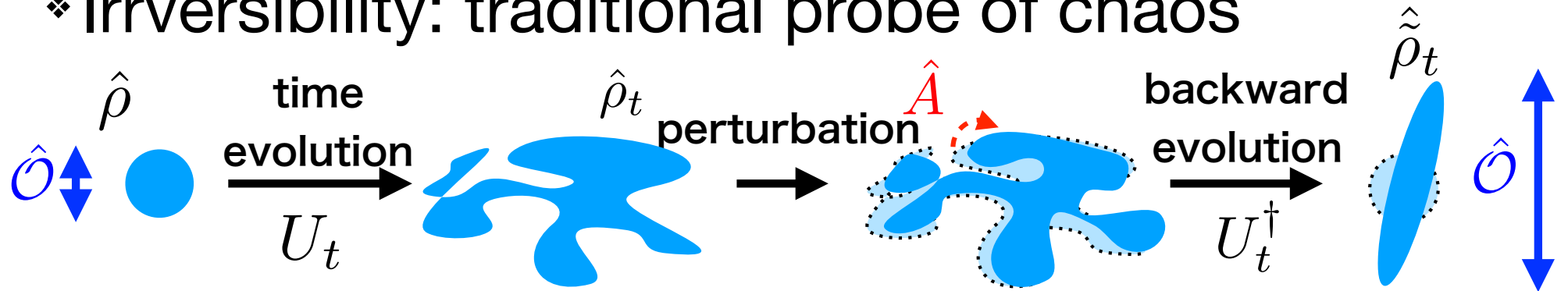


Operator noncommutativity and irreversibility in quantum chaos

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❖ Irreversibility: traditional probe of chaos



$\hat{O} = \hat{B}^\dagger \hat{B} \rightarrow$ We have $I_{AB}(t) = \langle \hat{A}(t)^\dagger \hat{B}^\dagger \hat{B} \hat{A}(t) \rangle$ for final state

❖ Noncommutativity: new probe of quantum chaos

$$C_{AB}(t) = - \langle ||[\hat{A}(t), \hat{B}]||^2 \rangle$$

❖ Our results: for initially localized states,

$$C_{AB}(t) \simeq I_{AB}(t) \quad \text{Noncommutativity and irreversibility are almost equivalent!}$$