

# 1. AUTO-COVARIANCE

$$\begin{aligned}
\mathbf{C}_{00}^G(k_1, k_2) &\simeq \sum_{\ell'_1, \ell'_2} P_{\ell'_1}(k_1) P_{\ell'_2}(k_2) \left\{ \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} W_{22}(\mathbf{x}_1) W_{22}(\mathbf{x}_2) e^{-i(\mathbf{x}_1 - \mathbf{x}_2) \cdot (\mathbf{k}_1 - \mathbf{k}_2)} \right. \\
&\quad \left. \times \mathcal{L}_{\ell'_1}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right\}, \\
\mathbf{C}_{22}^G(k_1, k_2) &\simeq \sum_{\ell'_1, \ell'_2} P_{\ell'_1}(k_1) P_{\ell'_2}(k_2) \left\{ \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} W_{22}(\mathbf{x}_1) W_{22}(\mathbf{x}_2) e^{-i(\mathbf{x}_1 - \mathbf{x}_2) \cdot (\mathbf{k}_1 - \mathbf{k}_2)} \right. \\
&\quad \left. \times \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_1}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \left[ \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right] \right\}, \\
\mathbf{C}_{44}^G(k_1, k_2) &\simeq \sum_{\ell'_1, \ell'_2} P_{\ell'_1}(k_1) P_{\ell'_2}(k_2) \left\{ \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} W_{22}(\mathbf{x}_1) W_{22}(\mathbf{x}_2) e^{-i(\mathbf{x}_1 - \mathbf{x}_2) \cdot (\mathbf{k}_1 - \mathbf{k}_2)} \right. \\
&\quad \left. \times \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_1}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \left[ \mathcal{L}_4(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right] \right\},
\end{aligned} \tag{1}$$

Shot noise in  $\mathbf{C}_{\ell_1 \ell_2}(k_1, k_2)$

$$\begin{aligned}
C_{\ell_1 \ell_2}^{\text{SN-G}}(k_1, k_2) &= \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} \left\{ (1 + \bar{\alpha})^2 W_{12}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} \mathcal{L}_{\ell_1}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \left[ \mathcal{L}_{\ell_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_{\ell_2}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) \right] \right. \\
&\quad \left. + (1 + \bar{\alpha}) \sum_{\ell'_1} P_{\ell'_1}(k_1) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} W_{12}(\mathbf{x}_1) W_{22}(\mathbf{x}_2) \mathcal{L}_{\ell'_1}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \right. \\
&\quad \left. \times \left[ \mathcal{L}_{\ell_1}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell_2}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_{\ell_1}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_{\ell_1}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_{\ell_1}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell_2}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) \right] \right\}
\end{aligned} \tag{2}$$

Shot noise in auto-covariance:

$$\begin{aligned}
\mathbf{C}_{00}^{\text{SN-G}}(k_1, k_2) &= \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} \left\{ (1 + \bar{\alpha})^2 W_{12}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} \right. \\
&\quad \left. + (1 + \bar{\alpha}) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} W_{22}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) \left[ \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_1) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) + \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_2) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right] \right\} \\
\mathbf{C}_{22}^{\text{SN-G}}(k_1, k_2) &= \frac{25}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} \left\{ (1 + \bar{\alpha})^2 W_{12}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \left[ \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) \right] \right. \\
&\quad \left. + (1 + \bar{\alpha}) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} W_{22}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) \left[ \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_1) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) + \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_2) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right] \right. \\
&\quad \left. \times \left[ \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) \right] \right\} \\
\mathbf{C}_{44}^{\text{SN-G}}(k_1, k_2) &= \frac{81}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} \left\{ (1 + \bar{\alpha})^2 W_{12}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \left[ \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_4(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) \right] \right. \\
&\quad \left. + (1 + \bar{\alpha}) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} W_{22}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) \left[ \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_1) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) + \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_2) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right] \right. \\
&\quad \left. \times \left[ \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_4(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_4(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_4(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_4(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) \right] \right\}
\end{aligned} \tag{3}$$

Going to higher order in multipoles

$$\mathcal{L}_6 = \frac{11}{5} \mathcal{L}_4 \mathcal{L}_2 - \frac{4}{7} \mathcal{L}_4^2 - \frac{22}{35} \mathcal{L}_2^2 \tag{4}$$

## 2. CROSS-COVARIANCE

Interchanging  $\ell'_1$  and  $\ell'_2$  in Eq. (56)

$$\begin{aligned} & \mathbf{C}_{\ell_1 \ell_2}^G(k_1, k_2) \\ & \simeq \sum_{\ell'_1, \ell'_2} P_{\ell'_1}(k_1) P_{\ell'_2}(k_2) \left\{ \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} W_{22}(\mathbf{x}_1) W_{22}(\mathbf{x}_2) e^{-i(\mathbf{x}_1 - \mathbf{x}_2) \cdot (\mathbf{k}_1 - \mathbf{k}_2)} \right. \\ & \quad \times \mathcal{L}_{\ell_1}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_1}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \left[ \mathcal{L}_{\ell_2}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_{\ell_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right] \Big\}, \end{aligned} \quad (5)$$

### 1. $\mathbf{C}_{02}$

$$\begin{aligned} & \mathbf{C}_{20}^G(k_1, k_2) \\ & \simeq \sum_{\ell'_1, \ell'_2} P_{\ell'_1}(k_1) P_{\ell'_2}(k_2) \left\{ \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} W_{22}(\mathbf{x}_1) W_{22}(\mathbf{x}_2) e^{-i(\mathbf{x}_1 - \mathbf{x}_2) \cdot (\mathbf{k}_1 - \mathbf{k}_2)} \right. \\ & \quad \times 2\mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_1}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \Big\}, \end{aligned} \quad (6)$$

Shot noise in  $\mathbf{C}_{20}(k_1, k_2)$

$$\begin{aligned} C_{20}^{\text{SN-G}}(k_1, k_2) &= \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} \\ & \times 2 \left\{ (1 + \bar{\alpha})^2 W_{12}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \right. \\ & \quad + (1 + \bar{\alpha}) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} W_{22}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) \left[ \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) + \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \right] \\ & \quad \times \left[ \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_1) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) + \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_2) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right] \Big\} \end{aligned} \quad (7)$$

### 2. $\mathbf{C}_{40}$

$$\begin{aligned} & \mathbf{C}_{40}^G(k_1, k_2) \\ & \simeq \sum_{\ell'_1, \ell'_2} P_{\ell'_1}(k_1) P_{\ell'_2}(k_2) \left\{ \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} W_{22}(\mathbf{x}_1) W_{22}(\mathbf{x}_2) e^{-i(\mathbf{x}_1 - \mathbf{x}_2) \cdot (\mathbf{k}_1 - \mathbf{k}_2)} \right. \\ & \quad \times 2\mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_1}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \Big\}, \end{aligned} \quad (8)$$

Shot noise in  $\mathbf{C}_{40}(k_1, k_2)$

$$\begin{aligned} C_{40}^{\text{SN-G}}(k_1, k_2) &= \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} \\ & \times 2 \left\{ (1 + \bar{\alpha})^2 W_{12}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \right. \\ & \quad + (1 + \bar{\alpha}) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} W_{22}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) \left[ \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) + \mathcal{L}_4(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \right] \\ & \quad \times \left[ \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_1) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) + \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_2) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right] \Big\} \end{aligned} \quad (9)$$

3.  $C_{42}$ 

$$\begin{aligned} \mathbf{C}_{42}^G(k_1, k_2) \simeq \sum_{\ell'_1, \ell'_2} P_{\ell'_1}(k_1) P_{\ell'_2}(k_2) & \left\{ \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} W_{22}(\mathbf{x}_1) W_{22}(\mathbf{x}_2) e^{-i(\mathbf{x}_1 - \mathbf{x}_2) \cdot (\mathbf{k}_1 - \mathbf{k}_2)} \right. \\ & \left. \times \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_1}(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_{\ell'_2}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \left[ \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right] \right\}, \end{aligned} \quad (10)$$

Shot noise in  $\mathbf{C}_{42}(k_1, k_2)$

$$\begin{aligned} \mathbf{C}_{\ell_1 \ell_2}^{\text{SN-G}}(k_1, k_2) &= \frac{(2\ell_1 + 1)(2\ell_2 + 1)}{I_{22}^2} \int_{\hat{\mathbf{k}}_1, \hat{\mathbf{k}}_2, \mathbf{x}_1, \mathbf{x}_2} \\ & \times \left\{ (1 + \bar{\alpha})^2 W_{12}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \left[ \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) \right] \right. \\ & \quad \left. + (1 + \bar{\alpha}) e^{-i(\mathbf{k}_1 - \mathbf{k}_2) \cdot (\mathbf{x}_1 - \mathbf{x}_2)} W_{22}(\mathbf{x}_1) W_{12}(\mathbf{x}_2) \left[ \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_1) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) + \frac{1}{2} \sum_{\ell'} P_{\ell'}(k_2) \mathcal{L}_{\ell'}(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) \right] \right. \\ & \quad \left. \times \left[ \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_4(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_4(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_2(\hat{\mathbf{x}}_1 \cdot \hat{\mathbf{k}}_2) + \mathcal{L}_4(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_1) \mathcal{L}_2(\hat{\mathbf{x}}_2 \cdot \hat{\mathbf{k}}_2) \right] \right\} \end{aligned} \quad (11)$$