

Wave operator and propagator

$$\begin{aligned} \text{Quadratic (free) action} \\ S = & \iiint \left(\frac{1}{6} (-4t_3 \omega_{\alpha}^{\alpha\beta} \omega_{\kappa}^{\kappa} + 6 f_{\alpha}^{\alpha\beta} \tau_{\alpha\beta} + 6 \omega^{\alpha\beta\chi} \sigma_{\alpha\beta\chi} + 8 t_3 \omega_{\alpha}^{\kappa} \partial_{\kappa} f^{\alpha\iota} - \right. \\ & 8 t_3 \omega_{\kappa}^{\kappa} \partial_{\kappa} f^{\alpha} + 4 t_3 \partial_{\kappa} f^{\kappa} \partial^{\iota} f^{\alpha} - 6 r_3 \partial_{\beta} \omega_{\iota}^{\theta} \partial^{\iota} \omega^{\alpha\beta} - \\ & 6 r_3 \partial_{\alpha} \omega^{\alpha\beta\iota} \partial_{\theta} \omega_{\iota}^{\theta} + 12 r_3 \partial^{\iota} \omega^{\alpha\beta} \partial_{\theta} \omega_{\iota}^{\theta} + \\ & 4 t_2 \omega_{\iota\theta\alpha} \partial^{\theta} f^{\alpha\iota} + 2 t_2 \partial_{\alpha} f_{\iota\theta} \partial^{\theta} f^{\alpha\iota} - t_2 \partial_{\alpha} f_{\theta\iota} \partial^{\theta} f^{\alpha\iota} - \\ & t_2 \partial_{\iota} f_{\alpha\theta} \partial^{\theta} f^{\alpha\iota} + t_2 \partial_{\theta} f_{\alpha\iota} \partial^{\theta} f^{\alpha\iota} - t_2 \partial_{\theta} f_{\iota\alpha} \partial^{\theta} f^{\alpha\iota} - \\ & 4 t_2 \omega_{\alpha\theta\iota} (\omega^{\alpha\iota\theta} + \partial^{\theta} f^{\alpha\iota}) + 2 t_2 \omega_{\alpha\theta} (\omega^{\alpha\theta} + 2 \partial^{\theta} f^{\alpha\iota}) + \\ & 8 r_2 \partial_{\beta} \omega_{\alpha\theta} \partial^{\theta} \omega^{\alpha\beta\iota} - 4 r_2 \partial_{\beta} \omega_{\alpha\theta\iota} \partial^{\theta} \omega^{\alpha\beta\iota} + \\ & 4 r_2 \partial_{\beta} \omega_{\iota\theta\alpha} \partial^{\theta} \omega^{\alpha\beta\iota} - 24 r_3 \partial_{\beta} \omega_{\iota\theta\alpha} \partial^{\theta} \omega^{\alpha\beta\iota} - \\ & 2 r_2 \partial_{\iota} \omega_{\alpha\theta\beta} \partial^{\theta} \omega^{\alpha\beta\iota} + 2 r_2 \partial_{\theta} \omega_{\alpha\beta\iota} \partial^{\theta} \omega^{\alpha\beta\iota} - \\ & 4 r_2 \partial_{\theta} \omega_{\alpha\beta} \partial^{\theta} \omega^{\alpha\beta\iota} + 4 t_3 \partial_{\kappa} f^{\alpha\iota} \partial_{\alpha} f^{\kappa} - \\ & \left. 8 t_3 \partial^{\iota} f^{\alpha} \partial_{\alpha} f^{\kappa} \right) [t, x, y, z] dz dy dx dt \end{aligned}$$

The diagram shows two vertices connected by a horizontal dashed line representing a massive particle. The left vertex has two external lines (one solid, one dashed) and is labeled $J^P = 0^-$. The right vertex has two external lines (one solid, one dashed). A momentum vector k^μ is shown below the dashed line pointing from left to right. To the right of the diagram is a table with properties of the massive particle.

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

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

$$\begin{array}{c}
\begin{array}{ccc}
\omega_{2^+ \alpha \beta}^{\#1} & f_{2^+ \alpha \beta}^{\#1} & \omega_{2^+ \alpha \beta \chi}^{\#1} \\
\omega_{2^+}^{\#1} \dagger \alpha \beta & -\frac{3k^2 r_3}{2} & 0 & 0 \\
f_{2^+}^{\#1} \dagger \alpha \beta & 0 & 0 & 0 \\
\omega_{2^+}^{\#1} \dagger \alpha \beta \chi & 0 & 0 & 0
\end{array} \\
\begin{array}{ccc}
\sigma_{0^+}^{\#1} & \tau_{0^+}^{\#1} & \tau_{0^+}^{\#2} & \sigma_{0^+}^{\#1} \\
\sigma_{0^+}^{\#1} \dagger & \frac{1}{(1+2k^2)^2 t_3} & -\frac{i\sqrt{2}k}{(1+2k^2)^2 t_3} & 0 & 0 \\
\tau_{0^+}^{\#1} \dagger & \frac{i\sqrt{2}k}{(1+2k^2)^2 t_3} & \frac{2k^2}{(1+2k^2)^2 t_3} & 0 & 0 \\
\tau_{0^+}^{\#2} \dagger & 0 & 0 & 0 & 0 \\
\sigma_{0^+}^{\#1} \dagger & 0 & 0 & 0 & \frac{1}{k^2 r_2 + t_2}
\end{array}
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\quad
\begin{array}{c}
\begin{array}{ccc}
\sigma_{2^+}^{\#1} \dagger \alpha \beta & \tau_{2^+}^{\#1} \dagger \alpha \beta & \sigma_{2^+}^{\#1} \dagger \alpha \beta \chi \\
\sigma_{2^+}^{\#1} \dagger \alpha \beta & -\frac{2}{3k^2 r_3} & 0 & 0 \\
\tau_{2^+}^{\#1} \dagger \alpha \beta & 0 & 0 & 0 \\
\sigma_{2^+}^{\#1} \dagger \alpha \beta \chi & 0 & 0 & 0
\end{array} \\
\begin{array}{ccc}
\omega_0^{\#1} & f_{0^+}^{\#2} & f_{0^+}^{\#1} & \omega_0^{\#1} \\
\omega_0^{\#1} & 0 & 0 & 0 & k^2 r_2 + t_2 \\
f_{0^+}^{\#2} & 0 & 0 & 0 & 0 \\
f_{0^+}^{\#1} & -i\sqrt{2}kt_3 & 2k^2 t_3 & 0 & 0 \\
\omega_0^{\#1} & t_3 & i\sqrt{2}kt_3 & 0 & 0
\end{array}
\end{array}$$