

$$P|Q \ltimes \gamma = P \sharp Q | \Delta \gamma = Q | f \rtimes P$$

$$K \ltimes \gamma \dot{\gamma} = \underbrace{K \ltimes \gamma} \underbrace{K \ltimes \dot{\gamma}}$$

$$E \ltimes \gamma \dot{\gamma} = \underbrace{E \ltimes \gamma} \underbrace{K \ltimes \dot{\gamma}} + \underbrace{\bar{K}^{-1} \ltimes \gamma} \underbrace{E \ltimes \dot{\gamma}}; \quad F \ltimes \gamma \dot{\gamma} = \underbrace{F \ltimes \gamma} \underbrace{K \ltimes \dot{\gamma}} + \underbrace{\bar{K}^{-1} \ltimes \gamma} \underbrace{F \ltimes \dot{\gamma}}$$

$$\begin{aligned} P| \overbrace{K \ltimes \gamma \dot{\gamma}} &= P \sharp K | \Delta \gamma \dot{\gamma} = P \sharp K | \underbrace{\Delta \gamma} \underbrace{\Delta \dot{\gamma}} = \Delta \underbrace{P \sharp K}_{\Delta \gamma \sharp \Delta \dot{\gamma}} \\ &= \underbrace{P_{\alpha} \sharp K \sharp^{\alpha} P \sharp K}_{\Delta \gamma \sharp \Delta \dot{\gamma}} = \underbrace{P_{\alpha} \sharp K}_{\Delta \gamma} \underbrace{\overset{\alpha}{P \sharp K}}_{\Delta \dot{\gamma}} = \underbrace{P_{\alpha} | K \ltimes \gamma}_{\Delta \gamma} \underbrace{\overset{\alpha}{P | K \ltimes \dot{\gamma}}}_{\Delta \dot{\gamma}} \\ &= \underbrace{P_{\alpha} \sharp^{\alpha} P}_{\Delta \gamma} | \underbrace{K \ltimes \gamma}_{\Delta \gamma} \sharp \underbrace{K \ltimes \dot{\gamma}}_{\Delta \dot{\gamma}} = \Delta P | \underbrace{K \ltimes \gamma}_{\Delta \gamma} \sharp \underbrace{K \ltimes \dot{\gamma}}_{\Delta \dot{\gamma}} = P | \underbrace{K \ltimes \gamma}_{\Delta \gamma} \underbrace{K \ltimes \dot{\gamma}}_{\Delta \dot{\gamma}} \end{aligned}$$