herding cats
a chaotic field theory

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ChaosBook.org/overheads/spatiotemporal
→ Chaotic field theory slides

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Q. what is a chaotic field theory?

A. say it three times

Bernoulli coin flip

serves here is the stage 1 of an introduction to the spatiotemporal cat[a]

which is the simplest example of spatiotemporally chaotic field theory[b]

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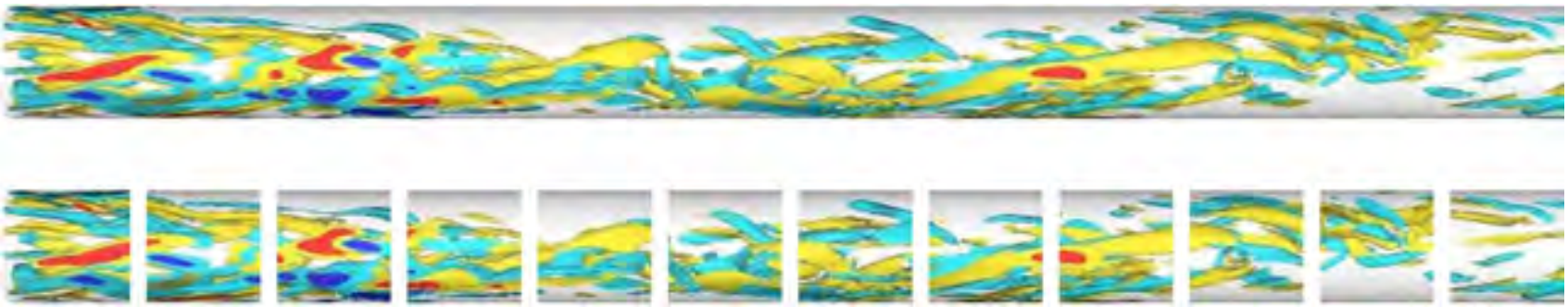
[a] P. Cvitanović and H. Liang, *Spatiotemporal cat: a chaotic field theory*, In preparation, 2021.

[b] M. N. Gudorf et al., *Spatiotemporal tiling of the Kuramoto-Sivashinsky flow*, In preparation, 2021.

a motivation : need a theory of large fluid domains

pipe flow close to onset of turbulence [1]



we have a detailed theory of small turbulent fluid cells

can we can we construct the infinite pipe by coupling small turbulent cells ?

what would that theory look like ?

[1] M. Avila and B. Hof, Phys. Rev. **E 87** (2013)

the goal

build
a chaotic field theory

from
the simplest chaotic blocks

using

- time invariance
- space invariance

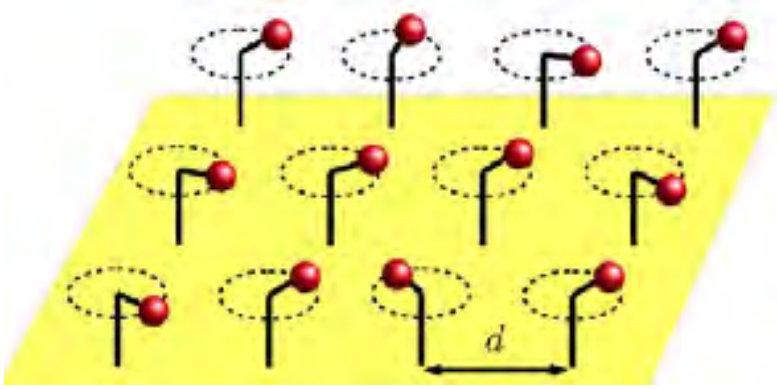
of the defining partial differential equations

take-home :

harmonic field theory

tight-binding model
(Helmholtz)

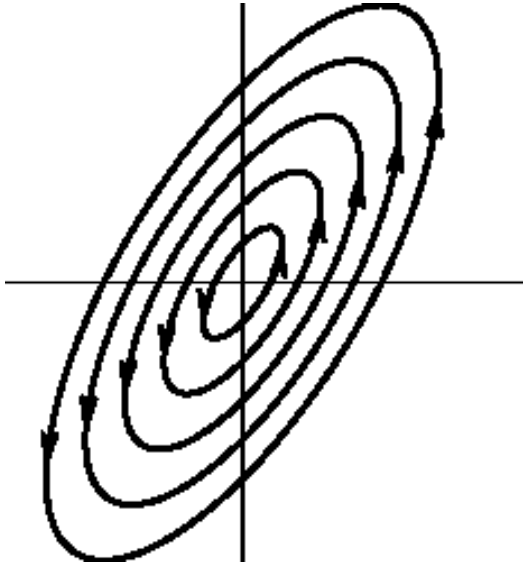
chaotic field theory



Euclidean Klein-Gordon
(damped Poisson)

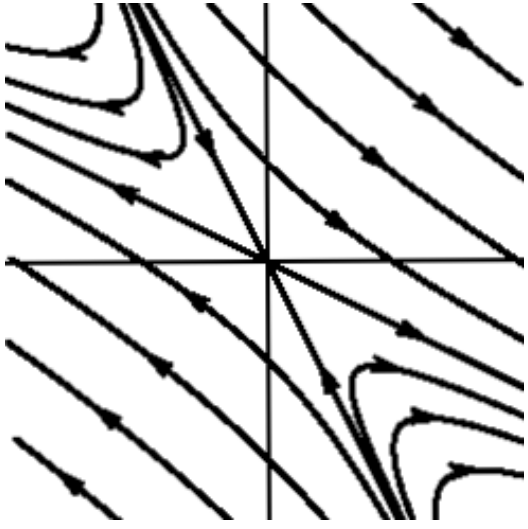
take-home :

harmonic field theory



oscillatory eigenmodes

chaotic field theory



hyperbolic instabilities

Mephistopheles knocks at Faust's door and says, "Du mußt es dreimal sagen!"

"You have to say it three times"

— Johann Wolfgang von Goethe
Faust I - Studierzimmer 2. Teil

1. coin toss
2. temporal cat
3. spatiotemporal cat
4. bye bye, dynamics