

Quantum chaotic thermalization

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to be exemplified for

Dicke model:
spin and oscillator coupled

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experiment with double condensate in optical resonator:

T. Esslinger 2010

phase transition observed

we propose extension for

chaos,

equilibration,

giant fluctuations

interlude:

classical dynamics according to drift

single classical trajectory on Bloch sphere



$$\frac{g}{g_c} = 0.2$$

~~0.7~~

~~0.9~~

~~1.01~~

~~1.~~

mimick initial coherent state
(with `tiny circular support` in energy shell)
as swarm of initial points

gives rise to bundle of trajectories

initially circular support deforms while preserving `area`:

squeezes, stretches, bends, folds, without end,

visits everywhere in the energy shell

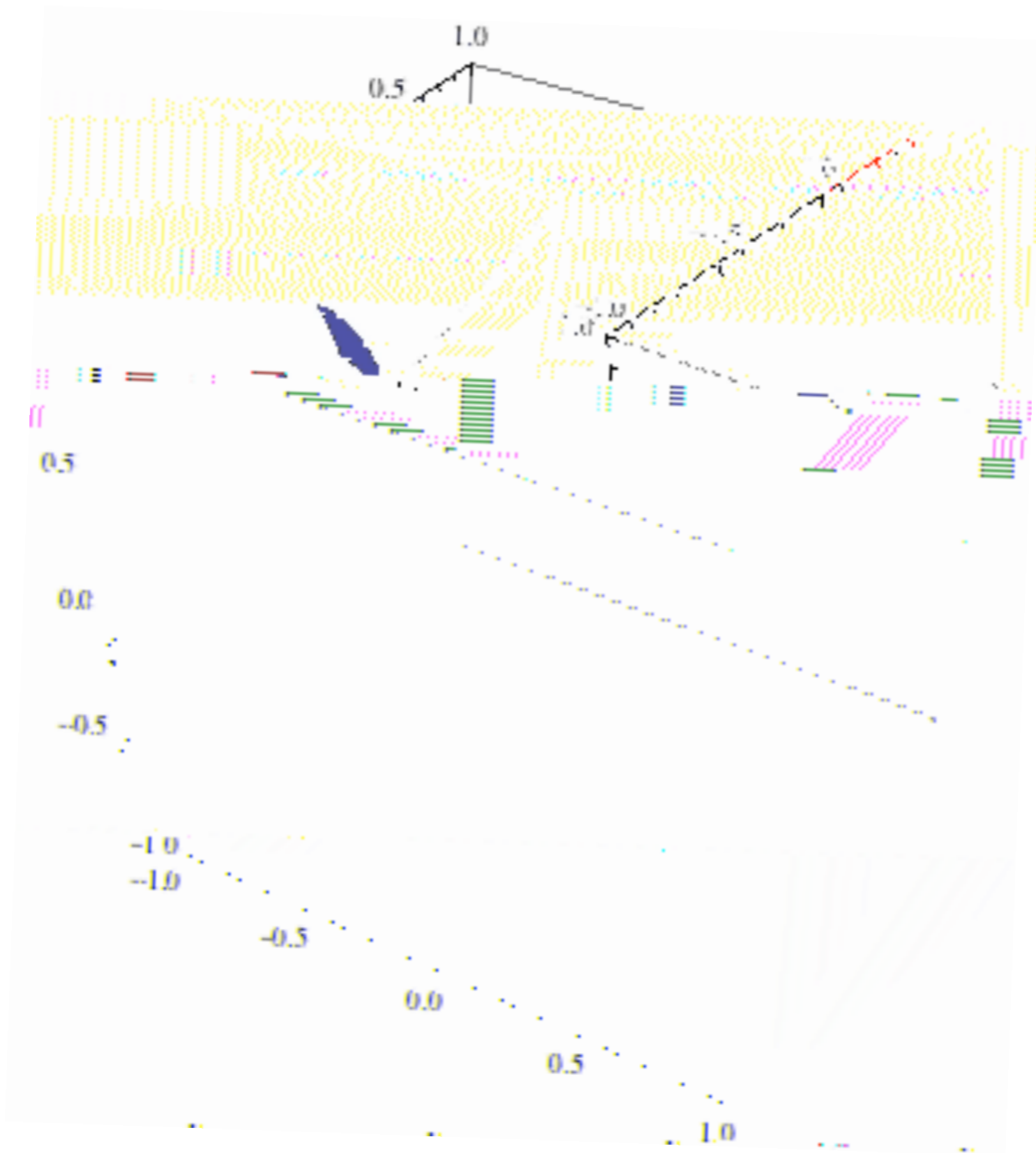
until

Q forms an `infinitely` fissured landscape,
over its infinitely wriggling support,

finite resolution, however, suggests

constant Q over the energy shell,

microcanonical distribution



quantum mechanics

forbids

classical nonsense like infinitely fine structures

quantum diffusion washes out singular fissures in Q

so as to corroborate microcanonical distribution

but how?

2 eig'vec's of D `expansive' $\longleftrightarrow \lambda > 0$

genuine
diffusion

2 `contractive' $\longleftrightarrow \lambda < 0$

antidiffusion

classical chaotic drift also has 4 distinguished directions:

classical vs quantum expansion/contraction:

fix phase space point

integrate out neutrals to get reduced Fokker-Planck eqn:

Lyapounov exponent independent of

$$\text{var}_t(s) = e^{-\lambda t} \mathbf{v}$$

equilibration mechanism:

chaos provides endless stretching
and folding in unstable direction

quantum diffusion smoothes
in classically stable direction,
to minimal scale \propto _____

how general?

Fokker-Planck equations often Q describe unitary dynamics

(kicked top, $SU(3)$ -dynamics, Bose-Hubbard model)

given chaos, equilibration as above

in general, given chaos,

.

summary

Q obeys Fokker-Planck equation

equilibration to microcanonical distribution,
due to classically chaotic drift and quantum diffusion
(stretching, folding, quantum smoothing)

The end