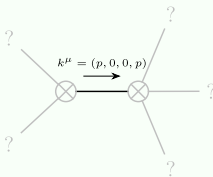


Wave operator and propagator

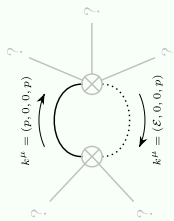
$$\begin{array}{c}
\begin{array}{cc}
\begin{array}{c} \#1 \\ 0^+ h \end{array} & \begin{array}{c} \#2 \\ 0^+ h \end{array} \\
\begin{array}{c} \#1 \\ 0^+ h \uparrow \end{array} & \begin{array}{c} \#2 \\ 0^+ h \uparrow \end{array}
\end{array}
\begin{array}{|c|c|}
\hline
(3\alpha - \beta)k^2 & 0 \\
\hline
0 & (\alpha - \beta)k^2 \\
\hline
\end{array}
\end{array}
\quad
\begin{array}{c}
\begin{array}{cc}
\begin{array}{c} \#1 \\ 0^+ \uparrow \end{array} & \begin{array}{c} \#2 \\ 0^+ \uparrow \end{array} \\
\begin{array}{c} \#1 \\ 0^+ \uparrow \end{array} & \begin{array}{c} \#2 \\ 0^+ \uparrow \end{array}
\end{array}
\begin{array}{|c|c|}
\hline
\frac{2}{(3\alpha\beta)k^2} & 0 \\
\hline
0 & \frac{2}{(\alpha\beta)k^2} \\
\hline
\end{array}
\end{array}
\quad
\begin{array}{c}
\begin{array}{c} \#1 \\ 1^+ \alpha \\ 1^+ h \end{array}
\begin{array}{c} \#1 \\ 0^+ \uparrow \end{array}
\begin{array}{c} \#2 \\ 0^+ \uparrow \end{array}
\end{array}
\begin{array}{|c|}
\hline
\frac{1}{2}(\alpha - \beta)k^2 \\
\hline
\end{array}
\quad
\begin{array}{c}
\begin{array}{c} \#1 \\ 2^+ \uparrow \end{array}
\begin{array}{c} \#1 \\ 0^+ \uparrow \end{array}
\begin{array}{c} \#2 \\ 0^+ \uparrow \end{array}
\end{array}
\begin{array}{|c|}
\hline
\frac{-2}{\beta k^2} \\
\hline
\end{array}
\quad
\begin{array}{c}
\begin{array}{c} \#1 \\ 2^+ \uparrow \end{array}
\begin{array}{c} \#1 \\ 0^+ \uparrow \end{array}
\begin{array}{c} \#2 \\ 0^+ \uparrow \end{array}
\end{array}
\begin{array}{|c|}
\hline
\frac{-\beta k^2}{2} \\
\hline
\end{array}
\quad
\begin{array}{c}
\begin{array}{c} \#1 \\ 2^+ \uparrow \end{array}
\begin{array}{c} \#1 \\ 0^+ \uparrow \end{array}
\begin{array}{c} \#2 \\ 0^+ \uparrow \end{array}
\end{array}
\begin{array}{|c|}
\hline
\frac{-\beta k^2}{2} \\
\hline
\end{array}
\quad
\begin{array}{c}
\begin{array}{c} \#1 \\ 1^+ \tau^\alpha \\ 1^+ h \end{array}
\begin{array}{c} \#1 \\ 0^+ \uparrow \end{array}
\begin{array}{c} \#2 \\ 0^+ \uparrow \end{array}
\end{array}
\begin{array}{|c|}
\hline
\frac{2}{(\alpha\beta)k^2} \\
\hline
\end{array}$$

A diagram showing a bubble with two vertices, each marked with a cross. Four external lines extend from the vertices, each ending in a question mark. The top arc of the bubble is labeled $k^\mu = (p, 0, 0, p)$ with an arrow pointing right. The bottom arc is labeled $k^\mu = (\mathcal{E}, 0, 0, p)$ with an arrow pointing left.

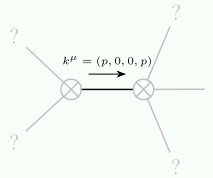
Pole residue:	0	$< \frac{-3 + \sqrt{57 + 48(\alpha - \beta)^2 p^2}}{(\alpha - \beta)(3\alpha - \beta)\beta} \&\& \frac{-3 + \sqrt{57 + 48(\alpha - \beta)^2 p^2}}{(\alpha - \beta)(3\alpha - \beta)\beta} > 0$
Polarisations:	1	



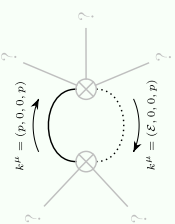
Pole residue:	$-\frac{2\alpha^2-5\alpha\beta+2\beta^2+\sqrt{\alpha^2(4\alpha^2-8\alpha\beta+5\beta^2)}}{3\alpha^2\beta-4\alpha\beta+\beta^3}$	>0
Polarisations:	1	



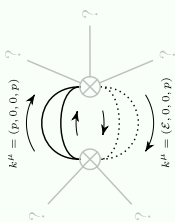
Pole residue:	$0 < \frac{\alpha}{\beta(-\alpha+\beta)} \&\& \frac{\alpha}{\beta(-\alpha+\beta)} > 0$
Polarisations:	2



Massless particle



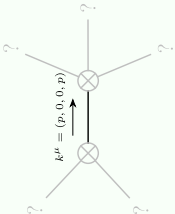
Pole residue:	$0 < -\frac{3 + \sqrt{57 + 48(\alpha\beta)^2} p^2}{(\alpha\beta)(3 - \alpha\beta)\beta}$	$\&\& -\frac{3 + \sqrt{57 + 48(\alpha\beta)^2} p^2}{(\alpha\beta)(3 - \alpha\beta)\beta} > 0$
Polarisations:	1	



(No particles)

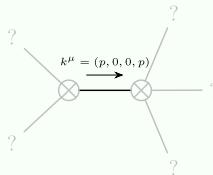
Hexic pole

Pole residue:	$-\frac{1}{3\alpha^2\beta^4\alpha\beta+\beta^3}$ & $-\frac{1}{3\alpha^2\beta^4\alpha\beta+\beta^3}$
Polarisations:	1



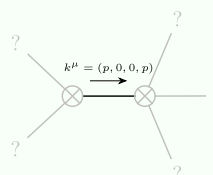
Massless particle

Pole residue:	$\frac{-2\alpha^2 + 5\alpha\beta 2\beta^2 + \sqrt{\alpha^2(4\alpha^2 - 8\alpha\beta + 5\beta^2)}}{\beta(3\alpha^2 - 4\alpha\beta + \beta^2)}$	> 0
Polarisations:	1	



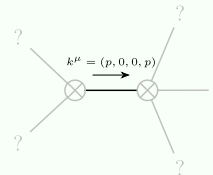
Massless particle

Pole residue:	$-\frac{\alpha^2 - 6\alpha\beta + 2\beta^2}{3\alpha^2\beta - 4\alpha\beta^2 + \beta^3} > 0$
Polarisations:	1



Massless particle

Poleresidue:	$\frac{1}{\beta} + \frac{1}{-\alpha+\beta} > 0$
Polarisations:	2



Massless particle

Poleresidue:	$\frac{\alpha-2\beta}{\beta(-\alpha+\beta)} > 0$
Polarisations:	2

Unitarity conditions