

$$|\rho^{\text{R}}_{\infty}) \approx \underbrace{\int_t^{t'} d\tau \, \mathcal{H}_I(\tau) | \rho(t)} + \underbrace{\int_{t'}^{\infty} d\tau \, \mathcal{V}_I^{(\epsilon)}(\tau) | \rho(t)}$$