

$$\langle D_1 \sqcup \Sigma D_2 \rangle$$

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

$$= \langle D_1 \overline{\cup} D_2 \rangle - q \langle D_1 \vee D_2 \rangle$$

$$= \langle \begin{smallmatrix} D_1 \\ | \\ q' \\ | \\ D_2 \end{smallmatrix} \rangle - q \langle \begin{smallmatrix} D_1 \\ | \\ \vee \\ | \\ D_2 \end{smallmatrix} \rangle$$

$$= \langle \begin{smallmatrix} D_1 \\ | \\ | \\ | \\ D_2 \end{smallmatrix} \rangle - q \langle \begin{smallmatrix} D_1 \\ | \\ | \sqcup 0 \\ | \\ D_2 \end{smallmatrix} \rangle - q \langle \begin{smallmatrix} D_1 \\ | \\ \cup \\ | \\ D_2 \end{smallmatrix} \rangle + q^2 \langle D_1 = D_2 \rangle$$

$$= \langle \begin{smallmatrix} D_1 \\ | \\ | \\ | \\ D_2 \end{smallmatrix} \rangle - \langle \begin{smallmatrix} D_1 \\ | \\ | \\ | \\ D_2 \end{smallmatrix} \rangle - q^2 \langle \begin{smallmatrix} D_1 \\ | \\ | \\ | \\ D_2 \end{smallmatrix} \rangle - q \langle \begin{smallmatrix} D_1 \\ | \\ \cup \\ | \\ D_2 \end{smallmatrix} \rangle + q^2 \langle D_1 = D_2 \rangle = -q \langle \begin{smallmatrix} D_1 \\ | \\ \cap \\ | \\ D_2 \end{smallmatrix} \rangle. \quad \square$$