	0	0	0	0
$\overset{1^+}{\cdot}\mathcal{A}^{\perp}\dagger^{\alpha\beta}$	$-\frac{\lambda.}{\sqrt{2}}$	0	0	0	0	0	0	0
$\overset{1^+}{\cdot}f^{\parallel}\dagger^{\alpha\beta}$	$\frac{i k \lambda.}{\sqrt{2}}$	0	0	0	0	0	0	0
$\overset{1^-}{\cdot}\mathcal{B}\dagger^{\alpha}$	0	0	0	$-6\lambda. + \frac{v.}{2} + 2k^2(-c._1 + \xi.)$	$\frac{1}{6}(-12\lambda. + v. + k^2(-5c._1 + 4\xi.))$	$\frac{12\lambda.-v.+2k^2(c._1-2\xi.)}{6\sqrt{2}}$	0	$\frac{1}{6} i k (12\lambda. - v.)$
$\overset{1^-}{\cdot}\mathcal{A}^{\parallel}\dagger^{\alpha}$	0	0	0	$\frac{1}{6}(-12\lambda. + v. + k^2(-5c._1 + 4\xi.))$	$\frac{1}{18}(-9\lambda. + v. + k^2(-6c._1 + 4\xi.))$	$\frac{18\lambda.-v.+k^2(3c._1-4\xi.)}{18\sqrt{2}}$	0	$\frac{1}{18} i k (18\lambda. - v.)$
$\overset{1^-}{\cdot}\mathcal{A}^{\perp}\dagger^{\alpha}$	0	0	0	$\frac{12\lambda.-v.+2k^2(c._1-2\xi.)}{6\sqrt{2}}$	$\frac{18\lambda.-v.+k^2(3c._1-4\xi.)}{18\sqrt{2}}$	$\frac{1}{36}(v. + 4k^2\xi.)$	0	$\frac{i k v.}{18\sqrt{2}}$
$\overset{1^-}{\cdot}f^{\parallel}\dagger^{\alpha}$	0	0	0	0	0	0	0	0
$\overset{1^-}{\cdot}f^{\perp}\dagger^{\alpha}$	0	0	0	$k(-2i\lambda. + \frac{i v.}{6})$	$k(-i\lambda. + \frac{i v.}{18})$	$-\frac{i k v.}{18\sqrt{2}}$	0	$\frac{1}{18}k^2(v. + 4k^2\xi.)$

	$\overset{2^+}{\cdot}\mathcal{A}^{\parallel}{}_{\alpha\beta}$	$\overset{2^+}{\cdot}f^{\parallel}{}_{\alpha\beta}$	$\overset{2^-}{\cdot}\mathcal{A}^{\parallel}{}_{\alpha\beta\chi}$
$\overset{2^+}{\cdot}\mathcal{A}^{\parallel}\dagger^{\alpha\beta}$	$\frac{\lambda.}{2}$	$-\frac{i k \lambda.}{\sqrt{2}}$	0
$\overset{2^+}{\cdot}f^{\parallel}\dagger^{\alpha\beta}$	$\frac{i k \lambda.}{\sqrt{2}}$	0	0
$\overset{2^-}{\cdot}\mathcal{A}^{\parallel}\dagger^{\alpha\beta\chi}$	0	0	$\frac{\lambda.}{2}$

Saturated propagator

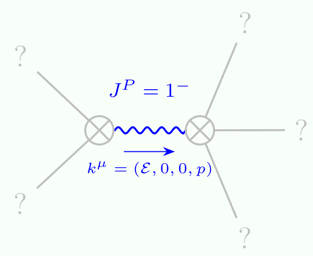
	${}^{0^+}\mathcal{J}$	${}^{0^+}\rho$	${}^{0^+}\sigma^{\Vert}$	${}^{0^+}\tau^{\Vert}$	${}^{0^+}\tau^{\perp}$	${}^{0^-}\sigma^{\Vert}$
${}^{0^+}\mathcal{J}^{\dagger}$	$\frac{6 v.}{49 \lambda. (-12 \lambda.+v.)}$	0	$\frac{\sqrt{6}\, v.}{588 \lambda.^2-49 \lambda. v.}$	$-\frac{i \sqrt{3}}{7 k \lambda.}$	0	0
${}^{0^+}\rho^{\dagger}$	0	0	0	0	0	0
${}^{0^+}\sigma^{\Vert\dagger}$	$\frac{\sqrt{6}\, v.}{588 \lambda.^2-49 \lambda. v.}$	0	$\frac{v.}{49 \lambda. (-12 \lambda.+v.)}$	$\frac{i}{7 \sqrt{2}\, k \lambda.}$	0	0
${}^{0^+}\tau^{\Vert\dagger}$	$\frac{i \sqrt{3}}{7 k \lambda.}$	0	$-\frac{i}{7 \sqrt{2}\, k \lambda.}$	$\frac{1}{2 k^2 \lambda.}$	0	0
${}^{0^+}\tau^{\perp\dagger}$	0	0	0	0	0	0
${}^{0^-}\sigma^{\Vert\dagger}$	0	0	0	0	0	$-\frac{1}{\lambda.}$

	${}^{1^+}\sigma^{\Vert}{}_{\alpha\beta}$	${}^{1^+}\sigma^{\perp}{}_{\alpha\beta}$	${}^{1^+}\tau^{\Vert}{}_{\alpha\beta}$	${}^{1^-}\mathcal{J}_{\alpha}$	${}^{1^-}\sigma^{\Vert}{}_{\alpha}$	${}^{1^-}\sigma^{\perp}{}_{\alpha}$	${}^{1^-}\tau^{\Vert}{}_{\alpha}$	${}^{1^-}\tau^{\perp}{}_{\alpha}$
${}^{1^+}\sigma^{\Vert\dagger\alpha\beta}$	0	$-\frac{\sqrt{2}}{\lambda.+k^2 \lambda.}$	$-\frac{i \sqrt{2}\, k}{\lambda.+k^2 \lambda.}$	0	0	0	0	0
${}^{1^+}\sigma^{\perp\dagger\alpha\beta}$	$-\frac{\sqrt{2}}{\lambda.+k^2 \lambda.}$	$\frac{1}{(1+k^2)^2 \lambda.}$	$\frac{i k}{(1+k^2)^2 \lambda.}$	0	0	0	0	0
${}^{1^+}\tau^{\Vert\dagger\alpha\beta}$	$\frac{i \sqrt{2}\, k}{\lambda.+k^2 \lambda.}$	$-\frac{i k}{(1+k^2)^2 \lambda.}$	$\frac{k^2}{(1+k^2)^2 \lambda.}$	0	0	0	0	0
${}^{1^-}\mathcal{J}^{\dagger\alpha}$	0	0	0	$-\frac{216 \lambda. (-12 \lambda.+v.+4 k^2 \xi.)}{49 k^2 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	$-\frac{12 (12 \lambda. (36 \lambda.-3 v.+2 k^2 \xi.)+7 k^2 c._1 (v.+4 k^2 \xi.))}{49 k^2 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	$-\frac{12 \sqrt{2} (3 \lambda. (180 \lambda.-15 v.-4 k^2 \xi.)+7 k^2 c._1 (v.+4 k^2 \xi.))}{49 k^2 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	0	$\frac{108 i \lambda. (2 k^2 c._1+12 \lambda.-v.)}{7 k^3 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda.}$
${}^{1^-}\sigma^{\Vert\dagger\alpha}$	0	0	0	$-\frac{12 (12 \lambda. (36 \lambda.-3 v.+2 k^2 \xi.)+7 k^2 c._1 (v.+4 k^2 \xi.))}{49 k^2 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	$\frac{16 (648 \lambda.^2+\lambda. (-54 v.+288 k^2 \xi.)+7 k^2 (-7 \xi. (v.+2 k^2 \xi.)+3 c._1 (v.+4 k^2 \xi.)))}{49 k^2 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	$\frac{2 \sqrt{2} (6480 \lambda.^2+108 \lambda. (-5 v.+22 k^2 \xi.)+7 k^2 (-56 \xi. (v.+2 k^2 \xi.)+27 c._1 (v.+4 k^2 \xi.)))}{49 k^2 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	0	$-\frac{6 i (36 \lambda. (12 \lambda.-v.)+k^2 (72 c._1 \lambda.+7 c._1 v.-168}{7 k^3 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda}$
${}^{1^-}\sigma^{\perp\dagger\alpha}$	0	0	0	$-\frac{12 \sqrt{2} (3 \lambda. (180 \lambda.-15 v.-4 k^2 \xi.)+7 k^2 c._1 (v.+4 k^2 \xi.))}{49 k^2 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	$\frac{2 \sqrt{2} (6480 \lambda.^2+108 \lambda. (-5 v.+22 k^2 \xi.)+7 k^2 (-56 \xi. (v.+2 k^2 \xi.)+27 c._1 (v.+4 k^2 \xi.)))}{49 k^2 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	$\frac{4 (8100 \lambda.^2+45 \lambda. (-15 v.+52 k^2 \xi.)+14 k^2 (-28 \xi. (v.+2 k^2 \xi.)+15 c._1 (v.+4 k^2 \xi.)))}{49 k^2 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	0	$-\frac{6 i \sqrt{2} (45 \lambda. (12 \lambda.-v.)+k^2 (90 c._1 \lambda.+7 c._1 v.-16}{7 k^3 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda}$
${}^{1^-}\tau^{\Vert\dagger\alpha}$	0	0	0	0	0	0	0	0
${}^{1^-}\tau^{\perp\dagger\alpha}$	0	0	0	$-\frac{108 i \lambda. (2 k^2 c._1+12 \lambda.-v.)}{7 k^3 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	$\frac{6 i (36 \lambda. (12 \lambda.-v.)+k^2 (72 c._1 \lambda.+7 c._1 v.-168 \lambda. \xi.))}{7 k^3 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	$\frac{6 i \sqrt{2} (45 \lambda. (12 \lambda.-v.)+k^2 (90 c._1 \lambda.+7 c._1 v.-168 \lambda. \xi.))}{7 k^3 (4 k^4 c._1^2 \xi.+24 \lambda. (12 \lambda.-v.) \xi.+k^2 (c._1^2 v.+48 c._1 \lambda. \xi.-48 \lambda. \xi.^2))}$	0	$\frac{18 (k^4 c._1^2+3 \lambda. (12 \lambda.-v.)+12 k^2 \lambda. (c._1-\xi.)}{4 k^8 c._1^2 \xi.+24 k^4 \lambda. (12 \lambda.-v.) \xi.+k^6 (c._1^2 v.+48 c._1 \lambda.}$

Source constraints

Spin-parity form	Covariant form	Multiplicities
${}^{0^+}\tau^{\perp} == 0$	$\partial_{\beta}\partial_{\alpha}\mathcal{J}^{\alpha\beta} == 0$	1
$2\, {}^{0^+}\sigma^{\Vert} + {}^{0^+}\mathcal{J} == 0$	$\partial_{\alpha}\mathcal{J}^{\alpha} == 2\, \partial_{\beta}\sigma^{\alpha}{}_{\alpha}{}^{\beta}$	1
${}^{0^+}\rho == 0$	$\rho == 0$	1
${}^{1^-}\tau^{\Vert\alpha} == 0$	$\partial_{\chi}\partial_{\beta}\partial^{\alpha}\mathcal{J}^{\beta\chi} == \partial_{\chi}\partial^{\chi}\partial_{\beta}\mathcal{J}^{\beta\alpha}$	3
$2\, {}^{1^-}\sigma^{\Vert\alpha} == 2\, {}^{1^-}\sigma^{\perp\alpha} + {}^{1^-}\mathcal{J}^{\alpha}$	$\partial_{\beta}\partial^{\alpha}\mathcal{J}^{\beta} == \partial_{\beta}\partial^{\beta}\mathcal{J}^{\alpha} + 2\, (\partial_{\chi}\partial^{\alpha}\sigma^{\beta}{}_{\beta}{}^{\chi} + \partial_{\chi}\partial^{\chi}\sigma^{\beta\alpha}{}_{\beta})$	3
$i\, k\, {}^{1^+}\sigma^{\perp\alpha\beta} + {}^{1^+}\tau^{\Vert\alpha\beta} == 0$	$\partial_{\chi}\partial^{\alpha}\mathcal{J}^{\beta\chi} + \partial_{\chi}\partial^{\beta}\mathcal{J}^{\chi\alpha} + \partial_{\chi}\partial^{\chi}\mathcal{J}^{\alpha\beta} + 2\, \partial_{\delta}\partial_{\chi}\partial^{\alpha}\sigma^{\chi\beta\delta} + 2\, \partial_{\delta}\partial^{\delta}\partial_{\chi}\sigma^{\chi\alpha\beta} == \partial_{\chi}\partial^{\alpha}\mathcal{J}^{\chi\beta} + \partial_{\chi}\partial^{\beta}\mathcal{J}^{\alpha\chi} + \partial_{\chi}\partial^{\chi}\mathcal{J}^{\beta\alpha} + 2\, \partial_{\delta}\partial_{\chi}\partial^{\beta}\sigma^{\chi\alpha\delta}$	3
Total expected gauge generators:		12

Massive spectrum



Massive particle

Pole residue:

$$(6\,(21\,c_1^8\,v^2 + 1008\,c_1^7\,\lambda\,v\,\xi - 4320\,c_1^6\,\lambda^2\,v\,\xi - 672\,c_1^6\,\lambda\,v^2\,\xi - 28\,c_1^6\,v^3\,\xi - 24\,192\,c_1^6\,\lambda^2\,\xi^2 - 207\,360\,c_1^5\,\lambda^3\,\xi^2 + 1008\,c_1^6\,\lambda\,v\,\xi^2 - 49\,536\,c_1^5\,\lambda^2\,v\,\xi^2 - 2688\,c_1^5\,\lambda\,v^2\,\xi^2 + 1\,755\,648\,c_1^4\,\lambda^3\,\xi^3 - 19\,584\,c_1^4\,\lambda^2\,v\,\xi^3 - 1344\,c_1^4\,\lambda\,v^2\,\xi^3 + 1\,658\,880\,c_1^3\,\lambda^3$$

$$3\,096\,576\,\lambda^3\,\xi^7 + 21\,c_1^6\,v\,\sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2} - 4320\,c_1^4\,\lambda^2\,\xi\,\sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2} - 672\,c_1^4\,\lambda\,v\,\xi\,\sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2} - 28$$

$$1344\,c_1^3\,\lambda\,v\,\xi^2\,\sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2} + 146\,304\,c_1^2\,\lambda^2\,\xi^3\,\sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2} + 2688\,c_1^2\,\lambda\,v\,\xi^3\,\sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2} - 193\,5$$

$$(7\,c_1^2\,(c_1^6\,v^3 + 144\,c_1^5\,\lambda\,v^2\,\xi + 2304\,c_1^4\,\lambda^2\,v\,\xi^2 + 240\,c_1^4\,\lambda\,v^2\,\xi^2 - 110\,592\,c_1^3\,\lambda^3\,\xi^3 + 4608\,c_1^3\,\lambda^2\,v\,\xi^3 - 110\,592\,c_1^2\,\lambda^3\,\xi^4 - 11\,520\,c_1^2\,\lambda^2\,v\,\xi^4 + 331\,776\,c_1\,\lambda^3\,\xi^5 - 110\,592\,\lambda^3\,\xi^6 + c_1^4\,v^2\,\sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2}$$

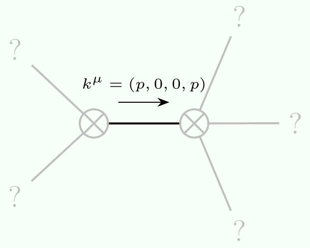
$$96\,c_1^2\,\lambda\,v\,\xi^2\,\sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2} - 4608\,c_1\,\lambda^2\,\xi^3\,\sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2} + 2304\,\lambda^2\,\xi^4\,\sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2}\,)) > 0$$

Square mass:

$$-\frac{c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2 + \sqrt{384\,c_1^2\,\lambda\,(-12\,\lambda + v)\,\xi^2 + (c_1^2\,v + 48\,c_1\,\lambda\,\xi - 48\,\lambda\,\xi^2)^2}}{8\,c_1^2\,\xi} > 0$$

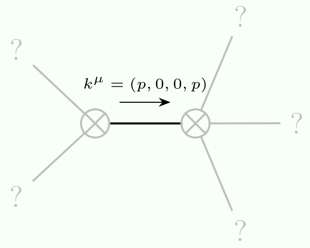
Spin:	1
Parity:	Odd

Massless spectrum



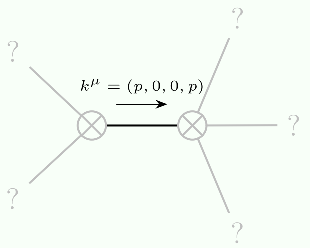
Massless particle

Pole residue:	$-\frac{1}{\lambda.\,\xi.^2} > 0$
Polarisations:	2



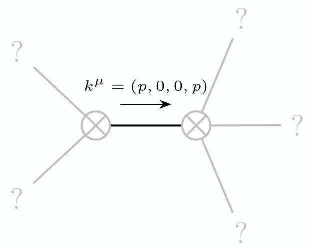
Massless particle

Pole residue:	$-\frac{163}{\lambda.^2\,\xi.} > 0$
Polarisations:	2



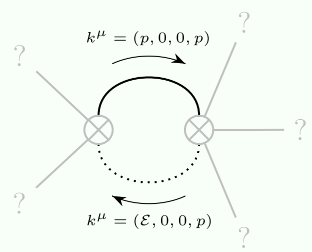
Massless particle

Pole residue:	$\frac{15\,c_{1}.^2\,\lambda.\,\nu.\,p^2 - \sqrt{5}\,\sqrt{c_{1}.^2\,\lambda.^2\,\nu.^2\,p^2\,(512+45\,c_{1}.^2\,p^2)}}{\lambda.^2\,(12\,\lambda.-\nu.)\,\xi.^2} > 0$
Polarisations:	1



Massless particle

Pole residue:	$\frac{15\,c_{1}.^2\,\lambda.\,\nu.\,p^2 + \sqrt{5}\,\sqrt{c_{1}.^2\,\lambda.^2\,\nu.^2\,p^2\,(512+45\,c_{1}.^2\,p^2)}}{\lambda.^2\,(12\,\lambda.-\nu.)\,\xi.^2} > 0$
Polarisations:	1



`Quartic pole`

Pole residue:	$0 < -\frac{1}{\xi.}$ && $-\frac{1}{\xi.} > 0$
Polarisations:	1

Unitarity conditions

(Demonstrably impossible)

Key observation: This marks the completion of the particle spectrum analysis for the modified E--H action with propagating compensator and vector.

Test case 4: Only propagating compensator and vector.

We test the case of preserving only the propagating compensator and vector B.

$$\frac{1}{2}\nu.\,\mathcal{D}^{\dagger}\phi_{\alpha}\,\mathcal{D}^{\dagger}\phi^{\alpha}+\xi.\,\mathcal{H}^{\dagger}{}_{\alpha\beta}\,\mathcal{H}^{\dagger\alpha\beta} \tag{25}$$

```
Here, we perform rescalings after application of Einstein Gauge: ϕ_0^2*λ -> λ, ϕ_0^2*ν -> ν, ϕ_0^2*t_i -> t_i. Also
  ϕ_0 -> 1, i.e. here I am making the compensator dimensionless, any possible masses order 1. I do this to prevent any denominators phi/phi0.
```

Here is the linearised Lagrangian before feeding into ParticleSpectrum[].

$$\begin{aligned}&-\frac{1}{18}\nu.\,\mathcal{A}^{\alpha\beta}{}_{\alpha}\,\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}-\frac{1}{3}\nu.\,\mathcal{A}_{\alpha}{}^{\beta}{}_{\beta}\,\mathcal{B}^{\alpha}+\frac{1}{2}\nu.\,\mathcal{B}_{\alpha}\,\mathcal{B}^{\alpha}+\frac{1}{3}\nu.\,\mathcal{B}^{\alpha}\,\partial_{\alpha}f^{\beta}{}_{\beta}-\frac{1}{3}\nu.\,\mathcal{B}^{\alpha}\,\partial_{\beta}f_{\alpha}{}^{\beta}+\frac{1}{9}\nu.\,\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\,\partial_{\beta}f^{\alpha\beta}-\frac{1}{9}\nu.\,\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\,\partial^{\beta}f^{\alpha}{}_{\alpha}+\frac{1}{18}\nu.\,\partial_{\beta}f^{\chi}{}_{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}+\frac{4}{3}\xi.\,\partial_{\alpha}\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\partial^{\beta}\mathcal{B}^{\alpha}-\\&2\xi.\,\partial_{\alpha}\mathcal{B}_{\beta}\partial^{\beta}\mathcal{B}^{\alpha}-\frac{4}{3}\xi.\,\partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\partial^{\beta}\mathcal{B}^{\alpha}+2\xi.\,\partial_{\beta}\mathcal{B}_{\alpha}\partial^{\beta}\mathcal{B}^{\alpha}+\frac{1}{18}\nu.\,\partial_{\beta}f^{\alpha\beta}\partial_{\chi}f_{\alpha}{}^{\chi}-\frac{1}{9}\nu.\,\partial^{\beta}f^{\alpha}{}_{\alpha}\partial_{\chi}f_{\beta}{}^{\chi}+\frac{4}{3}\xi.\,\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\partial_{\alpha}f_{\beta}{}^{\chi}-\frac{4}{3}\xi.\,\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\partial_{\beta}f_{\alpha}{}^{\chi}+\frac{2}{9}\xi.\,\partial_{\beta}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}-\frac{2}{9}\xi.\,\partial_{\chi}\mathcal{A}_{\beta}{}^{\delta}{}_{\delta}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}-\\&\frac{4}{9}\xi.\,\partial_{\alpha}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}+\frac{4}{9}\xi.\,\partial_{\chi}\mathcal{A}_{\alpha}{}^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}-\frac{2}{9}\xi.\,\partial_{\chi}\partial_{\alpha}f^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}+\frac{4}{9}\xi.\,\partial_{\beta}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}-\frac{4}{9}\xi.\,\partial_{\chi}\mathcal{A}_{\beta}{}^{\delta}{}_{\delta}\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}-\frac{2}{9}\xi.\,\partial^{\chi}\partial_{\beta}f^{\alpha\beta}\partial_{\delta}\partial_{\alpha}f_{\chi}{}^{\delta}+\frac{2}{9}\xi.\,\partial^{\chi}\partial_{\beta}f^{\alpha\beta}\partial_{\delta}\partial_{\chi}f_{\alpha}{}^{\delta}+\frac{2}{9}\xi.\,\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}\partial_{\delta}\partial_{\chi}f_{\beta}{}^{\delta}\end{aligned} \tag{26}$$

PSALTer results panel

$$\begin{aligned}\mathcal{S} ==&\\ \iiiint\Big(\frac{1}{18}\big(&18\,\phi\rho+18\,\sigma^{\alpha\beta\chi}\,\mathcal{A}_{\alpha\beta\chi}-\nu.\,\mathcal{A}^{\alpha\beta}{}_{\alpha}\,\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}+18\,\mathcal{J}^{\alpha\beta}\,f_{\alpha\beta}+18\,\mathcal{J}^{\alpha}\,\mathcal{B}_{\alpha}-6\,\nu.\,\mathcal{A}_{\alpha}{}^{\beta}{}_{\beta}\,\mathcal{B}^{\alpha}+9\,\nu.\,\mathcal{B}_{\alpha}\,\mathcal{B}^{\alpha}+6\,\nu.\,\mathcal{B}^{\alpha}\,\partial_{\alpha}f^{\beta}{}_{\beta}-6\,\nu.\,\mathcal{B}^{\alpha}\,\partial_{\beta}f_{\alpha}{}^{\beta}+2\,\nu.\,\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\,\partial_{\beta}f^{\alpha\beta}-2\,\nu.\,\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\,\partial^{\beta}f^{\alpha}{}_{\alpha}+\nu.\,\partial_{\beta}f^{\chi}{}_{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}+24\,\xi.\,\partial_{\alpha}\mathcal{A}_{\beta}{}^{\chi}{}_{\chi}\partial^{\beta}\mathcal{B}^{\alpha}-36\,\xi.\,\partial_{\alpha}\mathcal{B}_{\beta}\partial^{\beta}\mathcal{B}^{\alpha}-24\,\xi.\,\partial_{\beta}\mathcal{A}_{\alpha}{}^{\chi}{}_{\chi}\partial^{\beta}\mathcal{B}^{\alpha}+36\,\xi.\,\partial_{\beta}\mathcal{B}_{\alpha}\partial^{\beta}\mathcal{B}\\&\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\partial_{\alpha}f_{\beta}{}^{\chi}-24\,\xi.\,\partial^{\beta}\mathcal{B}^{\alpha}\partial_{\chi}\partial_{\beta}f_{\alpha}{}^{\chi}+4\,\xi.\,\partial_{\beta}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}-4\,\xi.\,\partial_{\chi}\mathcal{A}_{\beta}{}^{\delta}{}_{\delta}\partial^{\chi}\mathcal{A}^{\alpha\beta}{}_{\alpha}-8\,\xi.\,\partial_{\alpha}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}+8\,\xi.\,\partial_{\chi}\mathcal{A}_{\alpha}{}^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}-4\,\xi.\,\partial_{\chi}\partial_{\alpha}f^{\delta}{}_{\delta}\partial^{\chi}\partial_{\beta}f^{\alpha\beta}+8\,\xi.\,\partial_{\beta}\mathcal{A}_{\chi}{}^{\delta}{}_{\delta}\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}-8\,\xi.\,\partial_{\chi}\mathcal{A}_{\beta}{}^{\delta}{}_{\delta}\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}-4\,\xi.\,\partial^{\chi}\partial_{\beta}f^{\alpha\beta}\partial_{\delta}\partial_{\alpha}f_{\chi}{}^{\delta}+4\,\xi.\,\partial^{\chi}\partial_{\beta}f^{\alpha\beta}\partial_{\delta}\partial_{\chi}f_{\alpha}{}^{\delta}+4\,\xi.\,\partial^{\chi}\partial^{\beta}f^{\alpha}{}_{\alpha}\partial_{\delta}\partial_{\chi}f_{\beta}\end{aligned}$$

Wave operator

	$0^{+}\mathcal{B}$	$0^{+}\phi$	$0^{+}\mathcal{A}^{\parallel}$	$0^{+}f^{\parallel}$	$0^{+}f^{\perp}$	$0^{-}\mathcal{A}^{\parallel}$
$0^{+}\mathcal{B}\dagger$	$\frac{v_{\cdot}}{2}$	0	$-\frac{v_{\cdot}}{2\sqrt{6}}$	$\frac{i k v_{\cdot}}{2\sqrt{3}}$	0	0
$0^{+}\phi\dagger$	0	0	0	0	0	0
$0^{+}\mathcal{A}^{\parallel}\dagger$	$-\frac{v_{\cdot}}{2\sqrt{6}}$	0	$\frac{v_{\cdot}}{12}$	$-\frac{i k v_{\cdot}}{6\sqrt{2}}$	0	0
$0^{+}f^{\parallel}\dagger$	$-\frac{i k v_{\cdot}}{2\sqrt{3}}$	0	$\frac{i k v_{\cdot}}{6\sqrt{2}}$	$\frac{k^{2} v_{\cdot}}{6}$	0	0
$0^{+}f^{\perp}\dagger$	0	0	0	0	0	0
$0^{-}\mathcal{A}^{\parallel}\dagger$	0	0	0	0	0	0

	$1^{+}\mathcal{A}^{\parallel}{}_{\alpha\beta}$	$1^{+}\mathcal{A}^{\perp}{}_{\alpha\beta}$	$1^{+}f^{\parallel}{}_{\alpha\beta}$	$1^{-}\mathcal{B}_{\alpha}$	$1^{-}\mathcal{A}^{\parallel}{}_{\alpha}$	$1^{-}\mathcal{A}^{\perp}{}_{\alpha}$	$1^{-}f^{\parallel}{}_{\alpha}$	$1^{-}f^{\perp}{}_{\alpha}$
$1^{+}\mathcal{A}^{\parallel}\dagger^{\alpha\beta}$	0	0	0	0	0	0	0	0
$1^{+}\mathcal{A}^{\perp}\dagger^{\alpha\beta}$	0	0	0	0	0	0	0	0
$1^{+}f^{\parallel}\dagger^{\alpha\beta}$	0	0	0	0	0	0	0	0
$1^{-}\mathcal{B}\dagger^{\alpha}$	0	0	0	$\frac{1}{2}(v_{\cdot}+4k^{2}\xi_{\cdot})$	$\frac{1}{6}(v_{\cdot}+4k^{2}\xi_{\cdot})$	$-\frac{v_{\cdot}+4k^{2}\xi_{\cdot}}{6\sqrt{2}}$	0	$-\frac{1}{6} i k v_{\cdot}$
$1^{-}\mathcal{A}^{\parallel}\dagger^{\alpha}$	0	0	0	$\frac{1}{6}(v_{\cdot}+4k^{2}\xi_{\cdot})$	$\frac{1}{18}(v_{\cdot}+4k^{2}\xi_{\cdot})$	$-\frac{v_{\cdot}+4k^{2}\xi_{\cdot}}{18\sqrt{2}}$	0	$-\frac{1}{18} i k v_{\cdot}$
$1^{-}\mathcal{A}^{\perp}\dagger^{\alpha}$	0	0	0	$-\frac{v_{\cdot}+4k^{2}\xi_{\cdot}}{6\sqrt{2}}$	$-\frac{v_{\cdot}+4k^{2}\xi_{\cdot}}{18\sqrt{2}}$	$\frac{1}{36}(v_{\cdot}+4k^{2}\xi_{\cdot})$	0	$\frac{i k v_{\cdot}}{18\sqrt{2}}$
$1^{-}f^{\parallel}\dagger^{\alpha}$	0	0	0	0	0	0	0	0
$1^{-}f^{\perp}\dagger^{\alpha}$	0	0	0	$\frac{i k v_{\cdot}}{6}$	$\frac{i k v_{\cdot}}{18}$	$-\frac{i k v_{\cdot}}{18\sqrt{2}}$	0	$\frac{1}{18} k^{2}(v_{\cdot}+4k^{2}\xi_{\cdot})$

	$2^{+}\mathcal{A}^{\parallel}{}_{\alpha\beta}$	$2^{+}f^{\parallel}{}_{\alpha\beta}$	$2^{-}\mathcal{A}^{\parallel}{}_{\alpha\beta\chi}$
$2^{+}\mathcal{A}^{\parallel}\dagger^{\alpha\beta}$	0	0	0
$2^{+}f^{\parallel}\dagger^{\alpha\beta}$	0	0	0
$2^{-}\mathcal{A}^{\parallel}\dagger^{\alpha\beta\chi}$	0	0	0

Saturated propagator

	${}^{0^+}\mathcal{J}$	${}^{0^+}\rho$	${}^{0^+}\sigma^{\parallel}$	${}^{0^+}\tau^{\parallel}$	${}^{0^+}\tau^{\perp}$	${}^{0^-}\sigma^{\parallel}$
${}^{0^+}\mathcal{J}\dagger$	$\frac{72}{(7+2k^2)^2\,\nu_{\cdot}}$	0	$-\frac{12\sqrt{6}}{(7+2k^2)^2\,\nu_{\cdot}}$	$\frac{24 i\sqrt{3}\,k}{(7+2k^2)^2\,\nu_{\cdot}}$	0	0
${}^{0^+}\rho\dagger$	0	0	0	0	0	0
${}^{0^+}\sigma^{\parallel}\dagger$	$-\frac{12\sqrt{6}}{(7+2k^2)^2\,\nu_{\cdot}}$	0	$\frac{12}{(7+2k^2)^2\,\nu_{\cdot}}$	$-\frac{12 i\sqrt{2}\,k}{(7+2k^2)^2\,\nu_{\cdot}}$	0	0
${}^{0^+}\tau^{\parallel}\dagger$	$-\frac{24 i\sqrt{3}\,k}{(7+2k^2)^2\,\nu_{\cdot}}$	0	$\frac{12 i\sqrt{2}\,k}{(7+2k^2)^2\,\nu_{\cdot}}$	$\frac{24k^2}{(7+2k^2)^2\,\nu_{\cdot}}$	0	0
${}^{0^+}\tau^{\perp}\dagger$	0	0	0	0	0	0
${}^{0^-}\sigma^{\parallel}\dagger$	0	0	0	0	0	0

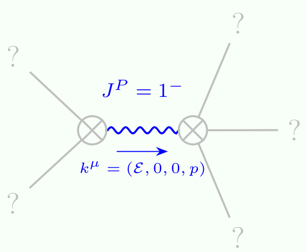
	${}^{1^+}\sigma^{\parallel}{}_{\alpha\beta}$	${}^{1^+}\sigma^{\perp}{}_{\alpha\beta}$	${}^{1^+}\tau^{\parallel}{}_{\alpha\beta}$	${}^{1^-}\mathcal{J}_{\alpha}$	${}^{1^-}\sigma^{\parallel}{}_{\alpha}$	${}^{1^-}\sigma^{\perp}{}_{\alpha}$	${}^{1^-}\tau^{\parallel}{}_{\alpha}$	${}^{1^-}\tau^{\perp}{}_{\alpha}$
${}^{1^+}\sigma^{\parallel}\dagger^{\alpha\beta}$	0	0	0	0	0	0	0	0
${}^{1^+}\sigma^{\perp}\dagger^{\alpha\beta}$	0	0	0	0	0	0	0	0
${}^{1^+}\tau^{\parallel}\dagger^{\alpha\beta}$	0	0	0	0	0	0	0	0
${}^{1^-}\mathcal{J}\dagger^{\alpha}$	0	0	0	$\frac{9}{49}\left(\frac{1}{k^2\xi_{\cdot}}+\frac{2}{\nu_{\cdot}+2k^2\xi_{\cdot}}\right)$	$\frac{3}{49}\left(\frac{1}{k^2\xi_{\cdot}}+\frac{2}{\nu_{\cdot}+2k^2\xi_{\cdot}}\right)$	$-\frac{3(\nu_{\cdot}+4k^2\xi_{\cdot})}{49\sqrt{2}\,k^2\xi_{\cdot}(\nu_{\cdot}+2k^2\xi_{\cdot})}$	0	$\frac{9 i\,\nu_{\cdot}}{14k^3\nu_{\cdot}\xi_{\cdot}+28k^5\xi_{\cdot}^2}$
${}^{1^-}\sigma^{\parallel}\dagger^{\alpha}$	0	0	0	$\frac{3}{49}\left(\frac{1}{k^2\xi_{\cdot}}+\frac{2}{\nu_{\cdot}+2k^2\xi_{\cdot}}\right)$	$\frac{\nu_{\cdot}+4k^2\xi_{\cdot}}{49k^2\nu_{\cdot}\xi_{\cdot}+98k^4\xi_{\cdot}^2}$	$-\frac{\nu_{\cdot}+4k^2\xi_{\cdot}}{49\sqrt{2}\,k^2\xi_{\cdot}(\nu_{\cdot}+2k^2\xi_{\cdot})}$	0	$\frac{3 i\,\nu_{\cdot}}{14k^3\nu_{\cdot}\xi_{\cdot}+28k^5\xi_{\cdot}^2}$
${}^{1^-}\sigma^{\perp}\dagger^{\alpha}$	0	0	0	$-\frac{3(\nu_{\cdot}+4k^2\xi_{\cdot})}{49\sqrt{2}\,k^2\xi_{\cdot}(\nu_{\cdot}+2k^2\xi_{\cdot})}$	$-\frac{\nu_{\cdot}+4k^2\xi_{\cdot}}{49\sqrt{2}\,k^2\xi_{\cdot}(\nu_{\cdot}+2k^2\xi_{\cdot})}$	$\frac{1}{98}\left(\frac{1}{k^2\xi_{\cdot}}+\frac{2}{\nu_{\cdot}+2k^2\xi_{\cdot}}\right)$	0	$-\frac{3 i\,\nu_{\cdot}}{\sqrt{2}\,(14k^3\nu_{\cdot}\xi_{\cdot}+28k^5\xi_{\cdot}^2)}$
${}^{1^-}\tau^{\parallel}\dagger^{\alpha}$	0	0	0	0	0	0	0	0
${}^{1^-}\tau^{\perp}\dagger^{\alpha}$	0	0	0	$-\frac{9 i\,\nu_{\cdot}}{14k^3\nu_{\cdot}\xi_{\cdot}+28k^5\xi_{\cdot}^2}$	$-\frac{3 i\,\nu_{\cdot}}{14k^3\nu_{\cdot}\xi_{\cdot}+28k^5\xi_{\cdot}^2}$	$\frac{3 i\,\nu_{\cdot}}{\sqrt{2}\,(14k^3\nu_{\cdot}\xi_{\cdot}+28k^5\xi_{\cdot}^2)}$	0	$\frac{9\nu_{\cdot}+36k^2\xi_{\cdot}}{4k^4\nu_{\cdot}\xi_{\cdot}+8k^6\xi_{\cdot}^2}$

	${}^{2^+}\sigma^{\parallel}{}_{\alpha\beta}$	${}^{2^+}\tau^{\parallel}{}_{\alpha\beta}$	${}^{2^-}\sigma^{\parallel}{}_{\alpha\beta\chi}$
${}^{2^+}\sigma^{\parallel}\dagger^{\alpha\beta}$	0	0	0
${}^{2^+}\tau^{\parallel}\dagger^{\alpha\beta}$	0	0	0
${}^{2^-}\sigma^{\parallel}\dagger^{\alpha\beta\chi}$	0	0	0

Source constraints

Spin-parity form	Covariant form
$\overset{0^-}{\cdot}\sigma^{\parallel} == 0$	True
$\overset{0^+}{\cdot}\tau^{\perp} == 0$	$\partial_\beta\partial_\alpha\mathcal{T}^{\alpha\beta} == 0$
$\overset{0^+}{\cdot}\tau^{\parallel} + i\,k\,\overset{0^+}{\cdot}\mathcal{T} == 0$	$\partial_\beta\partial_\alpha\mathcal{T}^{\alpha\beta} == \partial_\beta\partial^\beta\mathcal{T}^{\alpha}{}_{\alpha} + \partial_\beta\partial^\beta\partial_\alpha\mathcal{T}^{\alpha}$
$2\,\overset{0^+}{\cdot}\sigma^{\parallel} + \overset{0^+}{\cdot}\mathcal{T} == 0$	$\partial_\alpha\mathcal{T}^{\alpha} == 2\,\partial_\beta\sigma^{\alpha}{}_{\alpha}{}^{\beta}$
$\overset{0^+}{\cdot}\rho == 0$	$\rho == 0$
$\overset{1^-}{\cdot}\tau^{\parallel}{}^{\alpha} == 0$	$\partial_\chi\partial_\beta\partial^\alpha\mathcal{T}^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\mathcal{T}^{\beta\alpha}$
$6\ \overset{1^-}{\cdot}\sigma^{\perp}{}^{\alpha} + \overset{1^-}{\cdot}\mathcal{T}^{\alpha} == 0$	$\partial_\beta\partial^\alpha\mathcal{T}^{\beta} == \partial_\beta\partial^\beta\mathcal{T}^{\alpha} + 6\,\partial_\chi\partial_\beta\sigma^{\beta\alpha\chi}$
$3\ \overset{1^-}{\cdot}\sigma^{\parallel}{}^{\alpha} == \overset{1^-}{\cdot}\mathcal{T}^{\alpha}$	$\partial_\beta\partial^\alpha\mathcal{T}^{\beta} == \partial_\beta\partial^\beta\mathcal{T}^{\alpha} + 3\,(\partial_\delta\partial^\alpha\sigma^{\beta}{}_{\beta}{}^{\delta} - \partial_\delta\partial_\beta\sigma^{\beta\alpha\delta} + \partial_\delta\partial^\delta\sigma^{\beta\alpha}{}_{\beta})$
$\overset{1^+}{\cdot}\tau^{\parallel}{}^{\alpha\beta} == 0$	$\partial_\chi\partial^\alpha\mathcal{T}^{\beta\chi} + \partial_\chi\partial^\beta\mathcal{T}^{\chi\alpha} + \partial_\chi\partial^\chi\mathcal{T}^{\alpha\beta} == \partial_\chi\partial^\alpha\mathcal{T}^{\chi\beta} + \partial_\chi\partial^\beta\mathcal{T}^{\alpha\chi} + \partial_\chi\partial^\chi\mathcal{T}^{\beta\alpha}$
$\overset{1^+}{\cdot}\sigma^{\perp}{}^{\alpha\beta} == 0$	$\partial_\delta\partial_\chi\partial^\alpha\sigma^{\chi\beta\delta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\chi\alpha\beta} == \partial_\delta\partial_\chi\partial^\beta\sigma^{\chi\alpha\delta}$
$\overset{1^+}{\cdot}\sigma^{\parallel}{}^{\alpha\beta} == 0$	$\partial_\delta\partial_\chi\partial^\alpha\sigma^{\chi\beta\delta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\beta\alpha\chi} == \partial_\delta\partial_\chi\partial^\beta\sigma^{\chi\alpha\delta} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\beta\chi}$
$\overset{2^-}{\cdot}\sigma^{\parallel}{}^{\alpha\beta\chi} == 0$	$3\,\partial_\epsilon\partial_\delta\partial^\chi\partial^\alpha\sigma^{\delta\beta\epsilon} + 3\,\partial_\epsilon\partial^\epsilon\partial^\chi\partial^\alpha\sigma^{\delta\beta}{}_{\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\sigma^{\alpha\chi\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\sigma^{\chi\alpha\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\sigma^{\delta\alpha\chi} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\sigma^{\beta\alpha\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\sigma^{\delta\alpha\beta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\sigma^{\alpha\beta\chi} + 3\ \eta^{\beta\chi}\ \partial_\phi\partial^\phi\partial_\epsilon\partial^\alpha\sigma^{\delta}{}_{\delta}{}^{\epsilon} + 3\ \eta^{\alpha\chi}\ \partial_\phi\partial^\phi\partial_\epsilon\partial_\delta\sigma^{\delta\beta\epsilon} + 3\ \eta^{\beta\chi}\ \partial_\phi\partial^\phi\partial_\epsilon\partial^\epsilon\sigma^{\delta\alpha}{}_{\delta} ==$ $3\,\partial_\epsilon\partial_\delta\partial^\chi\partial^\beta\sigma^{\delta\alpha\epsilon} + 3\,\partial_\epsilon\partial^\epsilon\partial^\chi\partial^\beta\sigma^{\delta\alpha}{}_{\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\sigma^{\beta\chi\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\sigma^{\chi\beta\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\sigma^{\delta\beta\chi} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\sigma^{\alpha\beta\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\sigma^{\beta\alpha\chi} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\sigma^{\chi\alpha\beta} + 3\ \eta^{\alpha\chi}\ \partial_\phi\partial^\phi\partial_\epsilon\partial^\beta\sigma^{\delta}{}_{\delta}{}^{\epsilon} + 3\ \eta^{\beta\chi}\ \partial_\phi\partial^\phi\partial_\epsilon\partial_\delta\sigma^{\delta\alpha\epsilon} + 3\ \eta^{\alpha\chi}\ \partial_\phi\partial^\phi\partial_\epsilon\partial^\epsilon\sigma^{\delta\beta}{}_{\delta}$
$\overset{2^+}{\cdot}\tau^{\parallel}{}^{\alpha\beta} == 0$	$4\,\partial_\delta\partial_\chi\partial^\beta\partial^\alpha\mathcal{T}^{\chi\delta} + 2\,\partial_\delta\partial^\delta\partial^\beta\partial^\alpha\mathcal{T}^{\chi}{}_{\chi} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\mathcal{T}^{\alpha\beta} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\mathcal{T}^{\beta\alpha} + 2\ \eta^{\alpha\beta}\ \partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\mathcal{T}^{\chi\delta} == 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\alpha\mathcal{T}^{\beta\chi} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\alpha\mathcal{T}^{\chi\beta} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\beta\mathcal{T}^{\alpha\chi} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\beta\mathcal{T}^{\chi\alpha} + 2\ \eta^{\alpha\beta}\ \partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\mathcal{T}^{\chi}{}_{\chi}$
$\overset{2^+}{\cdot}\sigma^{\parallel}{}^{\alpha\beta} == 0$	$3\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\chi\beta\delta} + 3\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\chi\alpha\delta} + 2\ \eta^{\alpha\beta}\ \partial_\epsilon\partial^\epsilon\partial_\delta\sigma^{\chi}{}_{\chi}{}^{\delta} == 2\,\partial_\delta\partial^\beta\partial^\alpha\sigma^{\chi}{}_{\chi}{}^{\delta} + 3\,(\partial_\delta\partial^\delta\partial_\chi\sigma^{\alpha\beta\chi} + \partial_\delta\partial^\delta\partial_\chi\sigma^{\beta\alpha\chi})$
Total expected gauge generators:	

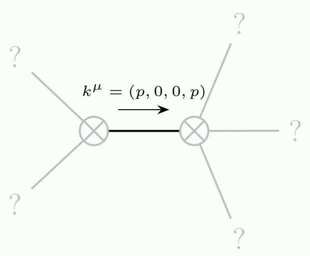
Massive spectrum



Massive particle

Pole residue:	$\frac{9}{2\,\nu.} - \frac{3}{14\,\xi.} > 0$
Square mass:	$-\frac{\nu.}{2\,\xi.} > 0$
Spin:	1
Parity:	Odd

Massless spectrum



Massless particle

Pole residue:	$-\frac{1}{\underset{\cdot}{\xi}} > 0$
Polarisations:	2

Unitarity conditions

$\underset{\cdot}{\xi} < 0 \;\&\&\; \underset{\cdot}{v} > 0$

Key observation: This marks the completion of the particle spectrum analysis for action with only propagating compensator and vector.

Killing off the quartic pole

We will kill the quartic pole.

$$\frac{1}{2}\underset{\cdot}{v}\,\mathcal{D}^{\dagger}\phi_{\alpha}\,\mathcal{D}^{\dagger}\phi^{\alpha} - \underset{1}{c}\,\mathcal{H}^{\dagger\alpha\beta}\,\mathcal{R}^{\dagger}{}_{\alpha}{}^{\chi}{}_{\beta\chi} + \underset{\cdot}{\lambda}\,\phi^{2}\,\mathcal{R}^{\dagger\alpha\beta}{}_{\alpha\beta} + \frac{1}{6}\left(2\underset{1}{r} + \underset{2}{r}\right)\mathcal{R}^{\dagger}{}_{\alpha\beta\chi\delta}\,\mathcal{R}^{\dagger\alpha\beta\chi\delta} + \frac{2}{3}\left(\underset{1}{r} - \underset{2}{r}\right)\mathcal{R}^{\dagger}{}_{\alpha\chi\beta\delta}\,\mathcal{R}^{\dagger\alpha\beta\chi\delta} + \left(\underset{4}{r} + \underset{5}{r}\right)\mathcal{R}^{\dagger\alpha\beta}{}_{\alpha}{}^{\chi}\,\mathcal{R}^{\dagger}{}_{\beta}{}^{\delta}{}_{\chi\delta} + \frac{1}{6}\left(2\underset{1}{r} + \underset{2}{r} - 6\underset{3}{r}\right)\mathcal{R}^{\dagger\alpha\beta\chi\delta}\,\mathcal{R}^{\dagger}{}_{\chi\delta\alpha\beta} + \left(\underset{4}{r} - \underset{5}{r}\right)\mathcal{R}^{\dagger\alpha\beta}{}_{\alpha}{}^{\chi}\,\mathcal{R}^{\dagger}{}_{\chi}{}^{\delta}{}_{\beta\delta} + \frac{1}{12}\left(3\underset{\cdot}{\lambda} + 4\underset{1}{t} + \underset{2}{t}\right)\phi^{2}\,\mathcal{T}^{\dagger}{}_{\alpha\beta\chi}\,\mathcal{T}^{\dagger\alpha\beta\chi} + \frac{1}{6}\left(3\underset{\cdot}{\lambda} + 2\underset{1}{t} - \underset{2}{t}\right)\phi^{2}\,\mathcal{T}^{\dagger\alpha\beta\chi}\,\mathcal{T}^{\dagger}{}_{\beta\alpha\chi} + \frac{1}{3}\left(3\underset{\cdot}{\lambda} + \underset{1}{t} - 2\underset{3}{t}\right)\phi^{2}\,\mathcal{T}^{\dagger\alpha}{}_{\alpha}{}^{\beta}\,\mathcal{T}^{\dagger\chi}{}_{\beta\chi} \tag{27}$$

Out[4]= $Aborted