# PSALTer results panel

$$S == \int\int\int\int \Big( \mathcal{A}^{\alpha\beta\chi}\ \sigma_{\alpha\beta\chi} + f^{\alpha\beta}\ \tau\,(\Delta+\mathcal{K})_{\alpha\beta} + \frac{1}{3}\,r_{.\,2}\,\big(4\,\partial_\beta \mathcal{A}_{\alpha\,\prime\,\theta} - 2\,\partial_\beta \mathcal{A}_{\alpha\theta\,\prime} + 2\,\partial_\beta \mathcal{A}_{\prime\,\theta\alpha} - \partial_\prime \mathcal{A}_{\alpha\beta\theta} + \partial_\theta \mathcal{A}_{\alpha\beta\,\prime} - 2\,\partial_\theta \mathcal{A}_{\alpha\,\prime\,\beta}\big)\,\partial^\theta \mathcal{A}^{\alpha\beta\,\prime} + \frac{1}{2}\,t_{.\,1}\,\big(2\ \mathcal{A}^{\alpha\,\prime}{}_{\alpha}\ \mathcal{A}_{\prime}{}^{\theta}{}_{\theta} - 4\ \mathcal{A}_{\alpha}{}^{\theta}{}_{\theta}\ \partial_\prime f^{\alpha\,\prime} + 4\ \mathcal{A}_{\prime}{}^{\theta}{}_{\theta}\ \partial^\prime f^{\alpha}{}_{\alpha} - 2\,\partial_\prime f^{\theta}{}_{\theta}\,\partial^\prime f^{\alpha}{}_{\alpha} - 2\,\partial_\prime f^{\alpha\,\prime}\,\partial_\theta f_{\alpha}{}^{\theta} + 4\,\partial^\prime f^{\alpha}{}_{\alpha}\,\partial_\theta f_{\prime}{}^{\theta} - 2\,\partial_\alpha f_{\prime\,\theta}\,\partial^\theta f^{\alpha\,\prime} - \partial_\alpha f_{\theta\,\prime}\,\partial^\theta f^{\alpha\,\prime} + \partial_\prime f_{\alpha\theta}\,\partial^\theta f^{\alpha\,\prime} + \partial_\theta f_{\alpha\,\prime}\,\partial^\theta f^{\alpha\,\prime} + \partial_\theta f_{\prime\,\alpha}\,\partial^\theta f^{\alpha\,\prime} + 2\ \mathcal{A}_{\alpha\theta\,\prime}\ \big(\mathcal{A}^{\alpha\,\prime\,\theta} + 2\,\partial^\theta f^{\alpha\,\prime}\big)\big)\Big)[t, x, y, z]\,dl z\,dl y\,dl x\,dl t$$

# Wave operator

| | $\overset{0^+}{\cdot}\mathcal{A}^{\parallel}$ | $\overset{0^+}{\cdot}f^{\parallel}$ | $\overset{0^+}{\cdot}f^{\perp}$ | $\overset{0^-}{\cdot}\mathcal{A}^{\parallel}$ |
|---|---|---|---|---|
| $\overset{0^+}{\cdot}\mathcal{A}^{\parallel}\,\dagger$ | $-t_{.\,1}$ | $i\,\sqrt{2}\,k\,t_{.\,1}$ | $0$ | $0$ |
| $\overset{0^+}{\cdot}f^{\parallel}\,\dagger$ | $-i\,\sqrt{2}\,k\,t_{.\,1}$ | $-2\,k^2\,t_{.\,1}$ | $0$ | $0$ |
| $\overset{0^+}{\cdot}f^{\perp}\,\dagger$ | $0$ | $0$ | $0$ | $0$ |
| $\overset{0^-}{\cdot}\mathcal{A}^{\parallel}\,\dagger$ | $0$ | $0$ | $0$ | $k^2\,r_{.\,2}\,-t_{.\,1}$ |

| | $\overset{1^+}{\cdot}\mathcal{A}^{\parallel}{}_{\alpha\beta}$ | $\overset{1^+}{\cdot}\mathcal{A}^{\perp}{}_{\alpha\beta}$ | $\overset{1^+}{\cdot}f^{\parallel}{}_{\alpha\beta}$ | $\overset{1^-}{\cdot}\mathcal{A}^{\parallel}{}_{\alpha}$ | $\overset{1^-}{\cdot}\mathcal{A}^{\perp}{}_{\alpha}$ | $\overset{1^-}{\cdot}f^{\parallel}{}_{\alpha}$ | $\overset{1^-}{\cdot}f^{\perp}{}_{\alpha}$ |
|---|---|---|---|---|---|---|---|
| $\overset{1^+}{\cdot}\mathcal{A}^{\parallel}\,\dagger^{\alpha\beta}$ | $-\frac{t_{.\,1}}{2}$ | $-\frac{t_{.\,1}}{\sqrt{2}}$ | $-\frac{i\,k\,t_{.\,1}}{\sqrt{2}}$ | $0$ | $0$ | $0$ | $0$ |
| $\overset{1^+}{\cdot}\mathcal{A}^{\perp}\,\dagger^{\alpha\beta}$ | $-\frac{t_{.\,1}}{\sqrt{2}}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $\overset{1^+}{\cdot}f^{\parallel}\,\dagger^{\alpha\beta}$ | $\frac{i\,k\,t_{.\,1}}{\sqrt{2}}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $\overset{1^-}{\cdot}\mathcal{A}^{\parallel}\,\dagger^{\alpha}$ | $0$ | $0$ | $0$ | $-\frac{t_{.\,1}}{2}$ | $\frac{t_{.\,1}}{\sqrt{2}}$ | $0$ | $i\,k\,t_{.\,1}$ |
| $\overset{1^-}{\cdot}\mathcal{A}^{\perp}\,\dagger^{\alpha}$ | $0$ | $0$ | $0$ | $\frac{t_{.\,1}}{\sqrt{2}}$ | $0$ | $0$ | $0$ |
| $\overset{1^-}{\cdot}f^{\parallel}\,\dagger^{\alpha}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $\overset{1^-}{\cdot}f^{\perp}\,\dagger^{\alpha}$ | $0$ | $0$ | $0$ | $-i\,k\,t_{.\,1}$ | $0$ | $0$ | $0$ |

| | $\overset{2^+}{\cdot}\mathcal{A}^{\parallel}{}_{\alpha\beta}$ | $\overset{2^+}{\cdot}f^{\parallel}{}_{\alpha\beta}$ | $\overset{2^-}{\cdot}\mathcal{A}^{\parallel}{}_{\alpha\beta\chi}$ |
|---|---|---|---|
| $\overset{2^+}{\cdot}\mathcal{A}^{\parallel}\,\dagger^{\alpha\beta}$ | $\frac{t_{.\,1}}{2}$ | $-\frac{i\,k\,t_{.\,1}}{\sqrt{2}}$ | $0$ |
| $\overset{2^+}{\cdot}f^{\parallel}\,\dagger^{\alpha\beta}$ | $\frac{i\,k\,t_{.\,1}}{\sqrt{2}}$ | $k^2\,t_{.\,1}$ | $0$ |
| $\overset{2^-}{\cdot}\mathcal{A}^{\parallel}\,\dagger^{\alpha\beta\chi}$ | $0$ | $0$ | $\frac{t_{.\,1}}{2}$ |

# Saturated propagator

| | $\overset{0^+}{\cdot}\sigma^{\parallel}$ | $\overset{0^+}{\cdot}\tau^{\parallel}$ | $\overset{0^+}{\cdot}\tau^{\perp}$ | $\overset{0^-}{\cdot}\sigma^{\parallel}$ |
|---|---|---|---|---|
| $\overset{0^+}{\cdot}\sigma^{\parallel}\,\dagger$ | $-\frac{1}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ | $\frac{i\,\sqrt{2}\,k}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ | $0$ | $0$ |
| $\overset{0^+}{\cdot}\tau^{\parallel}\,\dagger$ | $-\frac{i\,\sqrt{2}\,k}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ | $-\frac{2\,k^2}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ | $0$ | $0$ |
| $\overset{0^+}{\cdot}\tau^{\perp}\,\dagger$ | $0$ | $0$ | $0$ | $0$ |
| $\overset{0^-}{\cdot}\sigma^{\parallel}\,\dagger$ | $0$ | $0$ | $0$ | $\frac{1}{k^2\,r_{.\,2}\,-t_{.\,1}}$ |

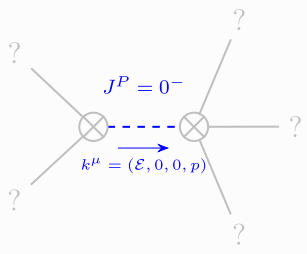
| | $\overset{1^+}{\cdot}\sigma^{\parallel}{}_{\alpha\beta}$ | $\overset{1^+}{\cdot}\sigma^{\perp}{}_{\alpha\beta}$ | $\overset{1^+}{\cdot}\tau^{\parallel}{}_{\alpha\beta}$ | $\overset{1^-}{\cdot}\sigma^{\parallel}{}_{\alpha}$ | $\overset{1^-}{\cdot}\sigma^{\perp}{}_{\alpha}$ | $\overset{1^-}{\cdot}\tau^{\parallel}{}_{\alpha}$ | $\overset{1^-}{\cdot}\tau^{\perp}{}_{\alpha}$ |
|---|---|---|---|---|---|---|---|
| $\overset{1^+}{\cdot}\sigma^{\parallel}\,\dagger^{\alpha\beta}$ | $0$ | $-\frac{\sqrt{2}}{t_{.\,1}+k^2\,t_{.\,1}}$ | $-\frac{i\,\sqrt{2}\,k}{t_{.\,1}+k^2\,t_{.\,1}}$ | $0$ | $0$ | $0$ | $0$ |
| $\overset{1^+}{\cdot}\sigma^{\perp}\,\dagger^{\alpha\beta}$ | $-\frac{\sqrt{2}}{t_{.\,1}+k^2\,t_{.\,1}}$ | $\frac{1}{\left(1+k^2\right)^2\,t_{.\,1}}$ | $\frac{i\,k}{\left(1+k^2\right)^2\,t_{.\,1}}$ | $0$ | $0$ | $0$ | $0$ |
| $\overset{1^+}{\cdot}\tau^{\parallel}\,\dagger^{\alpha\beta}$ | $\frac{i\,\sqrt{2}\,k}{t_{.\,1}+k^2\,t_{.\,1}}$ | $-\frac{i\,k}{\left(1+k^2\right)^2\,t_{.\,1}}$ | $\frac{k^2}{\left(1+k^2\right)^2\,t_{.\,1}}$ | $0$ | $0$ | $0$ | $0$ |
| $\overset{1^-}{\cdot}\sigma^{\parallel}\,\dagger^{\alpha}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}}{t_{.\,1}+2\,k^2\,t_{.\,1}}$ | $0$ | $\frac{2\,i\,k}{t_{.\,1}+2\,k^2\,t_{.\,1}}$ |
| $\overset{1^-}{\cdot}\sigma^{\perp}\,\dagger^{\alpha}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}}{t_{.\,1}+2\,k^2\,t_{.\,1}}$ | $\frac{1}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ | $0$ | $\frac{i\,\sqrt{2}\,k}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ |
| $\overset{1^-}{\cdot}\tau^{\parallel}\,\dagger^{\alpha}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $\overset{1^-}{\cdot}\tau^{\perp}\,\dagger^{\alpha}$ | $0$ | $0$ | $0$ | $-\frac{2\,i\,k}{t_{.\,1}+2\,k^2\,t_{.\,1}}$ | $-\frac{i\,\sqrt{2}\,k}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ | $0$ | $\frac{2\,k^2}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ |

| | $\overset{2^+}{\cdot}\sigma^{\parallel}{}_{\alpha\beta}$ | $\overset{2^+}{\cdot}\tau^{\parallel}{}_{\alpha\beta}$ | $\overset{2^-}{\cdot}\sigma^{\parallel}{}_{\alpha\beta\chi}$ |
|---|---|---|---|
| $\overset{2^+}{\cdot}\sigma^{\parallel}\,\dagger^{\alpha\beta}$ | $\frac{2}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ | $-\frac{2\,i\,\sqrt{2}\,k}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ | $0$ |
| $\overset{2^+}{\cdot}\tau^{\parallel}\,\dagger^{\alpha\beta}$ | $\frac{2\,i\,\sqrt{2}\,k}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ | $\frac{4\,k^2}{\left(1+2\,k^2\right)^2\,t_{.\,1}}$ | $0$ |
| $\overset{2^-}{\cdot}\sigma^{\parallel}\,\dagger^{\alpha\beta\chi}$ | $0$ | $0$ | $\frac{2}{t_{.\,1}}$ |

# Source constraints

| Spin-parity form | Covariant form | Multiplicities |
|---|---|---|
| $\overset{0^+}{\cdot}\tau^{\perp} == 0$ | $\partial_\beta\partial_\alpha\tau\,(\Delta+\mathcal{K})^{\alpha\beta} == 0$ | 1 |
| $-2\,i\,k\,\overset{0^+}{\cdot}\sigma^{\parallel} + \overset{0^+}{\cdot}\tau^{\parallel} == 0$ | $\partial_\beta\partial_\alpha\tau\,(\Delta+\mathcal{K})^{\alpha\beta} == \partial_\beta\partial^\beta\tau\,(\Delta+\mathcal{K})^{\alpha}{}_{\alpha} + 2\,\partial_\chi\partial^\chi\partial_\beta\sigma^{\alpha\ \beta}_{\ \alpha}$ | 1 |
| $2\,i\,k\ \overset{1^-}{\cdot}\sigma^{\perp}{}^{\alpha} + \overset{1^-}{\cdot}\tau^{\perp}{}^{\alpha} == 0$ | $\partial_\chi\partial_\beta\partial^\alpha\tau\,(\Delta+\mathcal{K})^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau\,(\Delta+\mathcal{K})^{\alpha\beta} + 2\,\partial_\delta\partial^\delta\partial_\chi\partial_\beta\sigma^{\beta\alpha\chi}$ | 3 |
| $\overset{1^-}{\cdot}\tau^{\parallel}{}^{\alpha} == 0$ | $\partial_\chi\partial_\beta\partial^\alpha\tau\,(\Delta+\mathcal{K})^{\beta\chi} == \partial_\chi\partial^\chi\partial_\beta\tau\,(\Delta+\mathcal{K})^{\beta\alpha}$ | 3 |
| $i\,k\ \overset{1^+}{\cdot}\sigma^{\perp}{}^{\alpha\beta} + \overset{1^+}{\cdot}\tau^{\parallel}{}^{\alpha\beta} == 0$ | $\partial_\chi\partial^\alpha\tau\,(\Delta+\mathcal{K})^{\beta\chi} + \partial_\chi\partial^\beta\tau\,(\Delta+\mathcal{K})^{\chi\alpha} + \partial_\chi\partial^\chi\tau\,(\Delta+\mathcal{K})^{\alpha\beta} + 2\,\partial_\delta\partial_\chi\partial^\alpha\sigma^{\chi\beta\delta} + 2\,\partial_\delta\partial^\delta\partial_\chi\sigma^{\chi\alpha\beta} == \partial_\chi\partial^\alpha\tau\,(\Delta+\mathcal{K})^{\chi\beta} + \partial_\chi\partial^\beta\tau\,(\Delta+\mathcal{K})^{\alpha\chi} + \partial_\chi\partial^\chi\tau\,(\Delta+\mathcal{K})^{\beta\alpha} + 2\,\partial_\delta\partial_\chi\partial^\beta\sigma^{\chi\alpha\delta}$ | 3 |
| $-2\,i\,k\ \overset{2^+}{\cdot}\sigma^{\parallel}{}^{\alpha\beta} + \overset{2^+}{\cdot}\tau^{\parallel}{}^{\alpha\beta} == 0$ | $-i\,\big(4\,\partial_\delta\partial_\chi\partial^\beta\partial^\alpha\tau\,(\Delta+\mathcal{K})^{\chi\delta} + 2\,\partial_\delta\partial^\delta\partial^\beta\partial^\alpha\tau\,(\Delta+\mathcal{K})^{\chi}{}_{\chi} - 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\alpha\tau\,(\Delta+\mathcal{K})^{\beta\chi} - 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\beta\tau\,(\Delta+\mathcal{K})^{\alpha\chi} - 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\tau\,(\Delta+\mathcal{K})^{\alpha\beta} + 3\,\partial_\delta\partial^\delta\partial_\chi\partial^\chi\tau\,(\Delta+\mathcal{K})^{\beta\alpha} + 4\,i\ k^\chi\ \partial_\epsilon\partial_\chi\partial^\beta\partial^\alpha\sigma^{\delta\ \epsilon}_{\ \delta} - 6\,i\ k^\chi\ \partial_\epsilon\partial_\delta\partial_\chi\partial^\alpha\sigma^{\delta\beta\epsilon} - 6\,i\ k^\chi\ \partial_\epsilon\partial_\delta\partial_\chi\partial^\beta\sigma^{\delta\alpha\epsilon} + 6\,i\ k^\chi\ \partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\sigma^{\alpha\beta\delta} + 6\,i\ k^\chi\ \partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\sigma^{\beta\alpha\delta} + 2\ \eta^{\alpha\beta}\ \partial_\epsilon\partial^\epsilon\partial_\delta\partial_\chi\tau\,(\Delta+\mathcal{K})^{\chi\delta} - 2\ \eta^{\alpha\beta}\ \partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\tau\,(\Delta+\mathcal{K})^{\chi}{}_{\chi} - 4\,i\ \eta^{\alpha\beta}\ k^\chi\ \partial_\phi\partial^\phi\partial_\epsilon\partial_\chi\sigma^{\delta\ \epsilon}_{\ \delta}\big) == 0$ | 5 |
| Total expected gauge generators: | | 16 |

# Massive spectrum




Massive particle

| | |
|---|---|
| Pole residue: | $-\frac{1}{r_{.\,2}} > 0$ |
| Square mass: | $\frac{t_{.\,1}}{r_{.\,2}} > 0$ |
| Spin: | 0 |
| Parity: | Odd |

# Massless spectrum

(There are no massless particles)

# Gauge symmetries

(Not yet implemented in PSALTer)

# Unitarity conditions

$r_{.\,2} < 0\ \&\&\ t_{.\,1} < 0$

# Validity assumptions

(Not yet implemented in PSALTer)