

$$\int^{\hbar} \gamma = \int^U \overbrace{\underline{\gamma} \underline{\gamma}^*}^{1/2} \gamma \times \gamma; \quad \int^{\hbar} 1 = \int^V \overbrace{\underline{1} \underline{1}^*}^{1/2} 1 \times 1$$

$$\begin{array}{ccc}
\hbar & \xrightarrow{\gamma} & \underline{\hbar} \\
\downarrow \gamma & & \downarrow \gamma^* \\
U & \xrightarrow{\gamma \gamma \gamma} & V
\end{array}
\qquad
\begin{array}{ccc}
\underline{\hbar} & \xrightarrow{\hbar \gamma} & \underline{\hbar}_{\hbar \gamma} \\
\downarrow \hbar \gamma & & \downarrow \hbar \gamma^* \\
\mathbb{R}^n & \xrightarrow{\gamma \gamma \gamma} & \mathbb{R}^n
\end{array}$$

$\underline{i} \underline{\gamma} = \gamma \underline{i} \Rightarrow \underline{i} \underline{\gamma} \times \underline{j} \underline{\gamma} = \underline{i} \underline{\gamma} \underline{j} \underline{\gamma}^* = \gamma \underline{i} \underline{\gamma} \widehat{\underline{j} \underline{\gamma}} = \gamma \underline{i} \underline{\gamma} \underline{j} \underline{\gamma}^* \Rightarrow \widehat{\underline{i} \underline{\gamma} \times \underline{j} \underline{\gamma}} = \widehat{\underline{i} \underline{\gamma}^*}$   
 $\underline{m} \underline{\gamma} = \gamma \underline{m} \Rightarrow \underline{m} \underline{\gamma} \times \underline{n} \underline{\gamma} = \underline{m} \underline{\gamma} \underline{n} \underline{\gamma}^* = \gamma \underline{m} \underline{\gamma} \widehat{\underline{n} \underline{\gamma}} = \gamma \underline{m} \underline{\gamma} \underline{n} \underline{\gamma}^* \Rightarrow \widehat{\underline{m} \underline{\gamma} \times \underline{n} \underline{\gamma}} = \widehat{\underline{\gamma} \underline{\gamma}^*}$

$$\overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y}^{1/2} \overbrace{\underline{\mathbf{V}}_{\text{h}} \underline{\mathbf{V}}_{\text{h}}} = \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{V}}_{\text{h}}^y}^{1/2} \overbrace{\underline{\mathbf{V}}_y^y \underline{\mathbf{U}}_x^x}^{1/2}$$

$$\begin{array}{ccc} \underline{\mathbf{h}}_h & \xrightarrow{k} & \underline{\mathbf{L}}_{h\gamma} \\ \downarrow & & \uparrow \\ \underline{\mathbf{V}}_x^x \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y}^{1/2} & & \overbrace{\underline{\mathbf{V}}_y^y \underline{\mathbf{U}}_x^x}^{-1/2} \end{array}$$

$$\mathbb{R}^n \xrightarrow[\overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y}^{-1/2}]{} \text{bic} \xrightarrow[\overbrace{\underline{\mathbf{U}}_h^x \underline{\mathbf{U}}_y^y}^{1/2}]{} \mathbb{R}^n$$

$$\overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y \underline{\mathbf{U}}_h^x \underline{\mathbf{U}}_y^y}^{-1/2} \overbrace{\underline{\mathbf{V}}_y^y \underline{\mathbf{U}}_x^x}^{1/2} = 1 \Rightarrow \overbrace{\underline{\mathbf{V}}_y^y \underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_h^x \underline{\mathbf{U}}_y^y}^{-1/2} \overbrace{\underline{\mathbf{V}}_x^x \underline{\mathbf{U}}_y^y}^{1/2} = 1$$

$$\begin{aligned} \overbrace{\underline{\mathbf{V}}_{\text{h}} \underline{\mathbf{V}}_{\text{h}}} &= \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y \underline{\mathbf{V}}_{\text{h}} \underline{\mathbf{V}}_{\text{h}}}^{-1/2} \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y}^{1/2} = \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y \underline{\mathbf{V}}_{\text{h}} \underline{\mathbf{V}}_{\text{h}}}^{-1/2} \overbrace{\underline{\mathbf{V}}_y^y \underline{\mathbf{U}}_x^x}^{1/2} \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y \underline{\mathbf{V}}_{\text{h}} \underline{\mathbf{V}}_{\text{h}}}^{-1/2} \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y}^{1/2} \\ &= \underbrace{\overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y \underline{\mathbf{V}}_{\text{h}} \underline{\mathbf{V}}_{\text{h}}}^{-1/2} \overbrace{\underline{\mathbf{V}}_y^y \underline{\mathbf{U}}_x^x}^{1/2}}_{=1} \underbrace{\overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y}^{-1/2} \overbrace{\underline{\mathbf{V}}_{\text{h}} \underline{\mathbf{V}}_{\text{h}}}^{1/2} \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y}^{1/2}}_{=1} = \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y}^{-1/2} \overbrace{\underline{\mathbf{V}}_{\text{h}} \underline{\mathbf{V}}_{\text{h}}}^{1/2} \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y}^{1/2} \end{aligned}$$

$$\int 1 = \int \overbrace{\underline{\mathbf{V}}_{\text{h}} \underline{\mathbf{V}}_{\text{h}}}^{\text{h}} \underline{\mathbf{V}} \times 1$$

$$\text{LHS} = \int^V \overbrace{\underline{\mathbf{U}}_x^x \underline{\mathbf{U}}_y^y}^{1/2} \underline{\mathbf{V}} \times 1 \underset{\text{trafo}}{=} \int^U \overbrace{\underline{\mathbf{U}} \underline{\mathbf{V}} \underline{\mathbf{U}}}^{1/2} \overbrace{\underline{\mathbf{V}} \underline{\mathbf{U}} \times \overbrace{\underline{\mathbf{U}} \underline{\mathbf{U}}}^{1/2} \underline{\mathbf{V}} \times 1}^{1/2} = \int^U \overbrace{\underline{\mathbf{U}} \underline{\mathbf{V}} \underline{\mathbf{U}}}^{1/2} \overbrace{\underline{\mathbf{V}} \underline{\mathbf{U}} \times \overbrace{\underline{\mathbf{U}} \underline{\mathbf{U}}}^{1/2} \underline{\mathbf{V}} \times 1}^{1/2}$$

$$= \int^U \overbrace{\underline{\mathbf{U}} \underline{\mathbf{V}} \underline{\mathbf{U}}}^{1/2} \overbrace{\underline{\mathbf{V}} \underline{\mathbf{U}} \times \overbrace{\underline{\mathbf{U}} \underline{\mathbf{U}}}^{1/2}}^{1/2} \underline{\mathbf{U}} \times \underline{\mathbf{V}} \times 1 = \int^U \overbrace{\underline{\mathbf{U}} \underline{\mathbf{U}}}^{1/2} \overbrace{\underline{\mathbf{U}} \times \overbrace{\underline{\mathbf{V}} \underline{\mathbf{V}}}^{1/2} \underline{\mathbf{U}} \times \underline{\mathbf{V}} \times 1}^{1/2} = \int^U \overbrace{\underline{\mathbf{U}} \underline{\mathbf{U}}}^{1/2} \underline{\mathbf{U}} \times \overbrace{\underline{\mathbf{V}} \underline{\mathbf{V}}}^{1/2} \underline{\mathbf{V}} \times 1 = \text{RHS}$$