$$\langle D_1 \sqcup\!\!\sqcup D_2 \rangle$$

$$= \langle D_1 \overline{\sqcup} D_2 \rangle - q \langle D_1 \sqcup\!\!\sqcup D_2 \rangle$$

$$= \langle D_1 \overline{\sqcup} D_2 \rangle - q \langle D_1 \times D_2 \rangle$$

$$= \left\langle \begin{matrix} P_1 \\ \bigcirc \\ D_2 \end{matrix} \right\rangle - q \left\langle \begin{matrix} P_1 \\ \times \\ D_2 \end{matrix} \right\rangle$$

$$= \left\langle \begin{matrix} P_1 \\ \| \\ D_2 \end{matrix} \right\rangle - q \left\langle \begin{matrix} P_1 \\ \| \\ D_2 \end{matrix} \sqcup \bigcirc \right\rangle - q \left\langle \begin{matrix} P_1 \\ \cup \\ D_2 \end{matrix} \right\rangle + q^2 \langle D_1 = P_2 \rangle$$

$$= \left\langle \begin{matrix} P_1 \\ \| \\ D_2 \end{matrix} \right\rangle - \left\langle \begin{matrix} P_1 \\ \| \\ D_2 \end{matrix} \right\rangle - q^2 \left\langle \begin{matrix} P_1 \\ \| \\ D_2 \end{matrix} \right\rangle - q \left\langle \begin{matrix} P_1 \\ \cap \\ D_2 \end{matrix} \right\rangle$$

$$+ q^2 \langle D_1 = P_2 \rangle = -q \left\langle \begin{matrix} P_1 \\ \cap \\ D_2 \end{matrix} \right\rangle . \quad \square$$