

Correlation engineering via non-local dissipation

Generalized algorithm

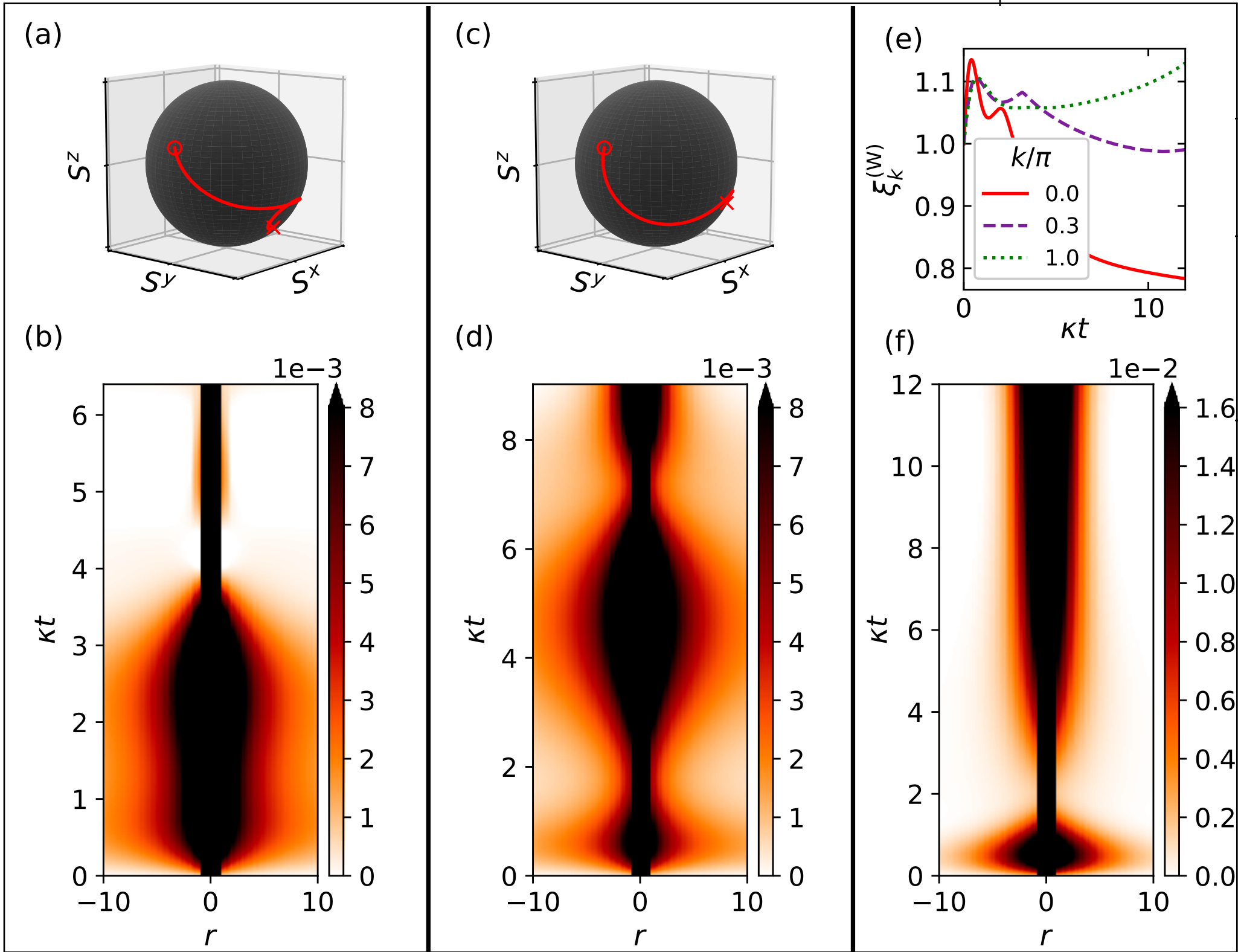
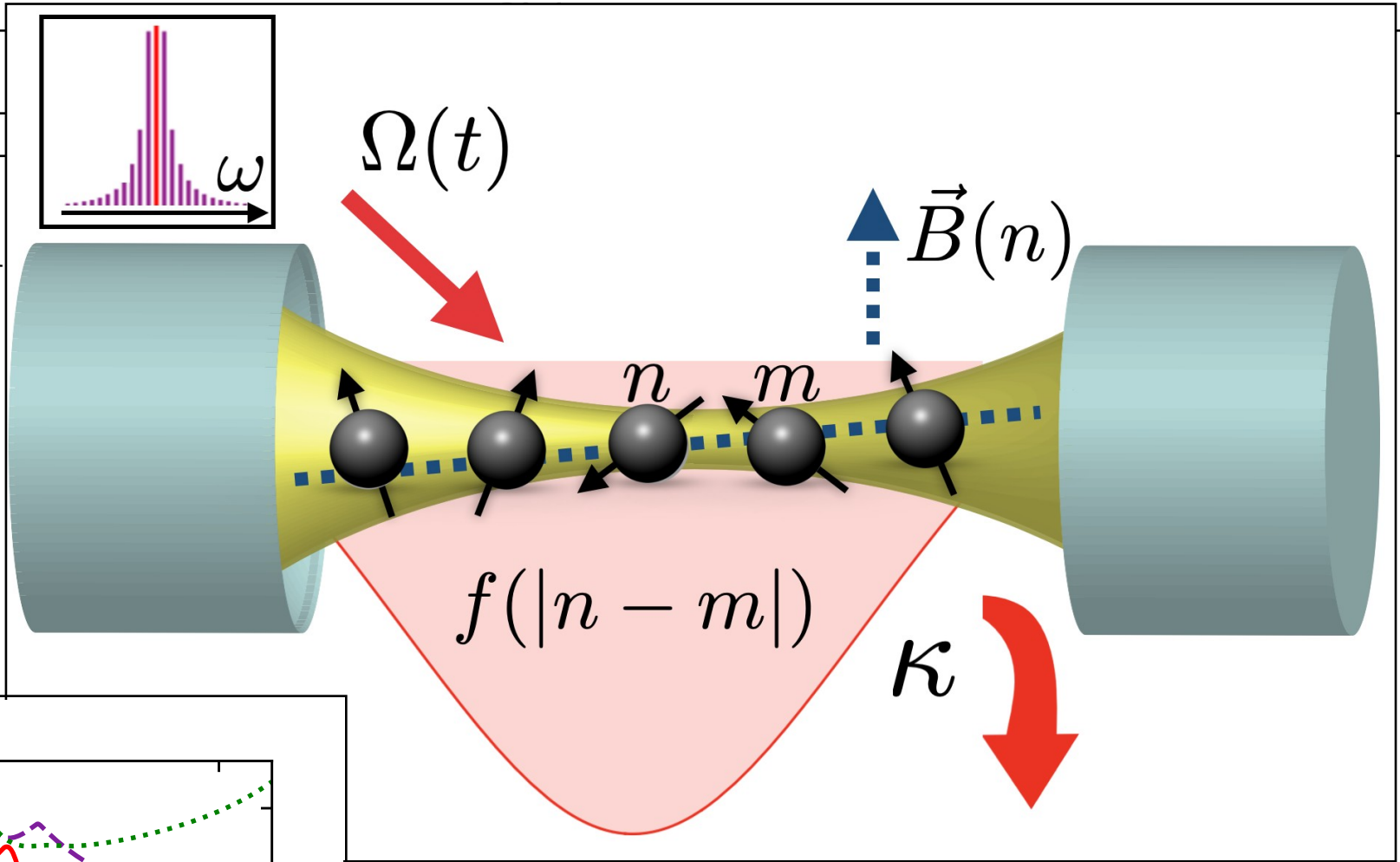
Kushal Seetharam (MIT, Harvard) May 5th, 2021

Outline

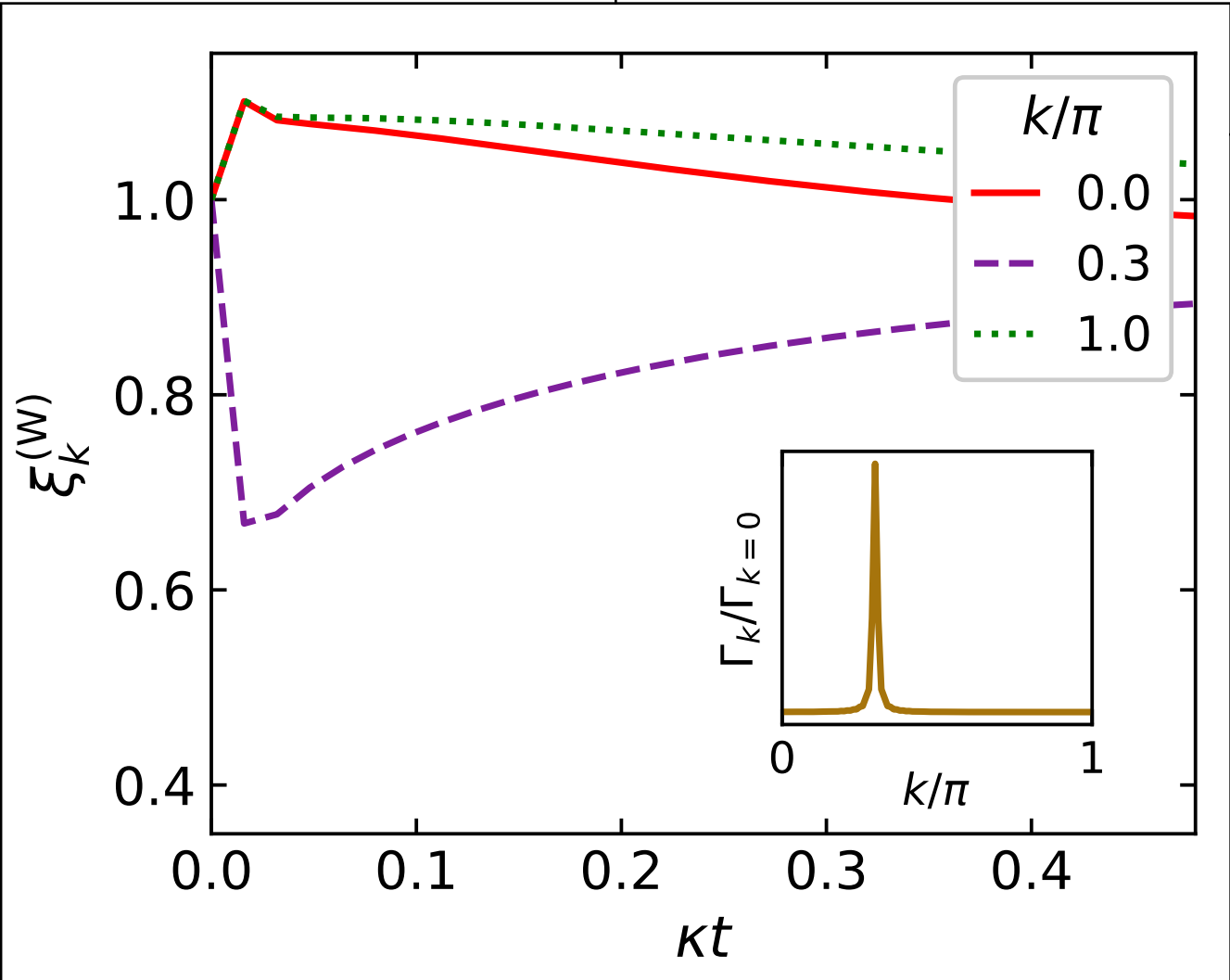
(1) How to engineer dissipation with arbitrary spatial profile

$$\frac{\kappa}{N} \sum_{n,m} f(|n-m|) \left(\hat{L}_n \rho \hat{L}_m^\dagger - \frac{1}{2} \{ \hat{L}_m^\dagger, \hat{L}_n \} \rho \right)$$

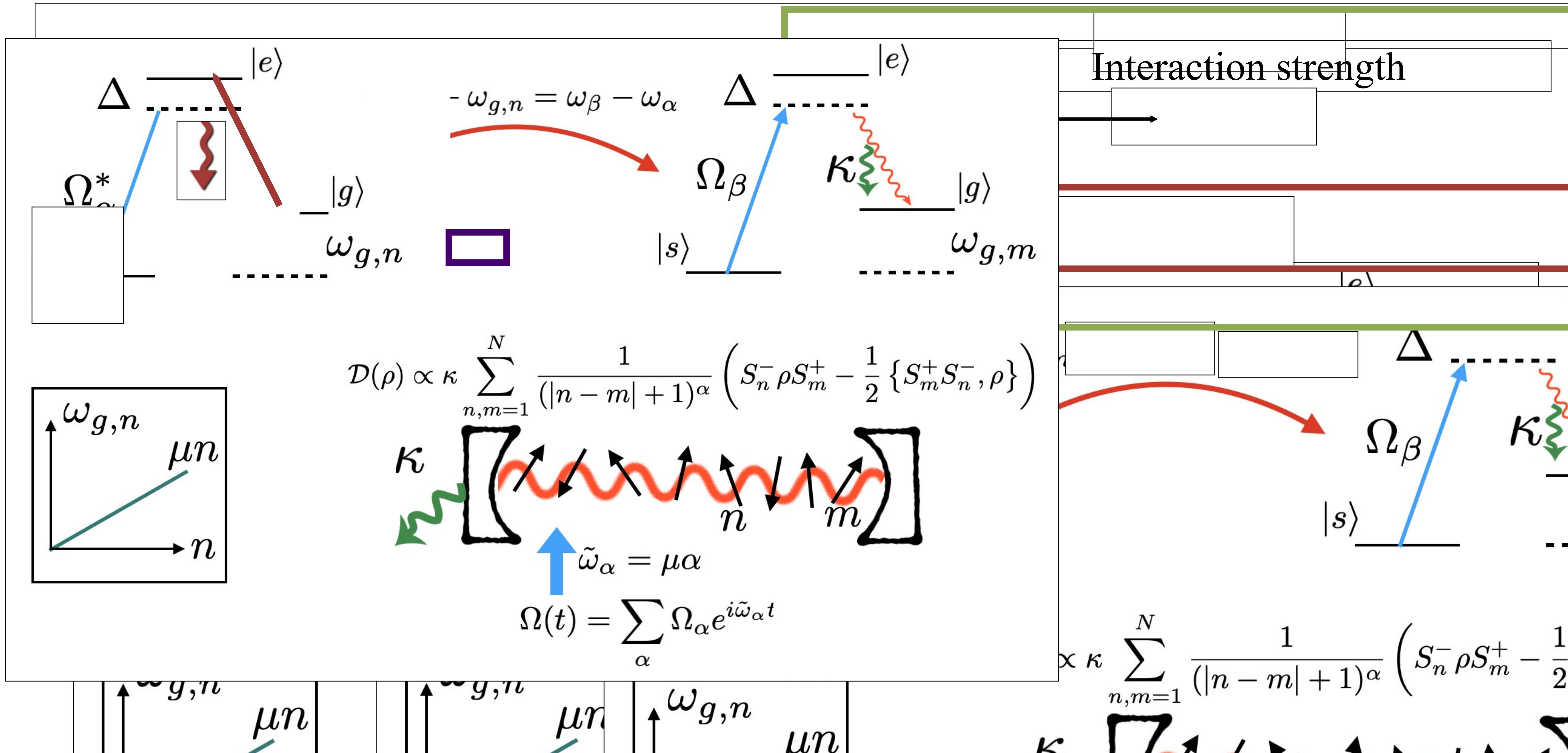
□ How to engineer dissipation profile



(3) Useful physics - squeezing



Experimental realization



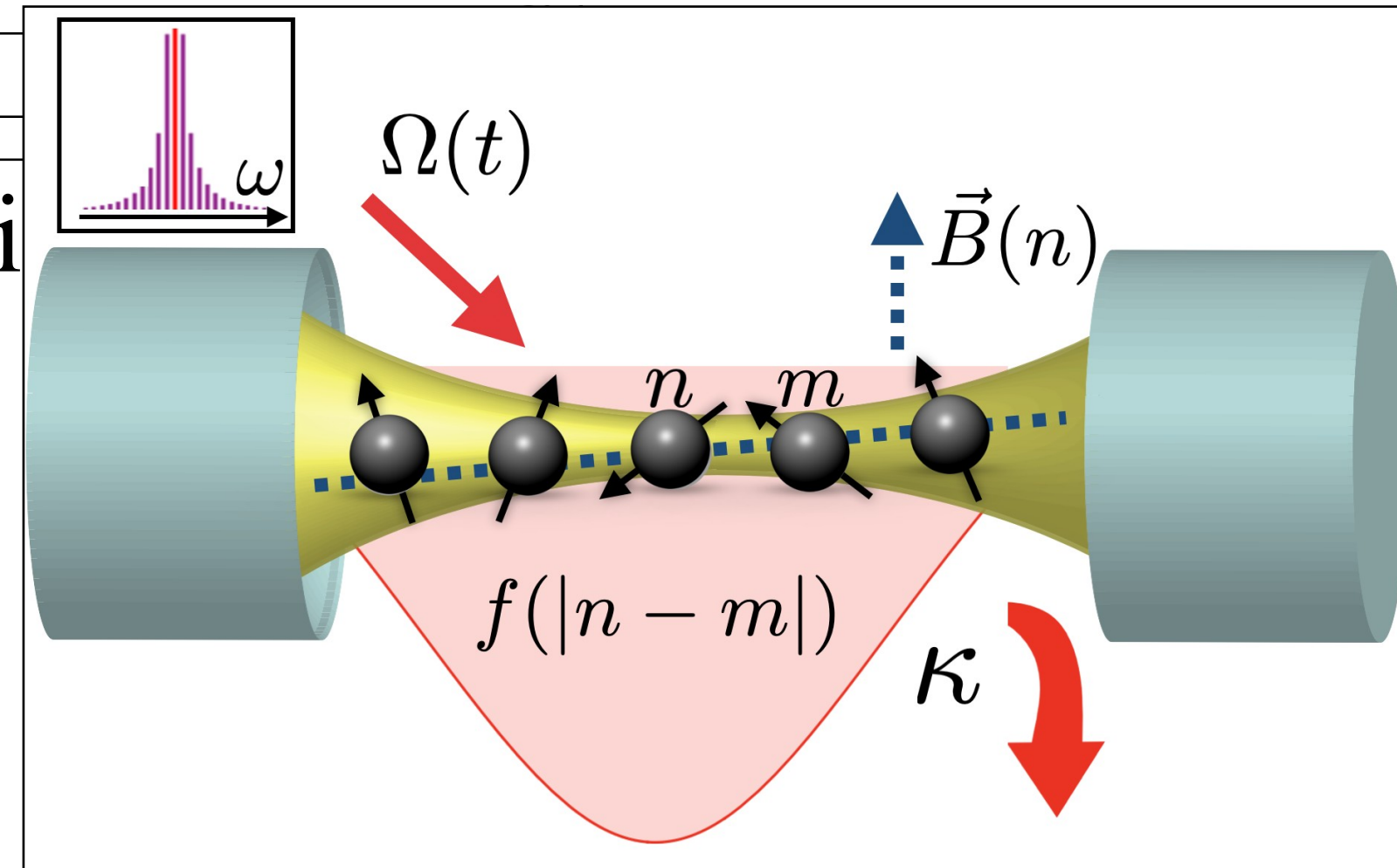
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□ How to engineer dissipation profile

□ Novel physics

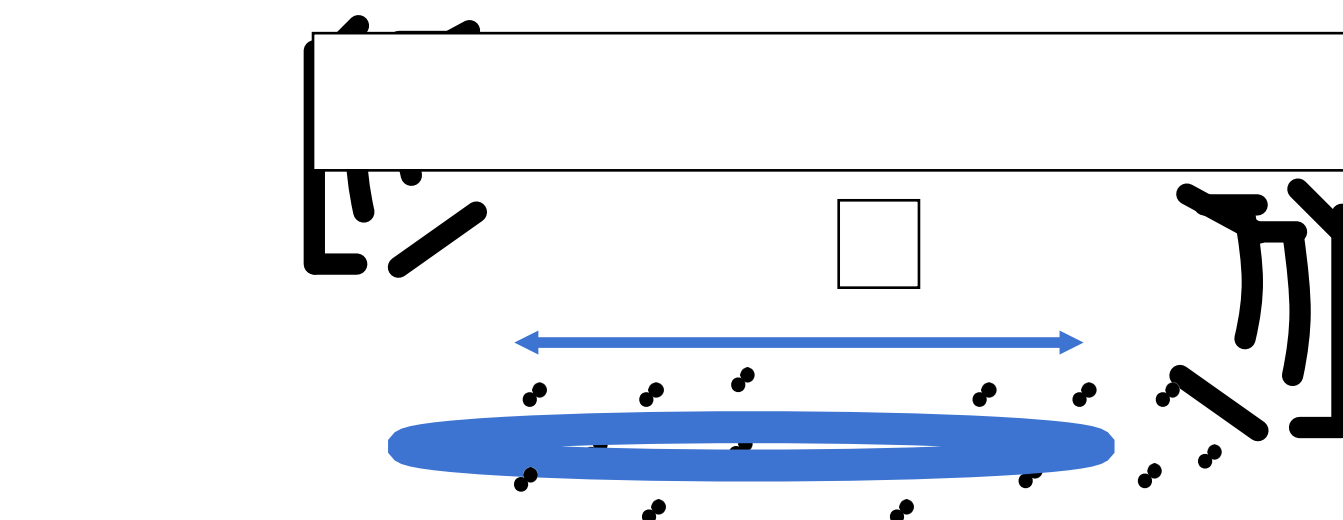
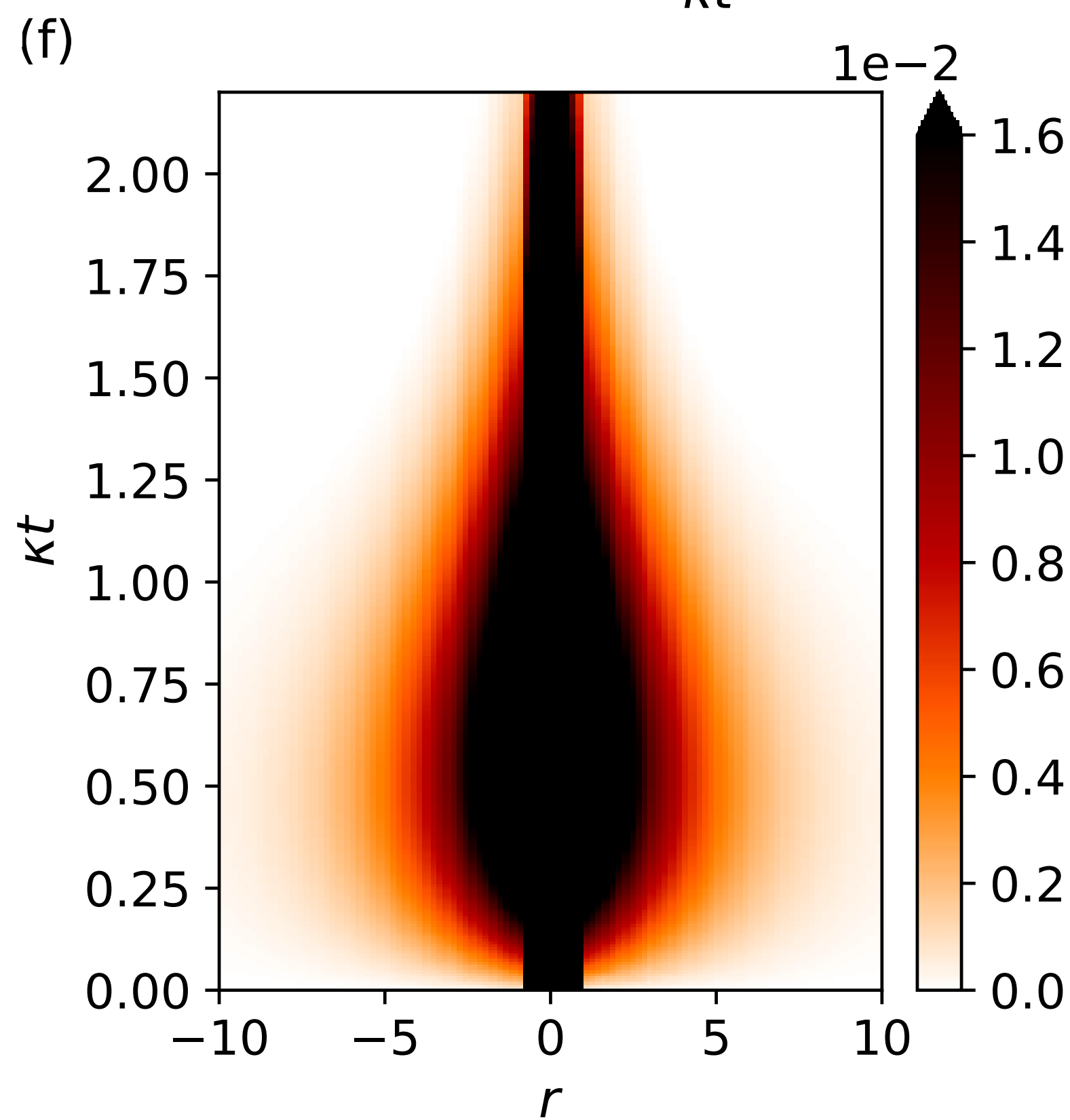
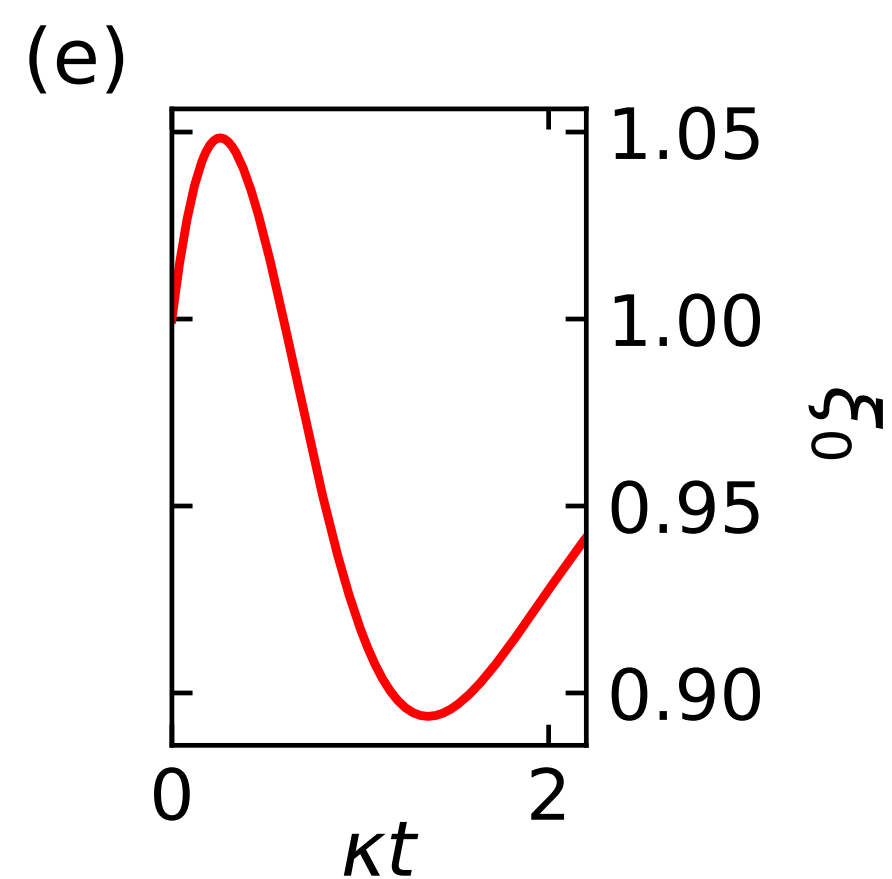
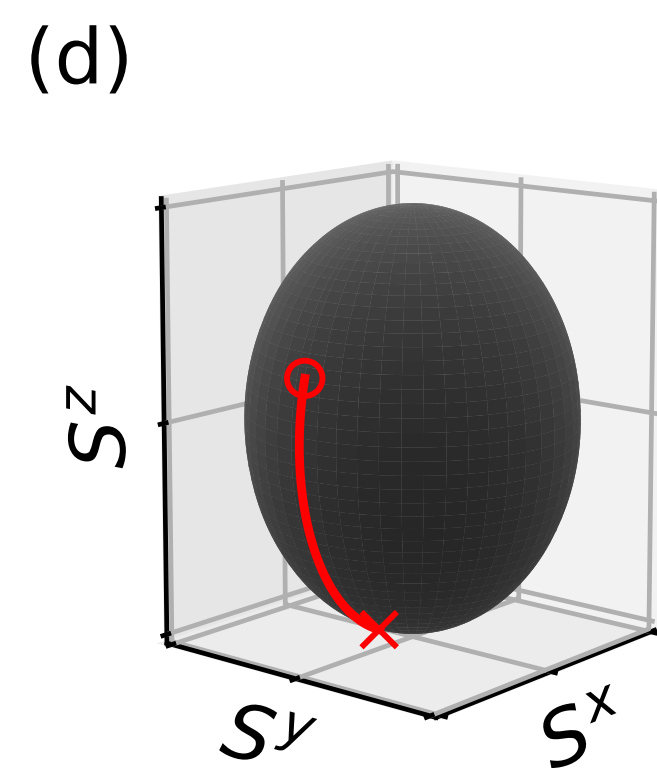


(2) Novel physics - correlation

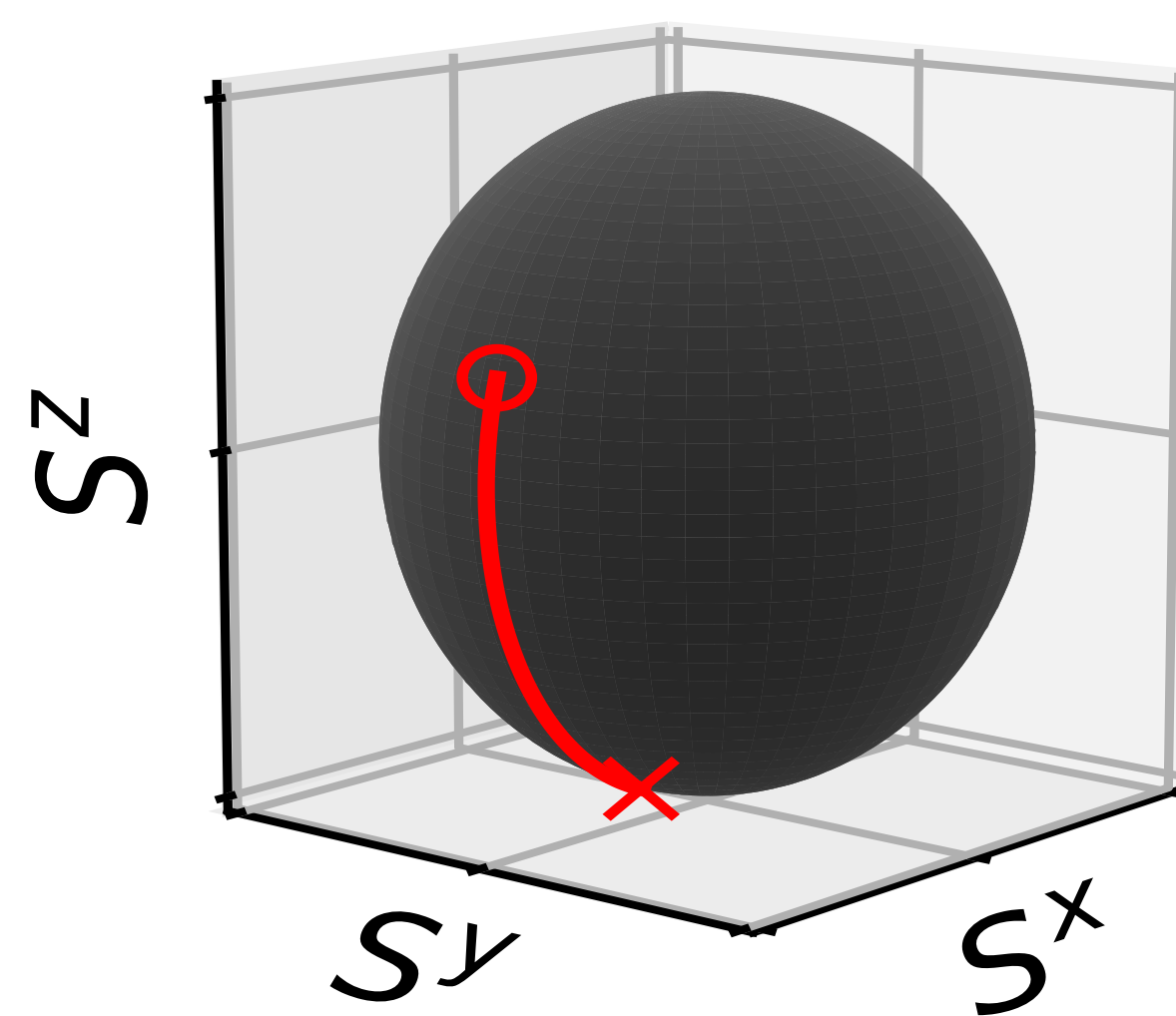
□ Useful physics dynamics



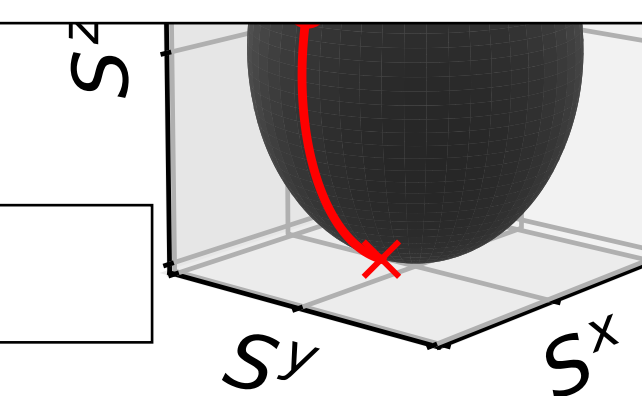
Correlation dynamics



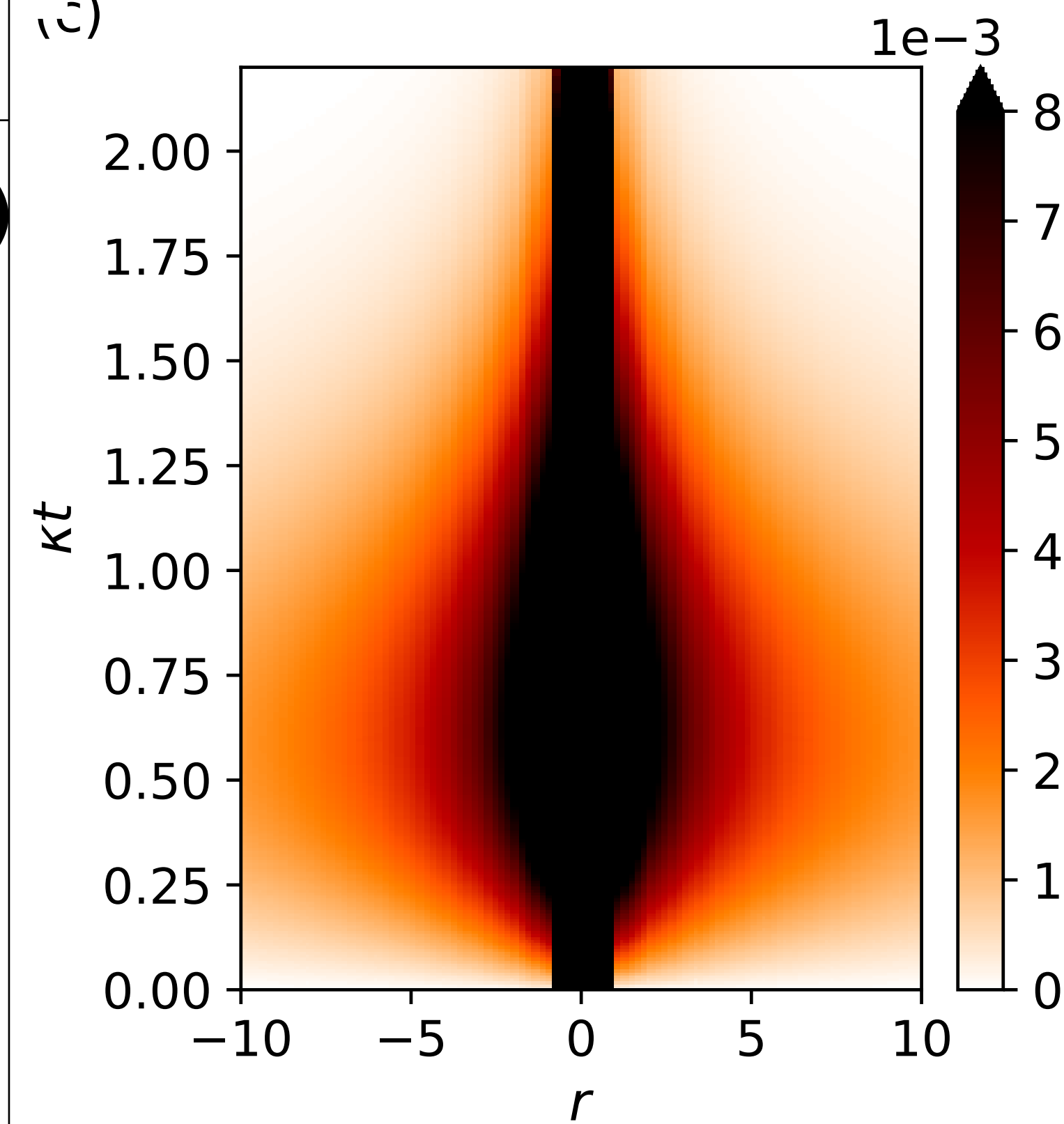
(a)



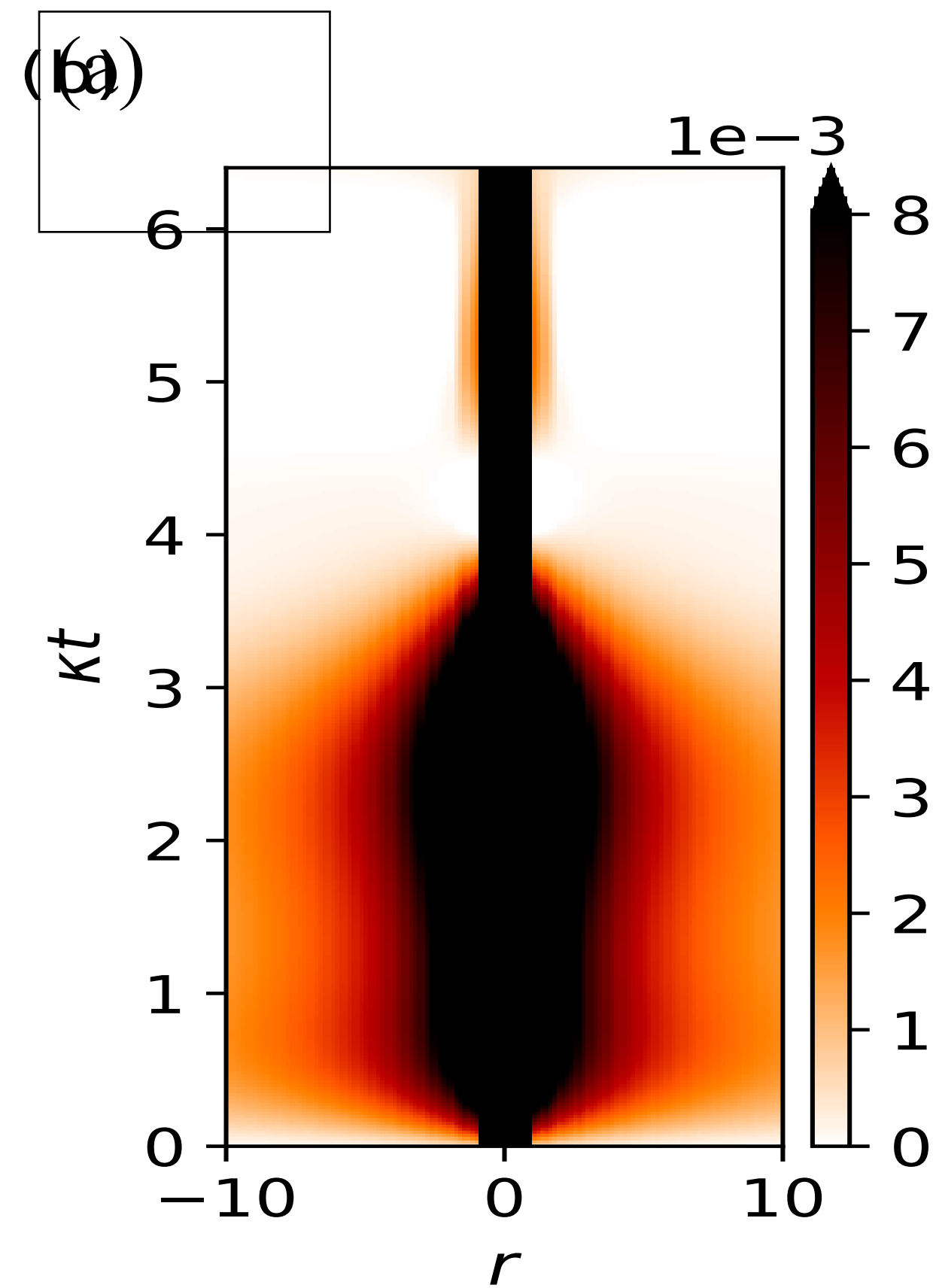
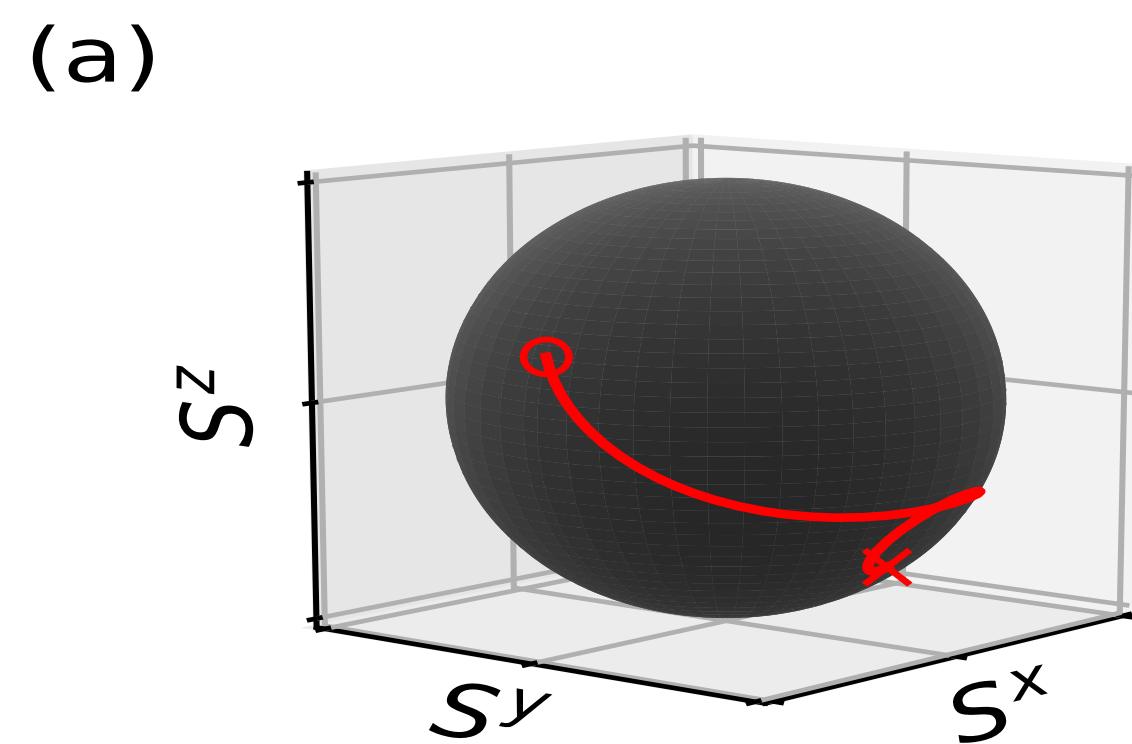
(b)



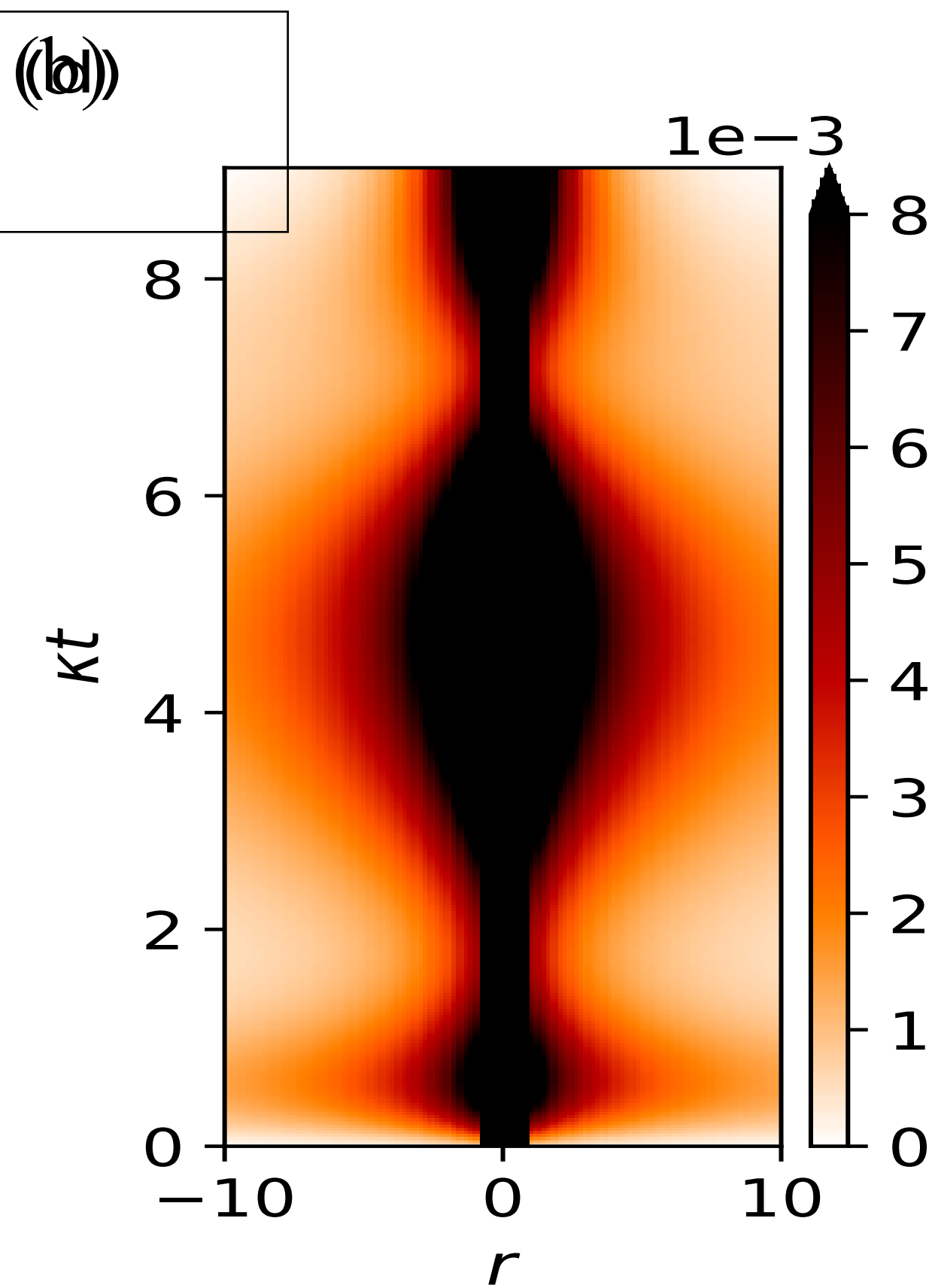
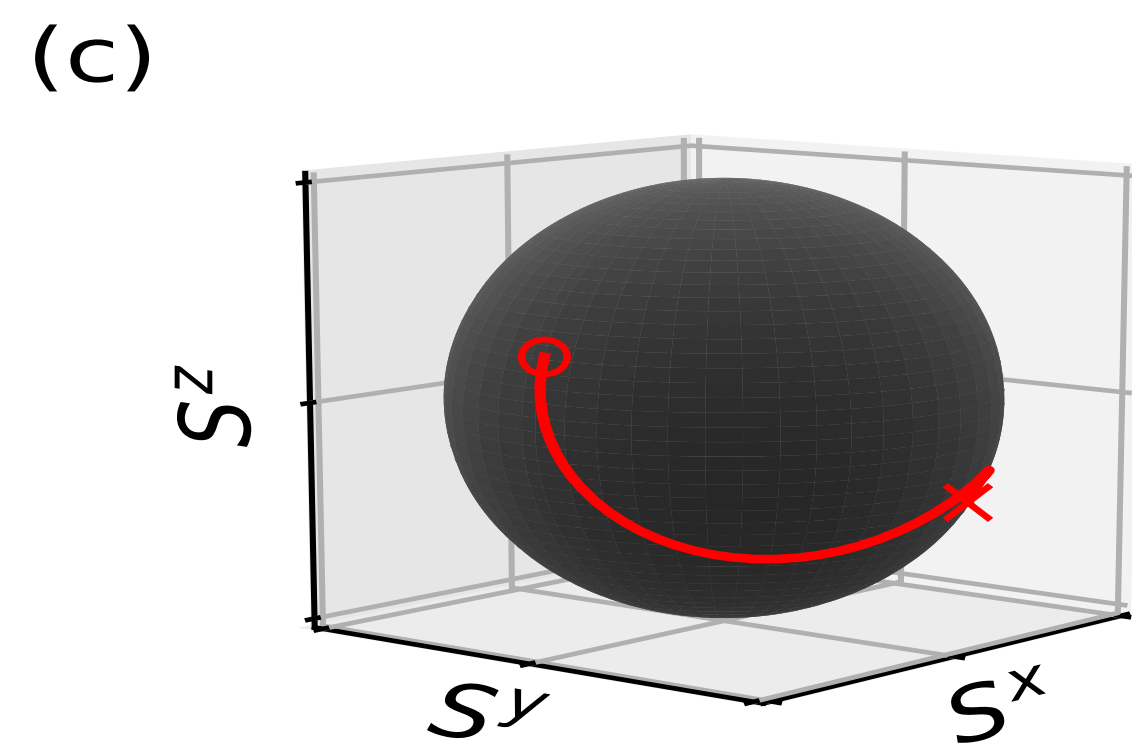
(c)



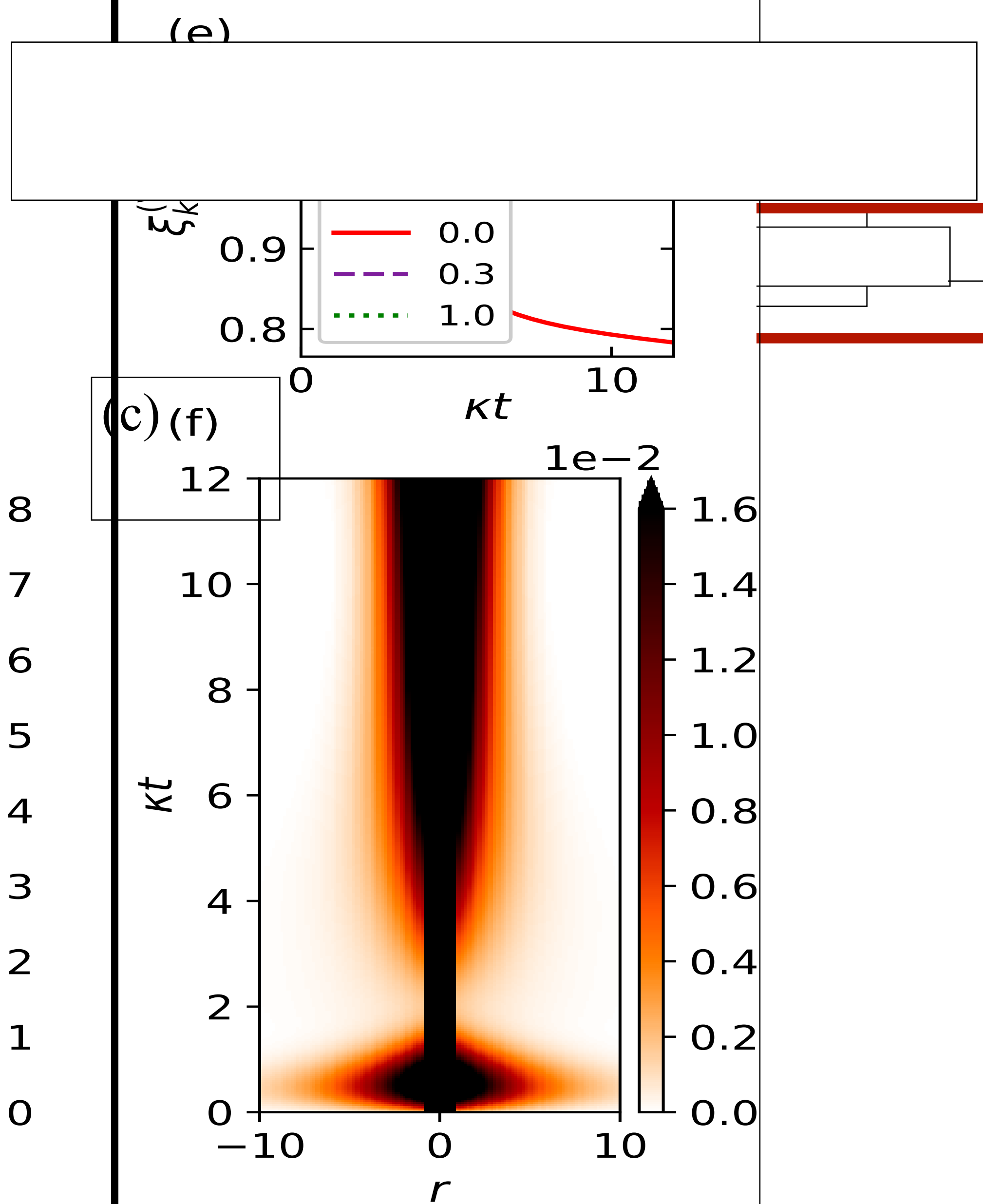
(c)



controlled
'confinement'



metastable quantum limit
cycle



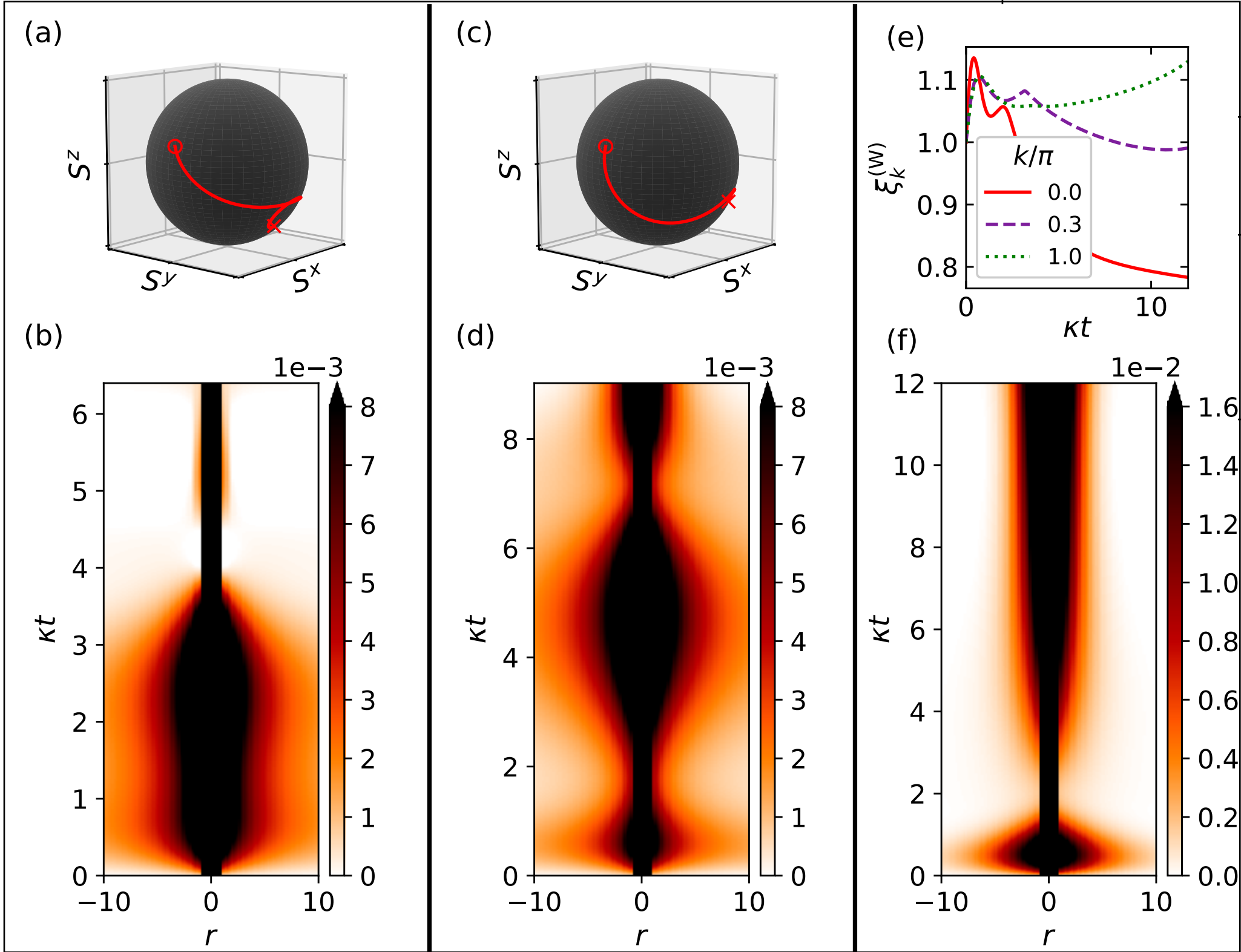
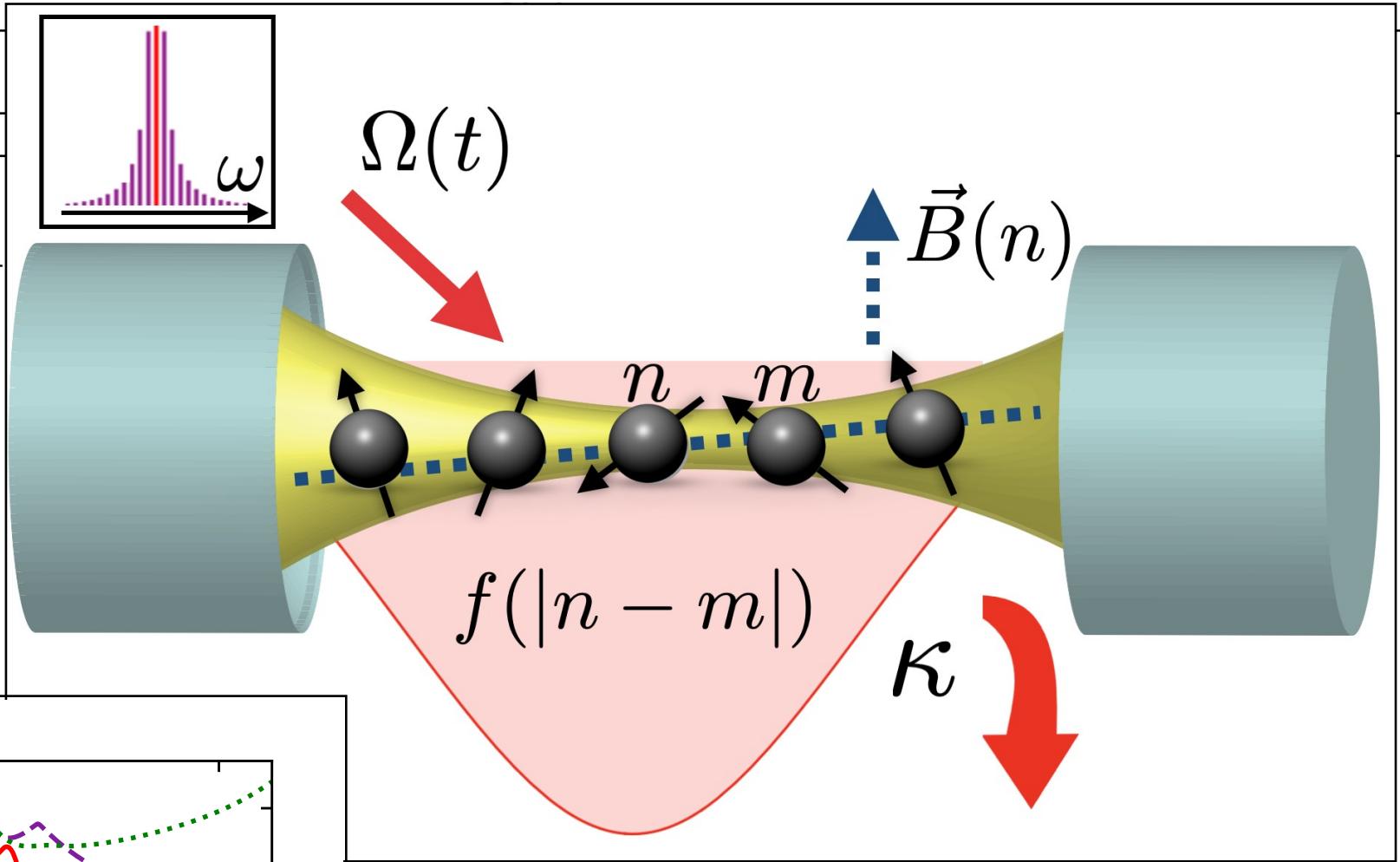
correlated/squeezed state

Outline

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□ How to engineer dissipation profile

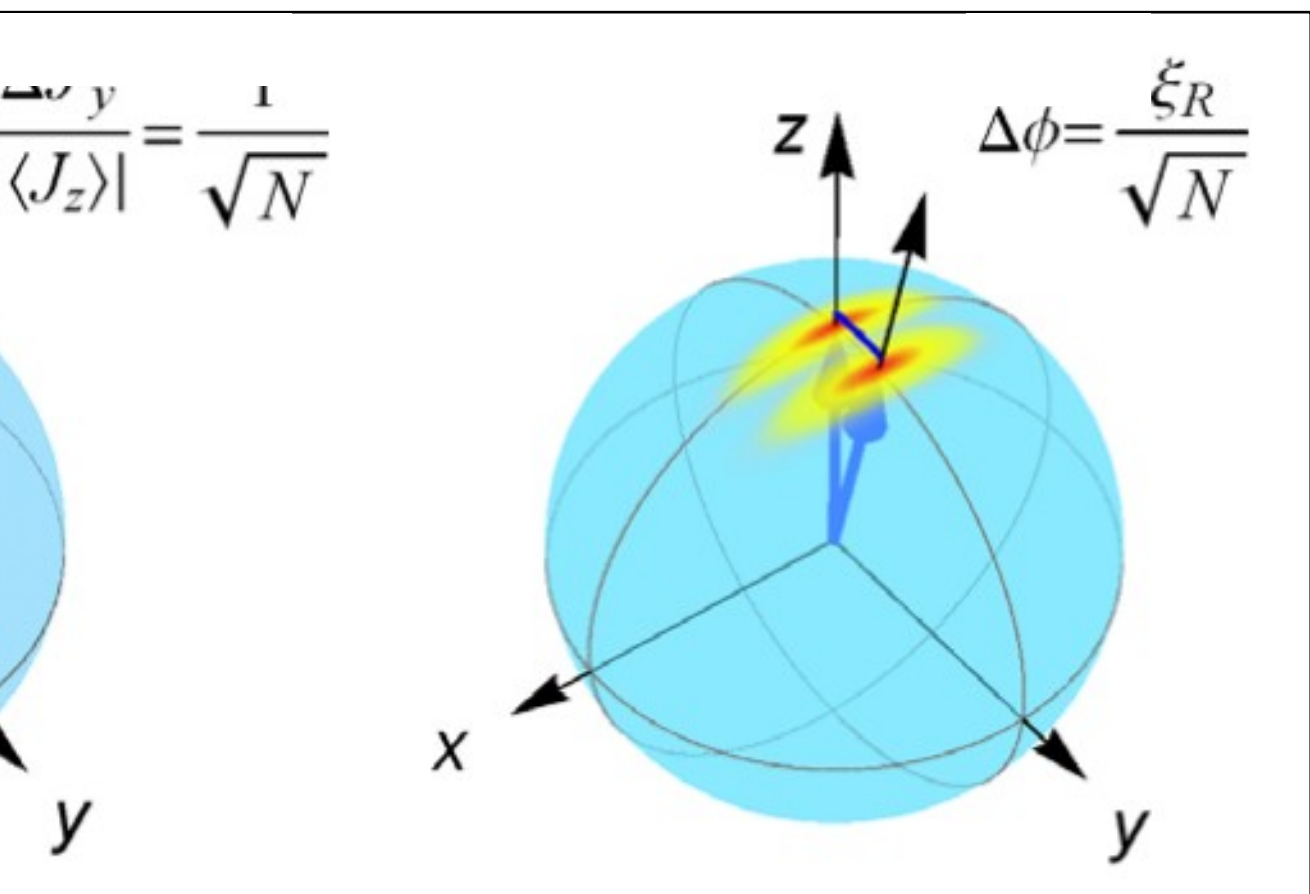
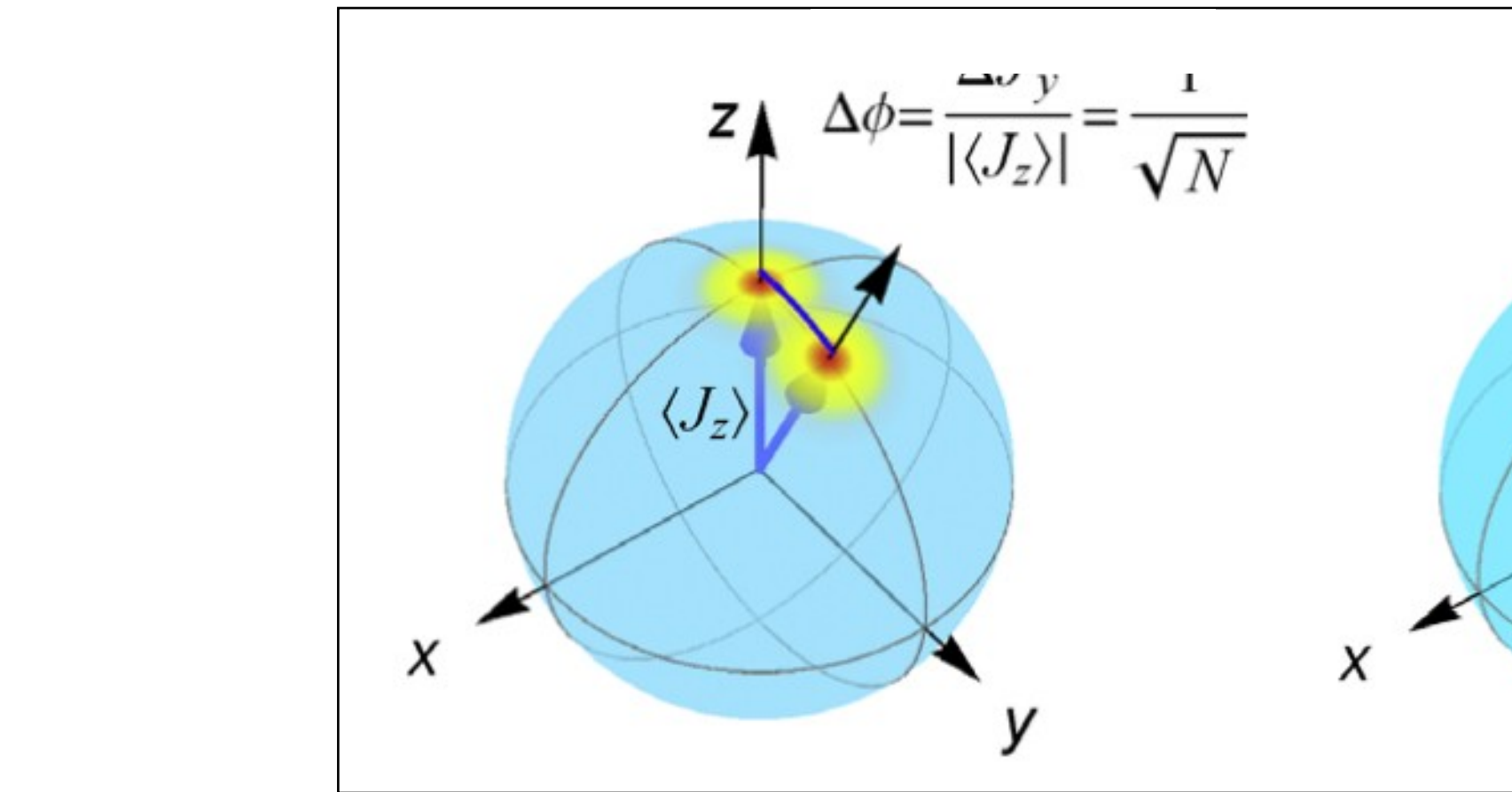
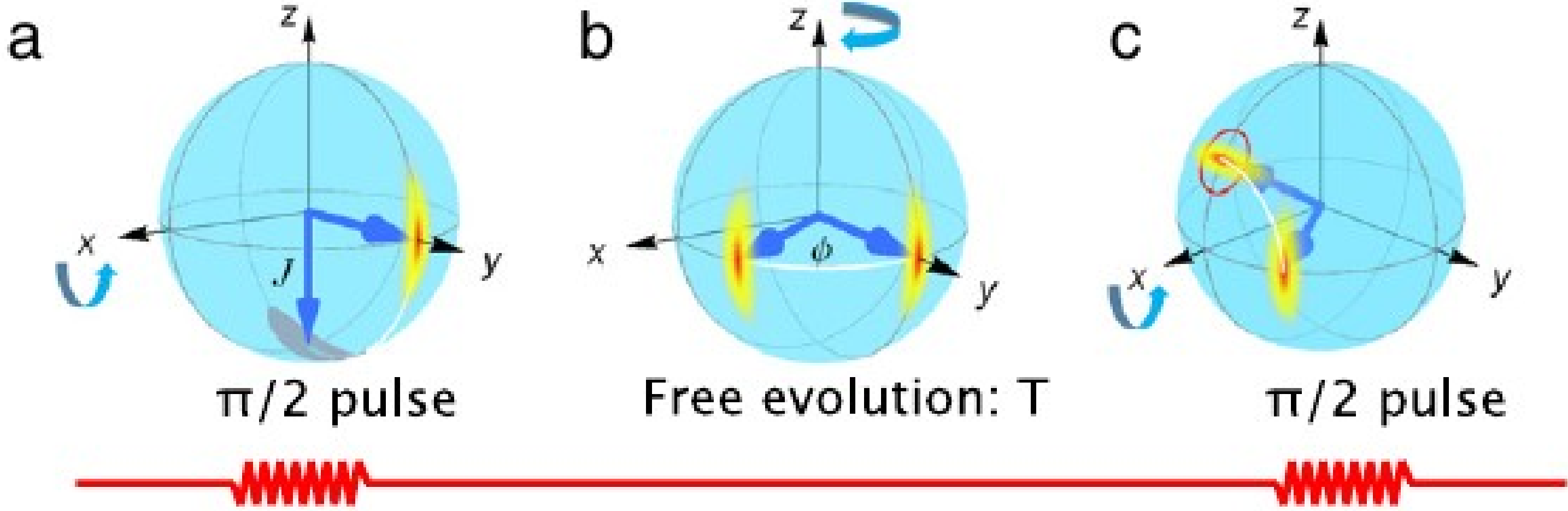


(3) Useful physics - squeezing



Collective spin squeezed states

Ramsey interferometer



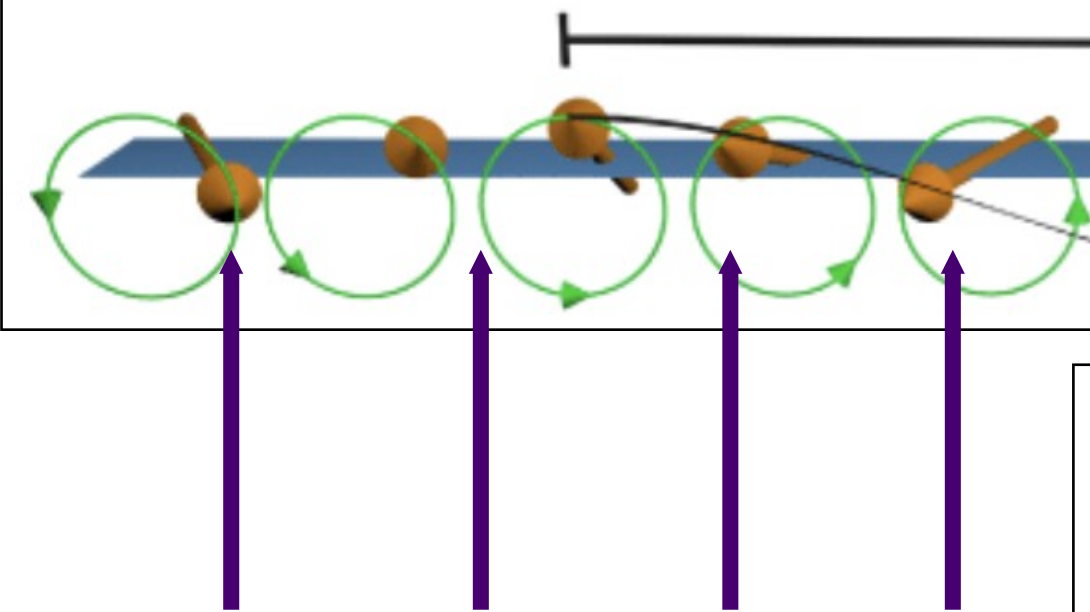
For sensing a uniform field,
precision

Finite wavevector squeezing

Finite wavevector squeezing
parameter

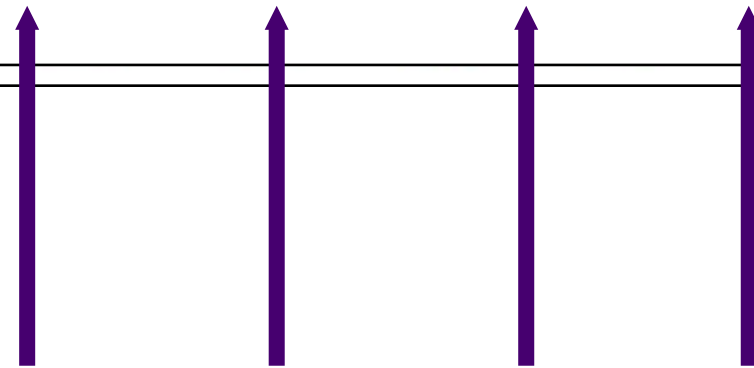
$$k = 0$$

yields
usual
collective spin
parameter



$$k \neq 0$$

Even though doesn't live on a Bloch sphere, quantifies entanglement enhanced precision when sensing a spatially varying field

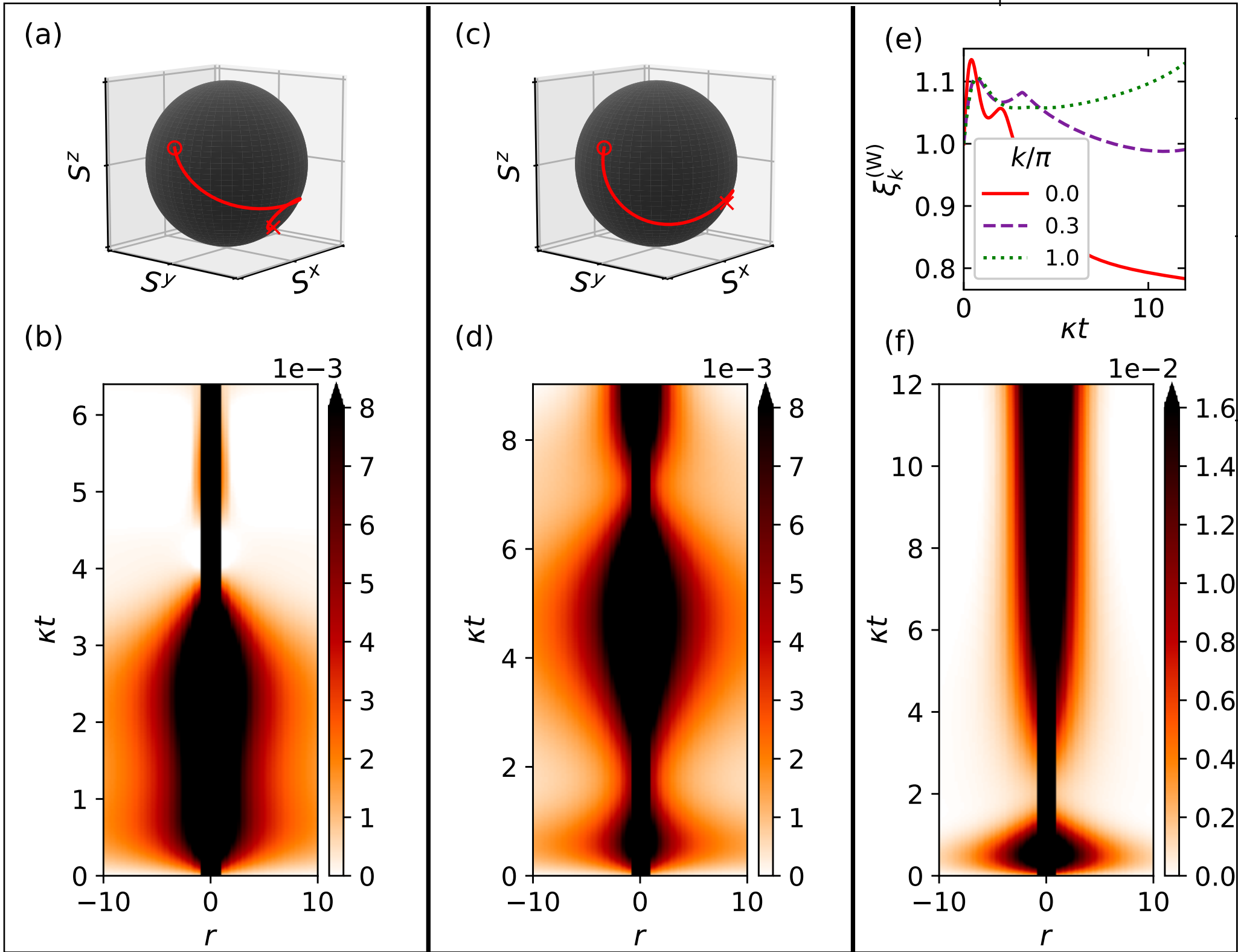
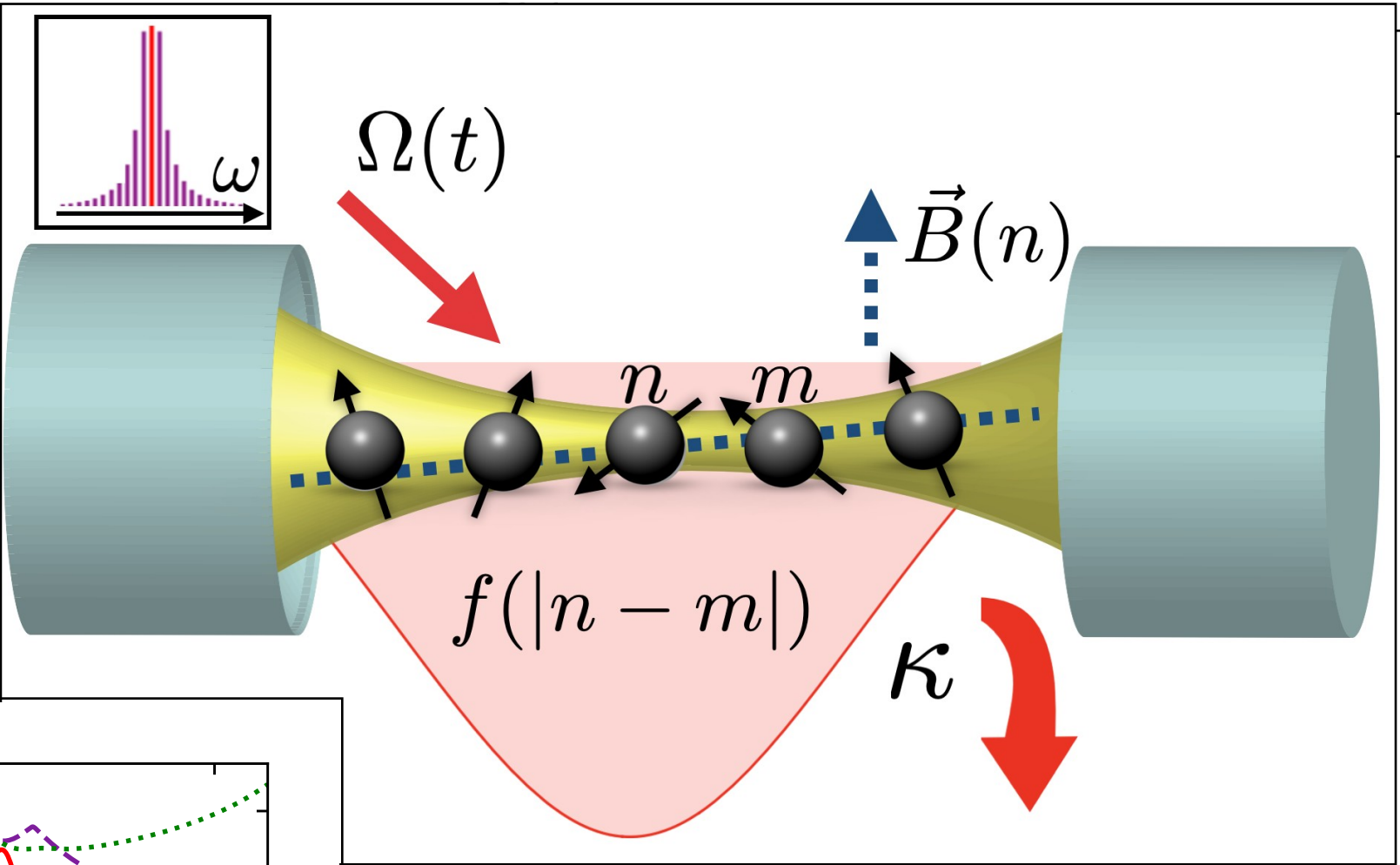


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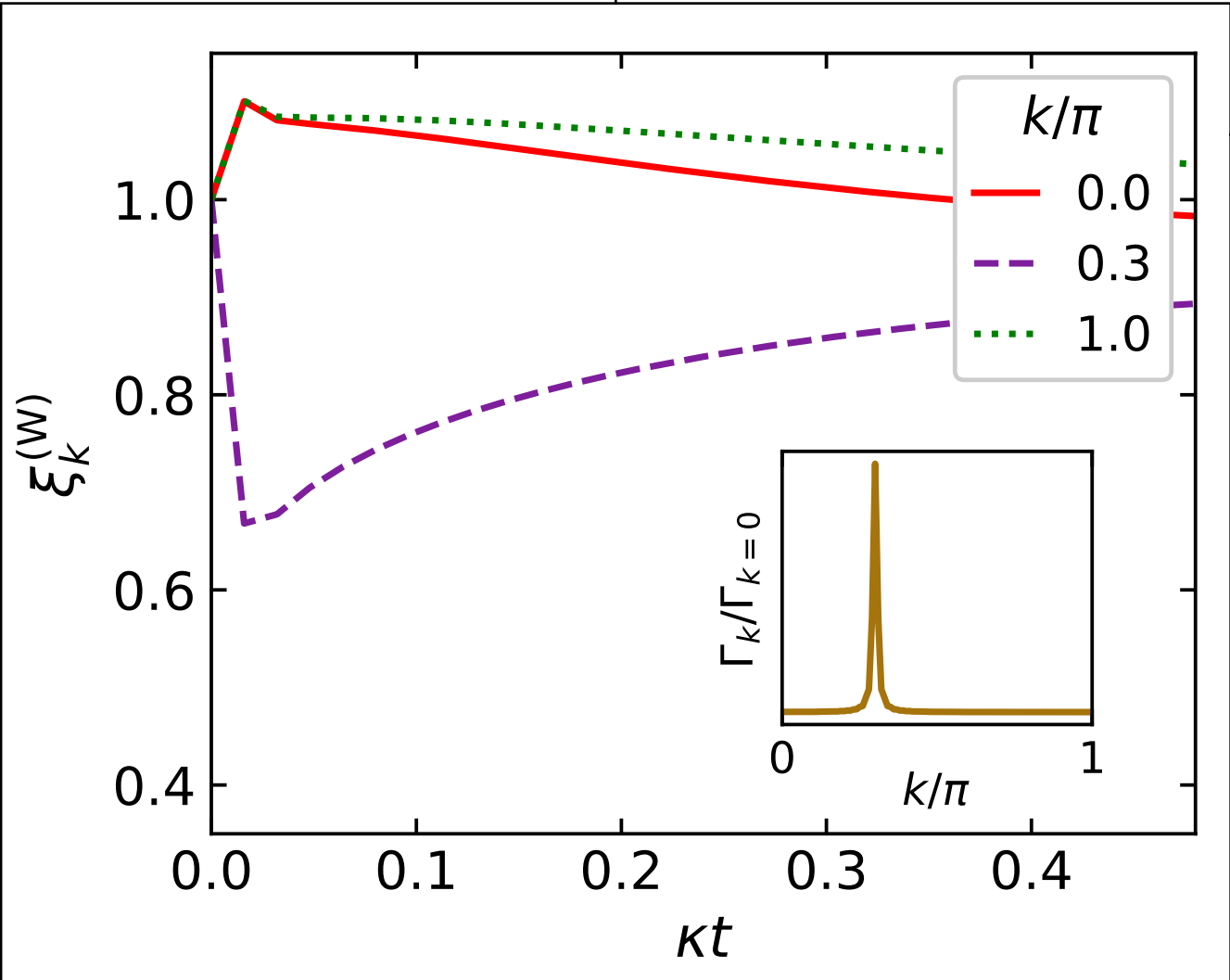
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(3) Useful physics - squeezing

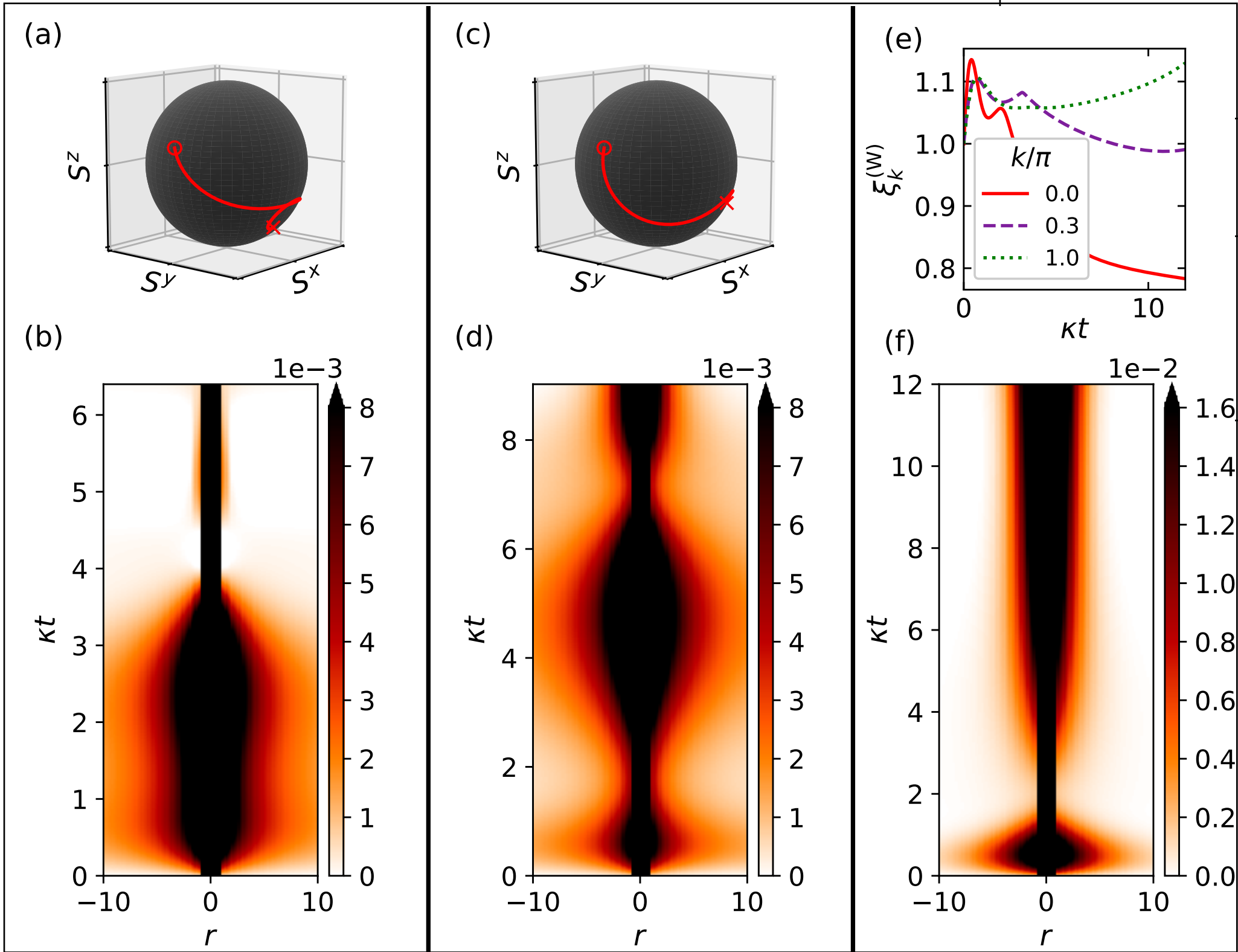
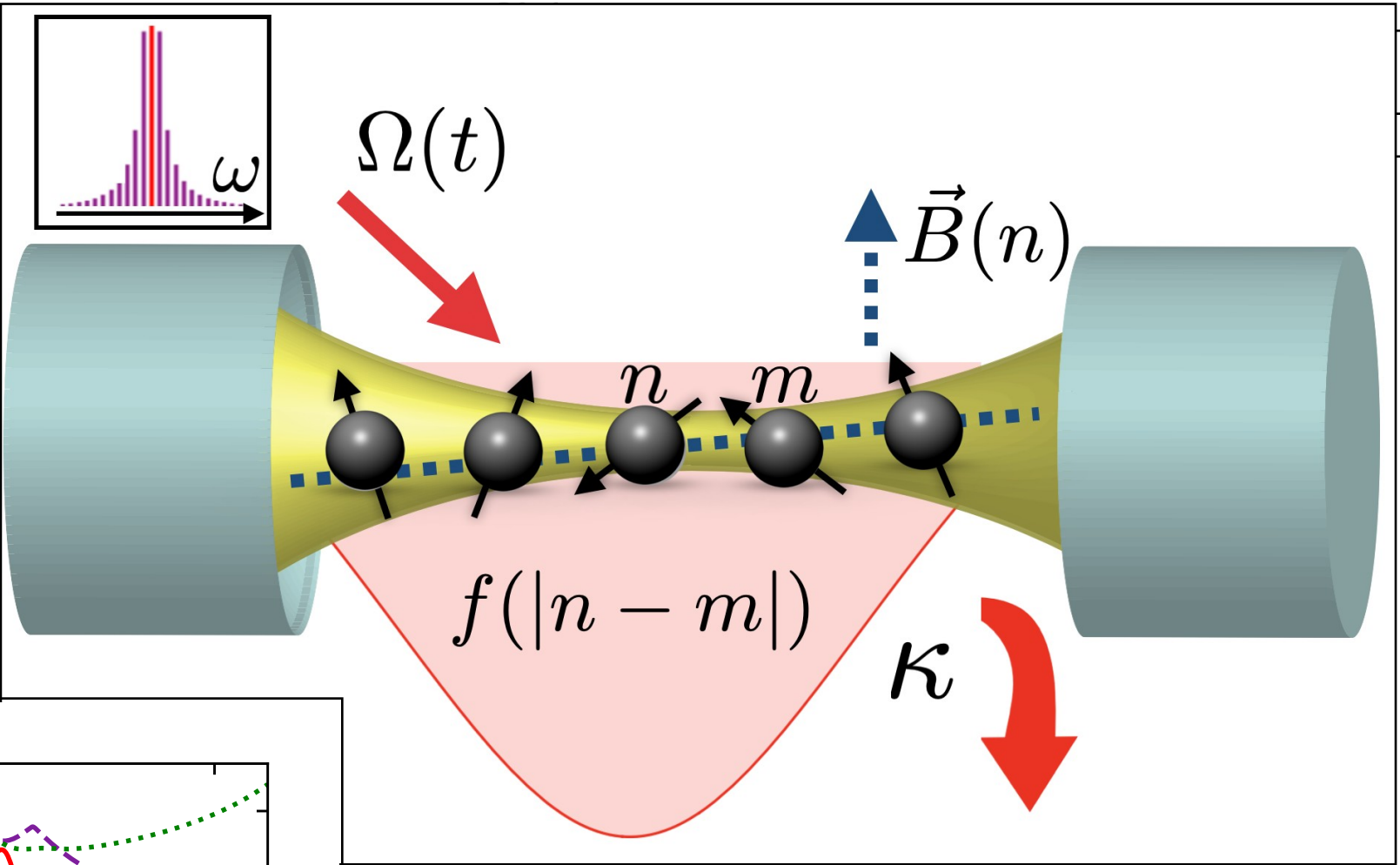


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□ How to engineer dissipation profile



(3) Useful physics - squeezing

