

X=T, n=3 : Operators and Kinematic Factors

E.T.

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(4, 1)

(Block 1) Trace = 0, Mixed Symmetry, C = 1

$$\begin{aligned} O_1^{T(4,1),1} &= O_{2,1,2} + O_{3,1,3} + O_{4,1,4} \\ K_1^{T(4,1),1} &= \frac{ip_2(E(p)^2 - m_N^2 - p_1^2 - p_2^2 - p_3^2)}{(E(p)(E(p) + m_N))} \end{aligned}$$

$$\begin{aligned} O_2^{T(4,1),1} &= O_{1,2,1} + O_{3,2,3} + O_{4,2,4} \\ K_2^{T(4,1),1} &= \frac{ip_1(-E(p)^2 + m_N^2 + p_1^2 + p_2^2 + p_3^2)}{(E(p)(E(p) + m_N))} \end{aligned}$$

$$\begin{aligned} O_3^{T(4,1),1} &= O_{1,3,1} + O_{2,3,2} + O_{4,3,4} \\ K_3^{T(4,1),1} &= 0 \end{aligned}$$

$$\begin{aligned} O_4^{T(4,1),1} &= O_{1,4,1} + O_{2,4,2} + O_{3,4,3} \\ K_4^{T(4,1),1} &= 0 \end{aligned}$$

(Block 2) Trace = 0, Mixed Symmetry, C = 1

$$\begin{aligned} O_1^{T(4,1),2} &= O_{2,2,1} + O_{3,3,1} + O_{4,4,1} \\ K_1^{T(4,1),2} &= 0 \end{aligned}$$

$$\begin{aligned} O_2^{T(4,1),2} &= O_{1,1,2} + O_{3,3,2} + O_{4,4,2} \\ K_2^{T(4,1),2} &= 0 \end{aligned}$$

$$\begin{aligned} O_3^{T(4,1),2} &= O_{1,1,3} + O_{2,2,3} + O_{4,4,3} \\ K_3^{T(4,1),2} &= 0 \end{aligned}$$

$$\begin{aligned} O_4^{T(4,1),2} &= O_{1,1,4} + O_{2,2,4} + O_{3,3,4} \\ K_4^{T(4,1),2} &= 0 \end{aligned}$$

(Block 3) Trace = 0, Symmetric, C = 1

$$\begin{aligned} O_1^{T(4,1),3} &= O_{1,1,1} \\ K_1^{T(4,1),3} &= 0 \end{aligned}$$

$$\begin{aligned} O_2^{T(4,1),3} &= O_{2,2,2} \\ K_2^{T(4,1),3} &= 0 \end{aligned}$$

$$\begin{aligned} O_3^{T(4,1),3} &= O_{3,3,3} \\ K_3^{T(4,1),3} &= 0 \end{aligned}$$

$$\begin{aligned} O_4^{T(4,1),3} &= O_{4,4,4} \\ K_4^{T(4,1),3} &= 0 \end{aligned}$$

(Block 4) Trace = 0, Mixed Symmetry, C = 1

$$O_1^{T(4,1),4} = O_{1,2,2} + O_{1,3,3} + O_{1,4,4}$$

$$K_1^{T(4,1),4} = \frac{ip_2(-E(p)^2 + m_N^2 + p_1^2 + p_2^2 + p_3^2)}{(E(p)(E(p) + m_N))}$$

$$O_2^{T(4,1),4} = O_{2,1,1} + O_{2,3,3} + O_{2,4,4}$$

$$K_2^{T(4,1),4} = \frac{ip_1(E(p)^2 - m_N^2 - p_1^2 - p_2^2 - p_3^2)}{(E(p)(E(p) + m_N))}$$

$$O_3^{T(4,1),4} = O_{3,1,1} + O_{3,2,2} + O_{3,4,4}$$

$$K_3^{T(4,1),4} = 0$$

$$O_4^{T(4,1),4} = O_{4,1,1} + O_{4,2,2} + O_{4,3,3}$$

$$K_4^{T(4,1),4} = 0$$

(4, 2)

(Block 1) Trace = 0, Symmetric, C = 1

$$\begin{aligned} O_1^{T(4,2),1} &= O_{2,3,4} + O_{2,4,3} + O_{3,2,4} + O_{3,4,2} + O_{4,2,3} + O_{4,3,2} \\ K_1^{T(4,2),1} &= 0 \end{aligned}$$

$$\begin{aligned} O_2^{T(4,2),1} &= O_{1,3,4} + O_{1,4,3} + O_{3,1,4} + O_{3,4,1} + O_{4,1,3} + O_{4,3,1} \\ K_2^{T(4,2),1} &= 0 \end{aligned}$$

$$\begin{aligned} O_3^{T(4,2),1} &= O_{1,2,4} + O_{1,4,2} + O_{2,1,4} + O_{2,4,1} + O_{4,1,2} + O_{4,2,1} \\ K_3^{T(4,2),1} &= 0 \end{aligned}$$

$$\begin{aligned} O_4^{T(4,2),1} &= O_{1,2,3} + O_{1,3,2} + O_{2,1,3} + O_{2,3,1} + O_{3,1,2} + O_{3,2,1} \\ K_4^{T(4,2),1} &= 0 \end{aligned}$$

(4, 4)

(Block 1) Trace = 0, Antisymmetric, C = 1

$$O_1^{T(4,4),1} = O_{2,3,4} - O_{2,4,3} - O_{3,2,4} + O_{3,4,2} + O_{4,2,3} - O_{4,3,2}$$

$$K_1^{T(4,4),1} = \frac{-4m_N p_1 p_3}{(E(p)(E(p) + m_N))}$$

$$O_2^{T(4,4),1} = O_{1,3,4} - O_{1,4,3} - O_{3,1,4} + O_{3,4,1} + O_{4,1,3} - O_{4,3,1}$$

$$K_2^{T(4,4),1} = \frac{4m_N p_2 p_3}{(E(p)(E(p) + m_N))}$$

$$O_3^{T(4,4),1} = O_{1,2,4} - O_{1,4,2} - O_{2,1,4} + O_{2,4,1} + O_{4,1,2} - O_{4,2,1}$$

$$K_3^{T(4,4),1} = \frac{2(-E(p)^3 - 2E(p)^2 m_N - E(p)m_N^2 + E(p)p_1^2 + E(p)p_2^2 + E(p)p_3^2 + 2m_N p_1^2 + 2m_N p_2^2)}{(E(p)(E(p) + m_N))}$$

$$O_4^{T(4,4),1} = O_{1,2,3} - O_{1,3,2} - O_{2,1,3} + O_{2,3,1} + O_{3,1,2} - O_{3,2,1}$$

$$K_4^{T(4,4),1} = \frac{2ip_3(E(p)^2 + 2E(p)m_N + m_N^2 - p_1^2 - p_2^2 - p_3^2)}{(E(p)(E(p) + m_N))}$$

(8, 1)

(Block 1) Trace = 0, Mixed Symmetry, C = 1

$$O_1^{T(8,1),1} = O_{2,1,2} - O_{3,1,3}/2 - O_{4,1,4}/2$$

$$K_1^{T(8,1),1} = \frac{ip_2(-2E(p)^2 - 3E(p)m_N - m_N^2 - p_1^2 - p_2^2 + 2p_3^2)}{(E(p)(E(p) + m_N))}$$

$$O_2^{T(8,1),1} = O_{1,2,1} - O_{3,2,3}/2 - O_{4,2,4}/2$$

$$K_2^{T(8,1),1} = \frac{ip_1(2E(p)^2 + 3E(p)m_N + m_N^2 + p_1^2 + p_2^2 - 2p_3^2)}{(E(p)(E(p) + m_N))}$$

$$O_3^{T(8,1),1} = O_{1,3,1} + O_{2,3,2} - 2O_{4,3,4}$$

$$K_3^{T(8,1),1} = 0$$

$$O_4^{T(8,1),1} = O_{1,4,1} + O_{2,4,2} - 2O_{3,4,3}$$

$$K_4^{T(8,1),1} = 0$$

$$O_5^{T(8,1),1} = O_{3,1,3} - O_{4,1,4}$$

$$K_5^{T(8,1),1} = \frac{-2ip_2(E(p)^2 + E(p)m_N + p_3^2)}{(E(p)(E(p) + m_N))}$$

$$O_6^{T(8,1),1} = O_{3,2,3} - O_{4,2,4}$$

$$K_6^{T(8,1),1} = \frac{2ip_1(E(p)^2 + E(p)m_N + p_3^2)}{(E(p)(E(p) + m_N))}$$

$$O_7^{T(8,1),1} = O_{1,3,1} - O_{2,3,2}$$

$$K_7^{T(8,1),1} = \frac{4ip_1p_2p_3}{(E(p)(E(p) + m_N))}$$

$$O_8^{T(8,1),1} = O_{1,4,1} - O_{2,4,2}$$

$$K_8^{T(8,1),1} = \frac{-4p_1p_2}{E(p)}$$

(Block 2) Trace = 0, Mixed Symmetry, C = 1

$$\begin{aligned} O_1^{T(8,1),2} &= O_{2,2,1} - O_{3,3,1}/2 - O_{4,4,1}/2 \\ K_1^{T(8,1),2} &= 0 \end{aligned}$$

$$\begin{aligned} O_2^{T(8,1),2} &= O_{1,1,2} - O_{3,3,2}/2 - O_{4,4,2}/2 \\ K_2^{T(8,1),2} &= 0 \end{aligned}$$

$$\begin{aligned} O_3^{T(8,1),2} &= O_{1,1,3} + O_{2,2,3} - 2O_{4,4,3} \\ K_3^{T(8,1),2} &= 0 \end{aligned}$$

$$\begin{aligned} O_4^{T(8,1),2} &= O_{1,1,4} + O_{2,2,4} - 2O_{3,3,4} \\ K_4^{T(8,1),2} &= 0 \end{aligned}$$

$$\begin{aligned} O_5^{T(8,1),2} &= O_{3,3,1} - O_{4,4,1} \\ K_5^{T(8,1),2} &= 0 \end{aligned}$$

$$\begin{aligned} O_6^{T(8,1),2} &= O_{3,3,2} - O_{4,4,2} \\ K_6^{T(8,1),2} &= 0 \end{aligned}$$

$$\begin{aligned} O_7^{T(8,1),2} &= O_{1,1,3} - O_{2,2,3} \\ K_7^{T(8,1),2} &= 0 \end{aligned}$$

$$\begin{aligned} O_8^{T(8,1),2} &= O_{1,1,4} - O_{2,2,4} \\ K_8^{T(8,1),2} &= 0 \end{aligned}$$

(Block 3) Trace = 0, Mixed Symmetry, C = 1

$$O_1^{T(8,1),3} = O_{1,2,2} - O_{1,3,3}/2 - O_{1,4,4}/2$$

$$K_1^{T(8,1),3} = \frac{ip_2(2E(p)^2 + 3E(p)m_N + m_N^2 + p_1^2 + p_2^2 - 2p_3^2)}{(E(p)(E(p) + m_N))}$$

$$O_2^{T(8,1),3} = O_{2,1,1} - O_{2,3,3}/2 - O_{2,4,4}/2$$

$$K_2^{T(8,1),3} = \frac{ip_1(-2E(p)^2 - 3E(p)m_N - m_N^2 - p_1^2 - p_2^2 + 2p_3^2)}{(E(p)(E(p) + m_N))}$$

$$O_3^{T(8,1),3} = O_{3,1,1} + O_{3,2,2} - 2O_{3,4,4}$$

$$K_3^{T(8,1),3} = 0$$

$$O_4^{T(8,1),3} = O_{4,1,1} + O_{4,2,2} - 2O_{4,3,3}$$

$$K_4^{T(8,1),3} = 0$$

$$O_5^{T(8,1),3} = O_{1,3,3} - O_{1,4,4}$$

$$K_5^{T(8,1),3} = \frac{2ip_2(E(p)^2 + E(p)m_N + p_3^2)}{(E(p)(E(p) + m_N))}$$

$$O_6^{T(8,1),3} = O_{2,3,3} - O_{2,4,4}$$

$$K_6^{T(8,1),3} = \frac{-2ip_1(E(p)^2 + E(p)m_N + p_3^2)}{(E(p)(E(p) + m_N))}$$

$$O_7^{T(8,1),3} = O_{3,1,1} - O_{3,2,2}$$

$$K_7^{T(8,1),3} = \frac{-4ip_1p_2p_3}{(E(p)(E(p) + m_N))}$$

$$O_8^{T(8,1),3} = O_{4,1,1} - O_{4,2,2}$$

$$K_8^{T(8,1),3} = \frac{4p_1p_2}{E(p)}$$

(8, 2)

(Block 1) Trace = 0, Mixed Symmetry, C = 1

$$O_1^{T(8,2),1} = O_{2,3,4} + O_{2,4,3} - O_{3,2,4} - O_{4,2,3}$$

$$K_1^{T(8,2),1} = \frac{4p_1p_3(2E(p) + m_N)}{(E(p)(E(p) + m_N))}$$

$$O_2^{T(8,2),1} = O_{1,3,4} + O_{1,4,3} - O_{3,1,4} - O_{4,1,3}$$

$$K_2^{T(8,2),1} = \frac{-4p_2p_3(2E(p) + m_N)}{(E(p)(E(p) + m_N))}$$

$$O_3^{T(8,2),1} = O_{1,4,2} + O_{2,4,1} - O_{4,1,2} - O_{4,2,1}$$

$$K_3^{T(8,2),1} = \frac{4(p_1^2 - p_2^2)}{E(p)}$$

$$O_4^{T(8,2),1} = O_{1,3,2} + O_{2,3,1} - O_{3,1,2} - O_{3,2,1}$$

$$K_4^{T(8,2),1} = \frac{4ip_3(-p_1^2 + p_2^2)}{(E(p)(E(p) + m_N))}$$

$$O_5^{T(8,2),1} = O_{2,3,4} - O_{2,4,3} - O_{3,2,4} - 2O_{3,4,2} + O_{4,2,3} + 2O_{4,3,2}$$

$$K_5^{T(8,2),1} = \frac{-4m_Np_1p_3}{(E(p)(E(p) + m_N))}$$

$$O_6^{T(8,2),1} = O_{1,3,4} - O_{1,4,3} - O_{3,1,4} - 2O_{3,4,1} + O_{4,1,3} + 2O_{4,3,1}$$

$$K_6^{T(8,2),1} = \frac{4m_Np_2p_3}{(E(p)(E(p) + m_N))}$$

$$O_7^{T(8,2),1} = O_{1,2,4} + O_{1,4,2}/2 - O_{2,1,4} - O_{2,4,1}/2 - O_{4,1,2}/2 + O_{4,2,1}/2$$

$$K_7^{T(8,2),1} = \frac{2(-E(p)^3 - 2E(p)^2m_N - E(p)m_N^2 - 2E(p)p_1^2 - 2E(p)p_2^2 + E(p)p_3^2 - m_Np_1^2 - m_Np_2^2)}{(E(p)(E(p) + m_N))}$$

$$O_8^{T(8,2),1} = O_{1,2,3} + O_{1,3,2}/2 - O_{2,1,3} - O_{2,3,1}/2 - O_{3,1,2}/2 + O_{3,2,1}/2$$

$$K_8^{T(8,2),1} = \frac{2ip_3(E(p)^2 + 2E(p)m_N + m_N^2 + 2p_1^2 + 2p_2^2 - p_3^2)}{(E(p)(E(p) + m_N))} \frac{1}{11}$$

(Block 2) Trace = 0, Mixed Symmetry, C = 1

$$O_1^{T(8,2),2} = O_{2,3,4} + O_{2,4,3} - O_{3,4,2} - O_{4,3,2}$$

$$K_1^{T(8,2),2} = \frac{2p_1 p_3 (2E(p) + m_N)}{(E(p)(E(p) + m_N))}$$

$$O_2^{T(8,2),2} = O_{1,3,4} + O_{1,4,3} - O_{3,4,1} - O_{4,3,1}$$

$$K_2^{T(8,2),2} = \frac{-2p_2 p_3 (2E(p) + m_N)}{(E(p)(E(p) + m_N))}$$

$$O_3^{T(8,2),2} = O_{1,2,4} + O_{2,1,4} - O_{4,1,2} - O_{4,2,1}$$

$$K_3^{T(8,2),2} = \frac{2(p_1^2 - p_2^2)}{E(p)}$$

$$O_4^{T(8,2),2} = O_{1,2,3} + O_{2,1,3} - O_{3,1,2} - O_{3,2,1}$$

$$K_4^{T(8,2),2} = \frac{2ip_3(-p_1^2 + p_2^2)}{(E(p)(E(p) + m_N))}$$

$$O_5^{T(8,2),2} = O_{2,3,4} - O_{2,4,3} + 2O_{3,2,4} + O_{3,4,2} - 2O_{4,2,3} - O_{4,3,2}$$

$$K_5^{T(8,2),2} = \frac{2m_N p_1 p_3}{(E(p)(E(p) + m_N))}$$

$$O_6^{T(8,2),2} = O_{1,3,4} - O_{1,4,3} + 2O_{3,1,4} + O_{3,4,1} - 2O_{4,1,3} - O_{4,3,1}$$

$$K_6^{T(8,2),2} = \frac{-2m_N p_2 p_3}{(E(p)(E(p) + m_N))}$$

$$O_7^{T(8,2),2} = O_{1,2,4} + 2O_{1,4,2} - O_{2,1,4} - 2O_{2,4,1} + O_{4,1,2} - O_{4,2,1}$$

$$K_7^{T(8,2),2} = \frac{2(-E(p)^3 - 2E(p)^2 m_N - E(p)m_N^2 - 2E(p)p_1^2 - 2E(p)p_2^2 + E(p)p_3^2 - m_N p_1^2 - m_N p_2^2)}{(E(p)(E(p) + m_N))}$$

$$O_8^{T(8,2),2} = O_{1,2,3} + 2O_{1,3,2} - O_{2,1,3} - 2O_{2,3,1} + O_{3,1,2} - O_{3,2,1}$$

$$K_8^{T(8,2),2} = \frac{2ip_3(E(p)^2 + 2E(p)m_N + m_N^2 + 2p_1^2 + 2p_2^2 - p_3^2)}{(E(p)(E(p) + m_N))}$$