

$$\Omega_z (v:w) = P_z \underbrace{\overline{P_z v} \rtimes \overline{P_z w}}_{\text{a-herm}} P_z$$

$$\Omega_{v:w} = \Omega_0 (v:w) = P_0 \underbrace{\overline{P_0 v} \rtimes \overline{P_0 w}}_{\text{a-herm}} P_0 = P \overline{P_v \rtimes P_w} P = P P_v P_w P - P P_w P_v P$$

$$\Omega_{v:w} = \overline{P \hat{U}_v P} \rtimes \overline{P \hat{U}_w P} - P \overline{\hat{U}_v \rtimes \hat{U}_w} P$$

$$P_z \hat{U}_z = \hat{U}_z P \Rightarrow P_v + P \hat{U}_v = \hat{U}_v P$$

$$P_v = \hat{U}_v P - P \hat{U}_v = \hat{U}_v \rtimes P$$

$$\begin{aligned} \text{LHS} &= P \overline{\hat{U}_v P - P \hat{U}_v} \overline{\hat{U}_w P - P \hat{U}_w} P - P \overline{\hat{U}_w P - P \hat{U}_w} \overline{\hat{U}_v P - P \hat{U}_v} P \\ &= -P \hat{U}_v \hat{U}_w P + P \hat{U}_v P \hat{U}_w P + P \hat{U}_w \hat{U}_v P - P \hat{U}_w P \hat{U}_v P = \text{RHS} \end{aligned}$$

$$\Omega_{v:w} = \overline{P \hat{U}_v P} \rtimes \overline{P \hat{U}_w P} - 2 \check{U}_{v\check{w} - w\check{v}}$$

$$\hat{U}_v \rtimes \hat{U}_w = 2 \hat{U}_{v\check{w} - w\check{v}} \Rightarrow P \overline{\hat{U}_v \rtimes \hat{U}_w} P = 2 P \hat{U}_{v\check{w} - w\check{v}} P = 2 \check{U}_{v\check{w} - w\check{v}}$$