

$$U|_{\mathbb{R}} \cong \mathbb{R} \quad \ni \quad \nu_t = e^{t\underline{1}}$$



$$U|_{\mathbb{R}} \cong \mathbb{R} \quad \ni \quad \underline{1} = \partial_t^0 \nu_t$$

$$\mathbb{R} \xrightarrow[\text{stet hom}]{\nu \cdot} U|_{\mathbb{R}} \\ t \mapsto \nu_t$$

$$\nu_t \partial_t^* = I = \partial_t^* \nu_t$$

$$\text{hom } \nu_s \nu_t = \nu_{s+t} \Rightarrow \nu_s \nu_t = \nu_t \nu_s$$

$$\text{stet } s \lim_{\rightarrow t} \nu_s = \nu_t$$

$$D_{\underline{1}} = \frac{1 \in \mathbb{R}}{\mathbb{R} \ni \frac{\nu_\varepsilon 1 - 1}{\varepsilon} \sim_{\|\underline{1}\|} \nu_\varepsilon 1 \text{ norm-Cau}} \subset \mathbb{R}$$

$$1 \in D_{\underline{1}} \Rightarrow \frac{\nu_\varepsilon 1 - 1}{\varepsilon} \sim_{\|\underline{1}\|} \nu_\varepsilon 1 \Rightarrow \begin{cases} \nu_t D_{\underline{1}} \subset D_{\underline{1}} \\ \nu_t \nu_{\underline{1}} = \nu_t \nu_t \end{cases}$$

$$\frac{\nu_\varepsilon \underline{1+1} - \underline{1+1}}{\varepsilon} = \frac{\nu_\varepsilon 1 - 1}{\varepsilon} + \frac{\nu_\varepsilon 1 - 1}{\varepsilon} \sim_{\|\underline{1}\|} \nu_\varepsilon 1 + \nu_\varepsilon 1 \Rightarrow \begin{cases} \underline{1+1} \in D_{\underline{1}} \\ \nu_\varepsilon \underline{1+1} = \nu_\varepsilon 1 + \nu_\varepsilon 1 \end{cases}$$

$$1 \in D_{\underline{1}} \Rightarrow \frac{\nu_\varepsilon 1 - 1}{\varepsilon} \sim_{\|\underline{1}\|} \nu_\varepsilon 1 \Rightarrow \frac{\nu_\varepsilon \nu_t 1 - \nu_t 1}{\varepsilon} \stackrel{\text{comm}}{=} \nu_t \frac{\nu_\varepsilon 1 - 1}{\varepsilon} \sim_{\nu_t \text{ stet}} \nu_t \nu_\varepsilon 1 \Rightarrow \begin{cases} \nu_t 1 \in D_{\underline{1}} \\ \nu_t \nu_t 1 = \nu_t \nu_t 1 \end{cases}$$

$$\mathcal{D}_{\underline{1}} = \frac{1 \in \mathbb{1}}{\mathbb{R} \ni t \xrightarrow{\text{diff}} \mathcal{V}_t 1 \in \mathbb{1}}$$

$$\bigwedge_{1 \in \mathcal{D}_{\underline{1}}} \partial_t \mathcal{V}_t 1 = \mathcal{V}_t \underline{1} 1$$

$$\supset: \mathbb{R} \ni t \xrightarrow{\text{diff}} \mathcal{V}_t 1 \in \mathbb{1} \Rightarrow \mathbb{R} \ni t \xrightarrow{\text{diff in } 0} \mathcal{V}_t 1 \in \mathbb{1} \Rightarrow \begin{cases} 1 \in \mathcal{D}_{\underline{1}} \\ \partial_t^0 \mathcal{V}_t 1 = \underline{1} 1 \end{cases}$$

$$\subset: 1 \in \mathcal{D}_{\underline{1}} \Rightarrow \mathcal{V}_t \widehat{\underline{1} 1} \rightsquigarrow \mathcal{V}_t \frac{\mathcal{V}_{t+\varepsilon} 1 - 1}{\varepsilon} = \frac{\mathcal{V}_{t+\varepsilon} 1 - \mathcal{V}_t 1}{\varepsilon} \rightsquigarrow \partial_t \mathcal{V}_t 1 \Rightarrow \mathcal{V}_t 1 \text{ diff}$$

$$\mathcal{V}_t 1 \stackrel{\mathcal{D}_{\underline{1}}}{=} 1 + \int_{ds}^{0|t} \underbrace{\mathcal{V}_s \widehat{\underline{1} 1}}_{\text{stet}}$$

$$\partial_t \text{ RHS} = \mathcal{V}_t \widehat{\underline{1} 1} = \partial_t \text{ LHS}$$

$$\mathcal{V}_0 1 = 1$$

$$\mathcal{G}_{\underline{v}} \subset \mathbb{1} \times \mathbb{1}$$

$$\mathcal{G}_{\underline{v}} \ni \gamma_n: \underline{v} \gamma_n \rightsquigarrow \gamma: \dot{\gamma} \in \mathbb{1} \times \mathbb{1} \Rightarrow \begin{cases} \mathcal{D}_{\underline{v}} \ni \gamma_n \rightsquigarrow \gamma y \\ \underline{v} \gamma_n \rightsquigarrow \dot{\gamma} \end{cases}$$

$$\Rightarrow \overbrace{\int_{ds}^{0|t} \underline{v}_s \overbrace{\gamma \gamma_n} - \int_{ds}^{0|t} \underline{v}_s \dot{\gamma}} \leq \int_{ds}^{0|t} \overbrace{\underline{v}_s \overbrace{\gamma \gamma_n} - \underline{v}_s \dot{\gamma}} \stackrel{\underline{v}_s \text{ unit}}{=} \int_{ds}^{0|t} \overbrace{\underline{v} \gamma_n - \dot{\gamma}} \rightsquigarrow 0$$

$$\Rightarrow \underline{v}_t \gamma \in \underline{v}_t \gamma_n = \gamma_n + \int_{ds}^{0|t} \underline{v}_s \overbrace{\gamma \gamma_n} \rightsquigarrow \gamma + \int_{ds}^{0|t} \underline{v}_s \dot{\gamma}$$

$$\Rightarrow \underline{v}_t \gamma = \gamma + \int_{ds}^{0|t} \underline{v}_s \dot{\gamma} \text{ diff in } t \Rightarrow \begin{cases} \gamma \in \mathcal{D}_{\underline{v}} \\ \underline{v} \gamma = \partial_t^0 \underline{v}_t \gamma = \underline{v}_0 \dot{\gamma} = \dot{\gamma} \end{cases} \Rightarrow \gamma: \dot{\gamma} \in \mathcal{G}_{\underline{v}}$$

-  $\underline{1} \square \dot{\underline{1}}$  skew-symm

$$1 \in \mathcal{D}_{\underline{1}} \Rightarrow \bigwedge_{\dot{1} \in \mathcal{D}_{\underline{1}}} 1 \star \dot{\underline{1}} = 1 \star \overline{\partial_t^0 \dot{\underline{1}}} = \partial_t^0 \overline{1 \star \dot{1}} = -\partial_t^0 \overline{1 \star \dot{1}}$$

$$= -\overline{\partial_t^0 1 \star \dot{1}} = -\overline{1 \star \dot{1}} \text{ stet in } \dot{1} \Rightarrow \begin{cases} 1 \in \mathcal{D}_{\dot{1}} \\ \dot{\underline{1}} = -\underline{1} \dot{1} \end{cases}$$

$$\varphi \in \begin{matrix} \mathbb{R} & 0 \\ & \triangle \\ & \infty \end{matrix} \mathbb{R}$$

$$1 \in \mathbb{1} \Rightarrow \underline{1}_\varphi := \int_{ds}^{\mathbb{R}} {}^s \varphi \underline{1}_s \quad 1 \in \mathbb{1} \text{ stet in } s$$

$$\underline{1}_\varphi \in \mathcal{D}_{\underline{1}}$$

$$\underline{1} \underline{1}_\varphi = -\underline{1}_\varphi$$

$$\underline{\varphi} \in \begin{matrix} \mathbb{R} & 0 \\ & \triangle \\ & \infty \end{matrix} \mathbb{R}$$

$$\int_{dt}^{0|\varepsilon} \underline{1}_t \underline{1}_\varphi = \int_{dt}^{0|\varepsilon} \underline{1}_t \int_{ds}^{\mathbb{R}} {}^s \varphi \underline{1}_s = \int_{ds}^{\mathbb{R}} {}^s \varphi \int_{dt}^{0|\varepsilon} \underline{1}_t \underline{1}_s = \int_{ds}^{\mathbb{R}} {}^s \varphi \int_{dt}^{0|\varepsilon} \underline{1}_{t+s} = \int_{ds}^{\mathbb{R}} {}^s \varphi \int_{dr}^{s|s+\varepsilon} \underline{1}_r$$

$$= - \int_{ds}^{\mathbb{R}} {}^s \varphi \frac{d}{ds} \underbrace{\int_{dr}^{s|s+\varepsilon} \underline{1}_r}_{\underline{1}_s - \underline{1}_{s+\varepsilon}} = \int_{ds}^{\mathbb{R}} {}^s \varphi \underline{1}_s - \int_{ds}^{\mathbb{R}} {}^s \varphi \underline{1}_{s+\varepsilon} = \int_{ds}^{\mathbb{R}} {}^s \varphi \underline{1}_s - \int_{ds}^{\mathbb{R}} {}^s \varphi \underline{1}_\varepsilon \underline{1}_s = \underline{1}_\varphi - \underline{1}_\varepsilon \underline{1}_\varphi$$

$$\Rightarrow \frac{\underline{1}_\varepsilon \underline{1}_\varphi - \underline{1}_\varphi}{\varepsilon} = -\frac{1}{\varepsilon} \int_{dt}^{0|\varepsilon} \underline{1}_t \underline{1}_\varphi \rightsquigarrow -\underline{1}_0 \underline{1}_\varphi = -\underline{1}_\varphi$$

$$\mathcal{D}_{\underline{\nu}} \stackrel{\text{hull}}{\subset} \mathbb{1}$$

$$\bigwedge_{\mathbb{1} \in \mathbb{1}} \bigwedge_{\varepsilon > 0} \bigvee_{\delta > 0} \bigwedge_{\underline{t} \leq \varepsilon} \|\underline{\nu}_t \mathbb{1} - \mathbb{1}\| \leq \varepsilon \Rightarrow \begin{cases} \forall \varphi \in \mathbb{R}^{-\delta|\delta} \mathbb{R}_+ \\ \int_{\mathbb{R}} \varphi = 1 (*) \end{cases}$$

$$\Rightarrow \begin{cases} \mathbb{1}_\varphi \in \mathcal{D}_{\underline{\nu}} \\ \|\mathbb{1}_\varphi - \mathbb{1}\| = \overline{\int_{\mathbb{R}}^t \varphi \underline{\nu}_t \mathbb{1} - \mathbb{1}} = \overline{\int_{\mathbb{R}}^t \varphi \underline{\nu}_t \mathbb{1} - \mathbb{1}} \leq \int_{\mathbb{R}}^t \varphi \|\underline{\nu}_t \mathbb{1} - \mathbb{1}\| = \int_{\mathbb{R}}^t \varphi \|\underline{\nu}_t \mathbb{1} - \mathbb{1}\| \leq \varepsilon \int_{\mathbb{R}}^t \varphi = \varepsilon \int_{\mathbb{R}}^t \varphi = \varepsilon \int_{\mathbb{R}} \varphi = \varepsilon \end{cases}$$

$$- \underline{\nu} \sqsupset \underline{\nu}^* \Rightarrow \underline{\nu} = - \underline{\nu}^* \in \mathcal{U}(\mathbb{1}) \text{ skew-adj}$$

$$\mathbb{1} \in \mathcal{D}_{\underline{\nu}} \Rightarrow \bigwedge_{\mathbb{1} \in \mathcal{D}_{\underline{\nu}}} \mathbb{1} \overline{\underline{\nu}_{-t} \mathbb{1}} = \overline{\underline{\nu}_t \mathbb{1} \mathbb{1}} = \mathbb{1} + \overline{\int_{ds}^{0|t} \underline{\nu}_s \underline{\nu} \mathbb{1} \mathbb{1}}$$

$$= \mathbb{1} \mathbb{1} \mathbb{1} + \int_{ds}^{0|t} \overline{\underline{\nu}_s \underline{\nu} \mathbb{1} \mathbb{1}} = \mathbb{1} \mathbb{1} \mathbb{1} + \int_{ds}^{0|t} \mathbb{1} \overline{\underline{\nu}_{-s} \underline{\nu}^* \mathbb{1}} = \mathbb{1} \mathbb{1} \mathbb{1} + \int_{ds}^{0|t} \underline{\nu}_{-s} \underline{\nu}^* \mathbb{1}$$

$$\mathcal{D}_{\underline{\nu}} \stackrel{\text{hull}}{\Rightarrow} \underline{\nu}_{-t} \mathbb{1} = \mathbb{1} + \int_{ds}^{0|t} \underline{\nu}_{-s} \underline{\nu}^* \mathbb{1} \text{ diff in } t \Rightarrow \mathbb{1} \in \mathcal{D}_{\underline{\nu}} \stackrel{\text{skew-symm}}{\Rightarrow} \underline{\nu}^* = - \underline{\nu}$$