# PSALTer results panel

$$\mathcal{S} == \iiiint (\mathcal{A}^{\alpha\beta\chi}\ \sigma_{\alpha\beta\chi} + f^{\alpha\beta}\ \tau(\Delta+\mathcal{K})_{\alpha\beta} - 2 r_{3} (\partial_{\beta}\mathcal{A}_{\iota\ \ \theta}^{\ \theta}\partial^{\iota}\mathcal{A}^{\alpha\beta}_{\ \ \ \alpha} + \partial_{\iota}\mathcal{A}_{\beta\ \ \theta}^{\ \theta}\partial^{\iota}\mathcal{A}^{\alpha\beta}_{\ \ \ \alpha} + \partial_{\alpha}\mathcal{A}^{\alpha\beta\iota}\partial_{\theta}\mathcal{A}_{\beta\ \ \iota}^{\ \theta} - 2\partial^{\iota}\mathcal{A}^{\alpha\beta}_{\ \ \ \alpha}\partial_{\theta}\mathcal{A}_{\beta\ \ \iota}^{\ \theta} + \partial_{\alpha}\mathcal{A}^{\alpha\beta\iota}\partial_{\theta}\mathcal{A}_{\iota\ \ \beta}^{\ \theta} - 2\partial^{\iota}\mathcal{A}^{\alpha\beta}_{\ \ \ \alpha}\partial_{\theta}\mathcal{A}_{\iota\ \ \beta}^{\ \theta} + 2\partial_{\beta}\mathcal{A}_{\iota\theta\alpha}\partial^{\theta}\mathcal{A}^{\alpha\beta\iota}) + \frac{2}{3} r_{1} (3\partial_{\beta}\mathcal{A}_{\iota\ \ \theta}^{\ \theta}\partial^{\iota}\mathcal{A}^{\alpha\beta}_{\ \ \ \alpha} + 3\partial_{\iota}\mathcal{A}_{\beta\ \ \theta}^{\ \theta}\partial^{\iota}\mathcal{A}^{\alpha\beta}_{\ \ \ \alpha} + 3\partial_{\alpha}\mathcal{A}^{\alpha\beta\iota}\partial_{\theta}\mathcal{A}_{\beta\ \ \iota}^{\ \theta} - 6\partial^{\iota}\mathcal{A}^{\alpha\beta}_{\ \ \ \alpha}\partial_{\theta}\mathcal{A}_{\beta\ \ \iota}^{\ \theta} + 3\partial_{\alpha}\mathcal{A}^{\alpha\beta\iota}\partial_{\theta}\mathcal{A}_{\iota\ \ \beta}^{\ \theta} - 6\partial^{\iota}\mathcal{A}^{\alpha\beta}_{\ \ \ \alpha}\partial_{\theta}\mathcal{A}_{\iota\ \ \beta}^{\ \theta} - 2\partial_{\beta}\mathcal{A}_{\alpha\iota\theta}\partial^{\theta}\mathcal{A}^{\alpha\beta\iota} + \partial_{\beta}\mathcal{A}_{\alpha\theta\iota}\partial^{\theta}\mathcal{A}^{\alpha\beta\iota} + 2\partial_{\beta}\mathcal{A}_{\iota\theta\alpha}\partial^{\theta}\mathcal{A}^{\alpha\beta\iota} - \partial_{\iota}\mathcal{A}_{\alpha\beta\theta}\partial^{\theta}\mathcal{A}^{\alpha\beta\iota} + \partial_{\theta}\mathcal{A}_{\alpha\beta\iota}\partial^{\theta}\mathcal{A}^{\alpha\beta\iota} + \partial_{\theta}\mathcal{A}_{\alpha\iota\beta}\partial^{\theta}\mathcal{A}^{\alpha\beta\iota}) + r_{5} (\partial_{\iota}\mathcal{A}_{\theta\ \ \kappa}^{\ \kappa}\partial^{\theta}\mathcal{A}^{\alpha\iota}_{\ \ \ \alpha} - \partial_{\theta}\mathcal{A}_{\iota\ \ \kappa}^{\ \kappa}\partial^{\theta}\mathcal{A}^{\alpha\iota}_{\ \ \ \alpha} - (\partial_{\alpha}\mathcal{A}^{\alpha\iota\theta} - 2\partial^{\theta}\mathcal{A}^{\alpha\iota}_{\ \ \ \alpha})(\partial_{\kappa}\mathcal{A}_{\iota\ \ \theta}^{\ \kappa} - \partial_{\kappa}\mathcal{A}_{\theta\ \ \iota}^{\ \kappa})))[t, x, y, z]\, dz\, dy\, dx\, dt$$

## Wave operator

| | $0^{+}\mathcal{A}^{\parallel}$ | $0^{+}f^{\parallel}$ | $0^{+}f^{\perp}$ | $0^{-}\mathcal{A}^{\parallel}$ |
|---|---|---|---|---|
| $0^{+}\mathcal{A}^{\parallel}\dagger$ | $6k^{2}(-r_{1}+r_{3})$ | 0 | 0 | 0 |
| $0^{+}f^{\parallel}\dagger$ | 0 | 0 | 0 | 0 |
| $0^{+}f^{\perp}\dagger$ | 0 | 0 | 0 | 0 |
| $0^{-}\mathcal{A}^{\parallel}\dagger$ | 0 | 0 | 0 | 0 |

| | $1^{+}\mathcal{A}^{\parallel}_{\alpha\beta}$ | $1^{+}\mathcal{A}^{\perp}_{\alpha\beta}$ | $1^{+}f^{\parallel}_{\alpha\beta}$ | $1^{-}\mathcal{A}^{\parallel}_{\alpha}$ | $1^{-}\mathcal{A}^{\perp}_{\alpha}$ | $1^{-}f^{\parallel}_{\alpha}$ | $1^{-}f^{\perp}_{\alpha}$ |
|---|---|---|---|---|---|---|---|
| $1^{+}\mathcal{A}^{\parallel}\dagger^{\alpha\beta}$ | $k^{2}(2r_{3}+r_{5})$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $1^{+}\mathcal{A}^{\perp}\dagger^{\alpha\beta}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $1^{+}f^{\parallel}\dagger^{\alpha\beta}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $1^{-}\mathcal{A}^{\parallel}\dagger^{\alpha}$ | 0 | 0 | 0 | $k^{2}(-r_{1}+2r_{3}+r_{5})$ | 0 | 0 | 0 |
| $1^{-}\mathcal{A}^{\perp}\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $1^{-}f^{\parallel}\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $1^{-}f^{\perp}\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | $2^{+}\mathcal{A}^{\parallel}_{\alpha\beta}$ | $2^{+}f^{\parallel}_{\alpha\beta}$ | $2^{-}\mathcal{A}^{\parallel}_{\alpha\beta\chi}$ |
|---|---|---|---|
| $2^{+}\mathcal{A}^{\parallel}\dagger^{\alpha\beta}$ | 0 | 0 | 0 |
| $2^{+}f^{\parallel}\dagger^{\alpha\beta}$ | 0 | 0 | 0 |
| $2^{-}\mathcal{A}^{\parallel}\dagger^{\alpha\beta\chi}$ | 0 | 0 | $k^{2}r_{1}$ |

## Saturated propagator

| | $0^{+}\sigma^{\parallel}$ | $0^{+}\tau^{\parallel}$ | $0^{+}\tau^{\perp}$ | $0^{-}\sigma^{\parallel}$ |
|---|---|---|---|---|
| $0^{+}\sigma^{\parallel}\dagger$ | $\frac{1}{6k^{2}(-r_{1}+r_{3})}$ | 0 | 0 | 0 |
| $0^{+}\tau^{\parallel}\dagger$ | 0 | 0 | 0 | 0 |
| $0^{+}\tau^{\perp}\dagger$ | 0 | 0 | 0 | 0 |
| $0^{-}\sigma^{\parallel}\dagger$ | 0 | 0 | 0 | 0 |

| | $1^{+}\sigma^{\parallel}_{\alpha\beta}$ | $1^{+}\sigma^{\perp}_{\alpha\beta}$ | $1^{+}\tau^{\parallel}_{\alpha\beta}$ | $1^{-}\sigma^{\parallel}_{\alpha}$ | $1^{-}\sigma^{\perp}_{\alpha}$ | $1^{-}\tau^{\parallel}_{\alpha}$ | $1^{-}\tau^{\perp}_{\alpha}$ |
|---|---|---|---|---|---|---|---|
| $1^{+}\sigma^{\parallel}\dagger^{\alpha\beta}$ | $\frac{1}{k^{2}(2r_{3}+r_{5})}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $1^{+}\sigma^{\perp}\dagger^{\alpha\beta}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $1^{+}\tau^{\parallel}\dagger^{\alpha\beta}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $1^{-}\sigma^{\parallel}\dagger^{\alpha}$ | 0 | 0 | 0 | $\frac{1}{k^{2}(-r_{1}+2r_{3}+r_{5})}$ | 0 | 0 | 0 |
| $1^{-}\sigma^{\perp}\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $1^{-}\tau^{\parallel}\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $1^{-}\tau^{\perp}\dagger^{\alpha}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | $2^{+}\sigma^{\parallel}_{\alpha\beta}$ | $2^{+}\tau^{\parallel}_{\alpha\beta}$ | $2^{-}\sigma^{\parallel}_{\alpha\beta\chi}$ |
|---|---|---|---|
| $2^{+}\sigma^{\parallel}\dagger^{\alpha\beta}$ | 0 | 0 | 0 |
| $2^{+}\tau^{\parallel}\dagger^{\alpha\beta}$ | 0 | 0 | 0 |
| $2^{-}\sigma^{\parallel}\dagger^{\alpha\beta\chi}$ | 0 | 0 | $\frac{1}{k^{2}r_{1}}$ |

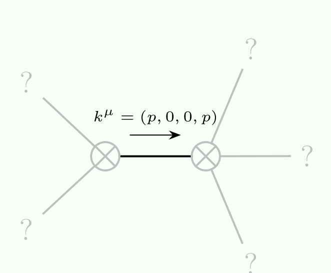
## Source constraints

| Spin-parity form | Covariant form | Multiplicities |
|---|---|---|
| $0^{-}\sigma^{\parallel} == 0$ | $\epsilon\eta_{\alpha\beta\chi\delta}\ \partial^{\delta}\sigma^{\alpha\beta\chi} == 0$ | 1 |
| $0^{+}\tau^{\perp} == 0$ | $\partial_{\beta}\partial_{\alpha}\tau(\Delta+\mathcal{K})^{\alpha\beta} == 0$ | 1 |
| $0^{+}\tau^{\parallel} == 0$ | $\partial_{\beta}\partial_{\alpha}\tau(\Delta+\mathcal{K})^{\alpha\beta} == \partial_{\beta}\partial^{\beta}\tau(\Delta+\mathcal{K})^{\alpha}_{\ \ \alpha}$ | 1 |
| $1^{-}\tau^{\perp\alpha} == 0$ | $\partial_{\chi}\partial_{\beta}\partial^{\alpha}\tau(\Delta+\mathcal{K})^{\beta\chi} == \partial_{\chi}\partial^{\chi}\partial_{\beta}\tau(\Delta+\mathcal{K})^{\alpha\beta}$ | 3 |
| $1^{-}\tau^{\parallel\alpha} == 0$ | $\partial_{\chi}\partial_{\beta}\partial^{\alpha}\tau(\Delta+\mathcal{K})^{\beta\chi} == \partial_{\chi}\partial^{\chi}\partial_{\beta}\tau(\Delta+\mathcal{K})^{\beta\alpha}$ | 3 |
| $1^{-}\sigma^{\perp\alpha} == 0$ | $\partial_{\chi}\partial_{\beta}\sigma^{\beta\alpha\chi} == 0$ | 3 |
| $1^{+}\tau^{\parallel\alpha\beta} == 0$ | $\partial_{\chi}\partial^{\alpha}\tau(\Delta+\mathcal{K})^{\beta\chi} + \partial_{\chi}\partial^{\beta}\tau(\Delta+\mathcal{K})^{\chi\alpha} + \partial_{\chi}\partial^{\chi}\tau(\Delta+\mathcal{K})^{\alpha\beta} == \partial_{\chi}\partial^{\alpha}\tau(\Delta+\mathcal{K})^{\chi\beta} + \partial_{\chi}\partial^{\beta}\tau(\Delta+\mathcal{K})^{\alpha\chi} + \partial_{\chi}\partial^{\chi}\tau(\Delta+\mathcal{K})^{\beta\alpha}$ | 3 |
| $1^{+}\sigma^{\perp\alpha\beta} == 0$ | $\partial_{\delta}\partial_{\chi}\partial^{\alpha}\sigma^{\chi\beta\delta} + \partial_{\delta}\partial^{\delta}\partial_{\chi}\sigma^{\chi\alpha\beta} == \partial_{\delta}\partial_{\chi}\partial^{\beta}\sigma^{\chi\alpha\delta}$ | 3 |
| $2^{+}\tau^{\parallel\alpha\beta} == 0$ | $4\partial_{\delta}\partial_{\chi}\partial^{\beta}\partial^{\alpha}\tau(\Delta+\mathcal{K})^{\chi\delta} + 2\partial_{\delta}\partial^{\delta}\partial^{\beta}\partial^{\alpha}\tau(\Delta+\mathcal{K})^{\chi}_{\ \ \chi} + 3\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial^{\chi}\tau(\Delta+\mathcal{K})^{\alpha\beta} + 3\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial^{\chi}\tau(\Delta+\mathcal{K})^{\beta\alpha} + 2\ \eta^{\alpha\beta}\ \partial_{\epsilon}\partial^{\epsilon}\partial_{\delta}\partial_{\chi}\tau(\Delta+\mathcal{K})^{\chi\delta} == 3\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial^{\alpha}\tau(\Delta+\mathcal{K})^{\beta\chi} + 3\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial^{\alpha}\tau(\Delta+\mathcal{K})^{\chi\beta} + 3\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial^{\beta}\tau(\Delta+\mathcal{K})^{\alpha\chi} + 3\partial_{\delta}\partial^{\delta}\partial_{\chi}\partial^{\beta}\tau(\Delta+\mathcal{K})^{\chi\alpha} + 2\ \eta^{\alpha\beta}\ \partial_{\epsilon}\partial^{\epsilon}\partial_{\delta}\partial^{\delta}\tau(\Delta+\mathcal{K})^{\chi}_{\ \ \chi}$ | 5 |
| $2^{+}\sigma^{\parallel\alpha\beta} == 0$ | $3\partial_{\delta}\partial_{\chi}\partial^{\alpha}\sigma^{\chi\beta\delta} + 3\partial_{\delta}\partial_{\chi}\partial^{\beta}\sigma^{\chi\alpha\delta} + 2\ \eta^{\alpha\beta}\ \partial_{\epsilon}\partial^{\epsilon}\partial_{\delta}\sigma^{\chi\ \ \delta}_{\ \ \chi} == 2\partial_{\delta}\partial^{\beta}\partial^{\alpha}\sigma^{\chi\ \ \delta}_{\ \ \chi} + 3(\partial_{\delta}\partial^{\delta}\partial_{\chi}\sigma^{\alpha\beta\chi} + \partial_{\delta}\partial^{\delta}\partial_{\chi}\sigma^{\beta\alpha\chi})$ | 5 |
| Total expected gauge generators: | | 28 |

## Massive spectrum

(No particles)

## Massless spectrum




Massless particle

| | |
|---|---|
| Pole residue: | $-\frac{3}{r_{1}} + \frac{3}{r_{1}-2r_{3}-r_{5}} + \frac{8}{2r_{3}+r_{5}} > 0$ |
| Polarisations: | 2 |

## Unitarity conditions

$r_{3} \in \mathbb{R}\ \&\&\ ((r_{5} < -2r_{3}\ \&\&\ 2r_{3}+r_{5} < r_{1} < 0)\ \|\ (r_{5} > -2r_{3}\ \&\&\ (r_{1} < 0\ \|\ r_{1} > 2r_{3}+r_{5})))$