

Particle spectrograph

Wave operator and propagator

Quadratic (free) action

$$S = \int \int \int \int (h^{\alpha\beta} \mathcal{T}_{\alpha\beta} + \beta \partial_\alpha h^{\alpha\beta} \partial_\chi h_\beta^\chi + \frac{1}{2} \alpha (\partial_\beta h_\chi^\chi \partial^\beta h_\alpha^\alpha - 2 \partial^\beta h_\alpha^\alpha \partial_\chi h_\beta^\chi - \partial_\chi h_{\alpha\beta} \partial^\chi h^{\alpha\beta})) [t, x, y, z] dz dy dx dt$$

\mathcal{T}_{+0}^{+2}

0

$\frac{1}{\alpha(\beta+\alpha)k^2}$

\mathcal{T}_{+0}^{+1}

$\frac{1}{\alpha k^2}$

0

\mathcal{T}_{+0}^{+1}

0

0

\mathcal{T}_{+0}^{+2}

0

0

$h_{+0}^{\#1}$

αk^2

0

$h_{+0}^{\#2}$

0

$(-\alpha+\beta)k^2$

(No source constraints)

$h_{+1}^{\#1\alpha}$

$\frac{1}{2}(-\alpha+\beta)k^2$

0

$\mathcal{T}_{+1}^{\#1}$

$-\frac{2}{(\alpha-\beta)k^2}$

0

$\mathcal{T}_{+1}^{\#2}$

0

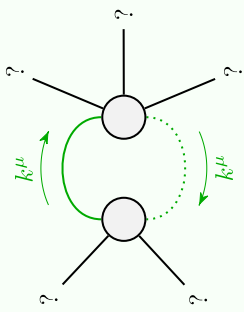
0

$h_{+2}^{\#1\alpha\beta}$

$-\frac{\alpha k^2}{2}$

0

Massive and massless spectra

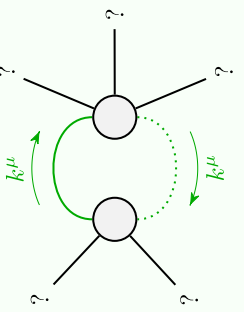


Quartic pole

Pole residue:

$$0 < \frac{6\alpha+3\beta-\sqrt{3}\sqrt{12\alpha^2+12\alpha\beta+19\beta^2+64(\alpha-\beta)^2}p^2}{\alpha(\alpha-\beta)} \&\& \frac{6\alpha+3\beta-\sqrt{3}\sqrt{12\alpha^2+12\alpha\beta+19\beta^2+64(\alpha-\beta)^2}p^2}{\alpha(\alpha-\beta)} > 0$$

Polarisations: 1

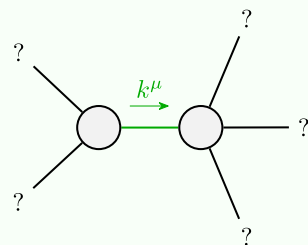


Quartic pole

Pole residue:

$$0 < \frac{6\alpha+3\beta+\sqrt{3}\sqrt{12\alpha^2+12\alpha\beta+19\beta^2+64(\alpha-\beta)^2}p^2}{\alpha(\alpha-\beta)} \&\& \frac{6\alpha+3\beta+\sqrt{3}\sqrt{12\alpha^2+12\alpha\beta+19\beta^2+64(\alpha-\beta)^2}p^2}{\alpha(\alpha-\beta)} > 0$$

Polarisations: 1



Quadratic pole

Pole residue:

$$-\frac{2\alpha-\beta+\sqrt{20\alpha^2-36\alpha\beta+17\beta^2}}{\alpha^2-\alpha\beta} > 0$$

Polarisations: 1

Quadratic pole

Pole residue:

$$-\frac{2\alpha+\beta+\sqrt{20\alpha^2-36\alpha\beta+17\beta^2}}{\alpha(\alpha-\beta)} > 0$$

Polarisations: 1

Quadratic pole

Pole residue:

$$-\frac{1}{\alpha} + \frac{5}{-\alpha+\beta} > 0$$

Polarisations: 1

Quadratic pole

Pole residue:

$$\frac{1}{\alpha} + \frac{1}{\alpha-\beta} > 0$$

Polarisations: 2

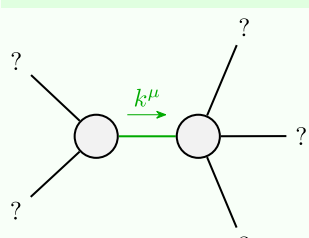
Quadratic pole

Pole residue:

$$\frac{1}{\alpha} + \frac{5}{\alpha-\beta} > 0$$

Polarisations: 1

(No massive particles)



Quadratic pole

Pole residue:

$$-\frac{1}{\alpha} > 0$$

Polarisations: 2

Hexic pole

Pole residue:

$$0 < \frac{2\alpha+\beta}{\alpha^2-\alpha\beta} \&\& \frac{2\alpha+\beta}{\alpha^2-\alpha\beta} > 0$$

Polarisations: 1

Quartic pole

Pole residue:

$$0 < \frac{\beta}{\alpha^2-\alpha\beta} \&\& \frac{\beta}{\alpha^2-\alpha\beta} > 0$$

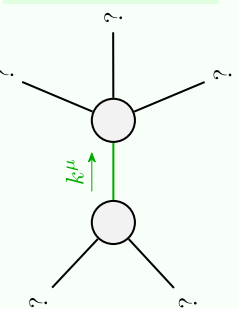
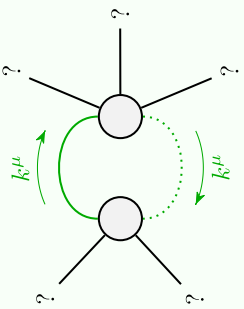
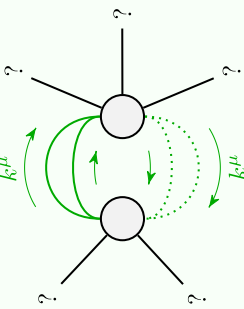
Polarisations: 2

Quadratic pole

Pole residue:

$$-\frac{1}{\alpha} + \frac{1}{-\alpha+\beta} > 0$$

Polarisations: 2



Unitarity conditions

(Unitarity is demonstrably impossible)