

Title: How to characterise large systems?

Date: Aug 27, 2008 03:15 PM

URL: <http://pirsa.org/08080103>

Abstract:

Discussion:

How to characterise large systems?

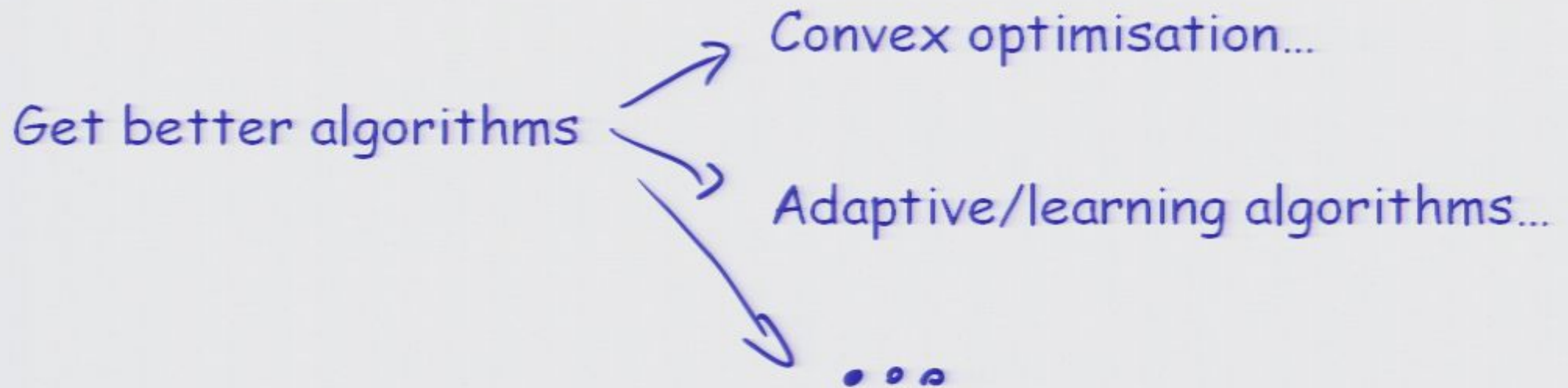
The problem: just size...

$$|\phi\rangle \left\langle \begin{array}{c} \text{---} \\ \boxed{\varepsilon} \\ \text{---} \end{array} \right\} \rho_{\varepsilon}$$

$$\varepsilon(\rho) = \sum_{jk} \chi_{jk} \Gamma_j \rho \Gamma_k^\dagger$$

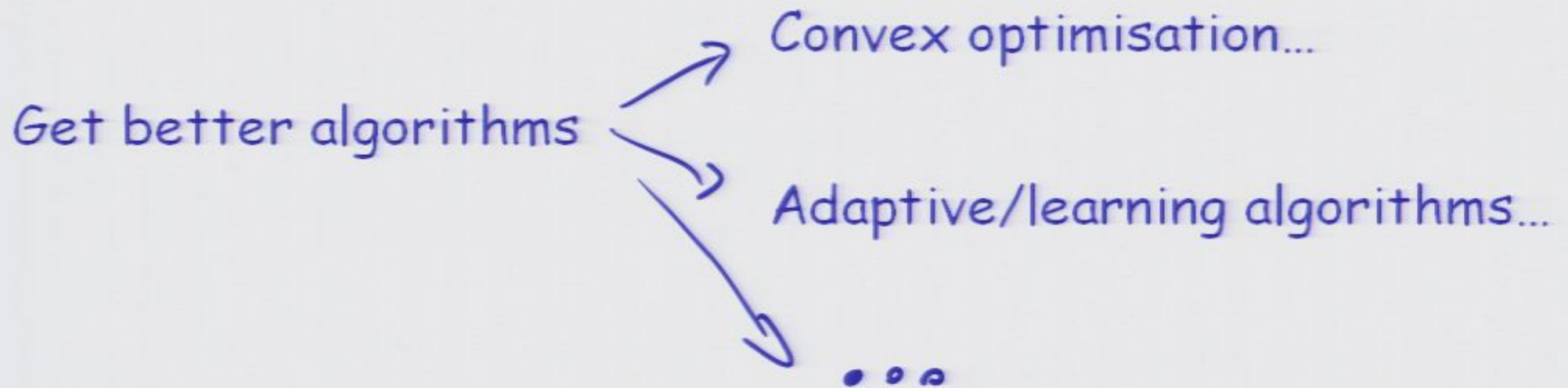
probabilities to be estimated  $\sim 2^{4n}$

# Short/mid term ...



Get lucky...

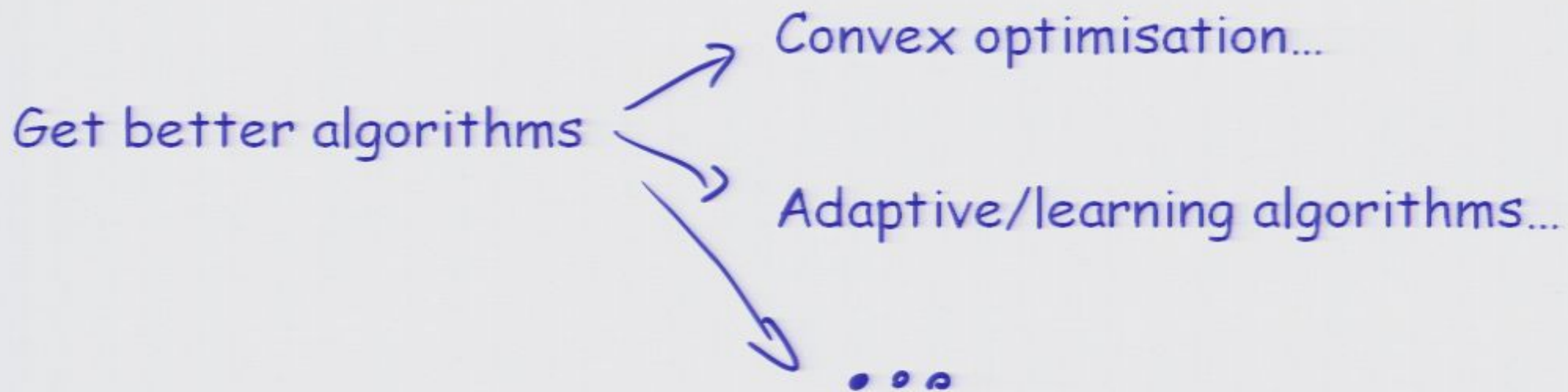
Short/mid term ...



Get lucky...

Long term ...

## Short/mid term ...



Get lucky...

## Long term ...

If  $\chi$  is your answer  
you've asked the wrong question!

# Question for funders: "how good is it?"



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- > operational interpretation
- > metric
- > efficient to determine

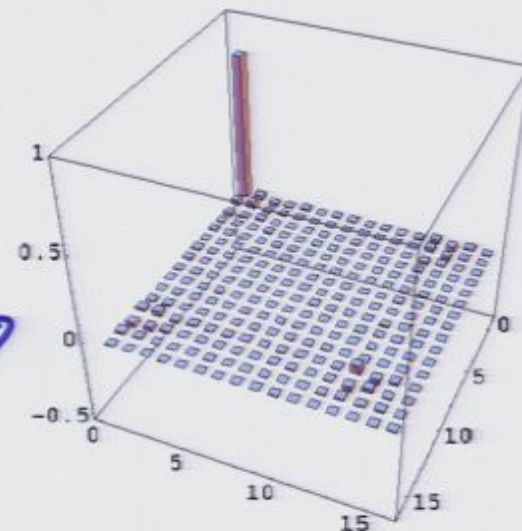
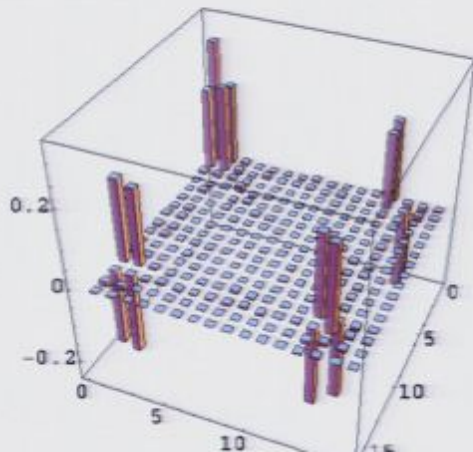


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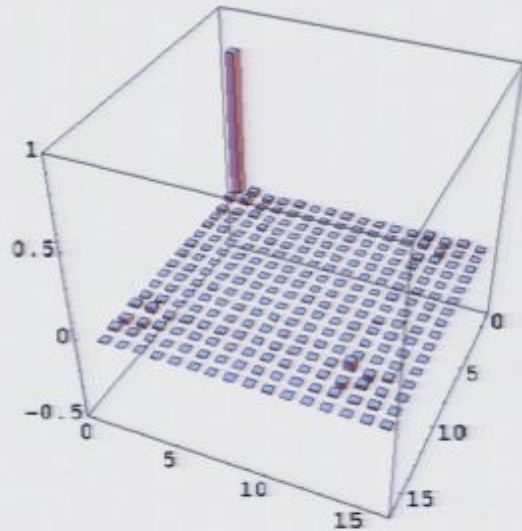


$CNOT\{I \otimes I, I \otimes X, I \otimes Y, \dots\}$

Question for experimentalists: "What is going wrong?"

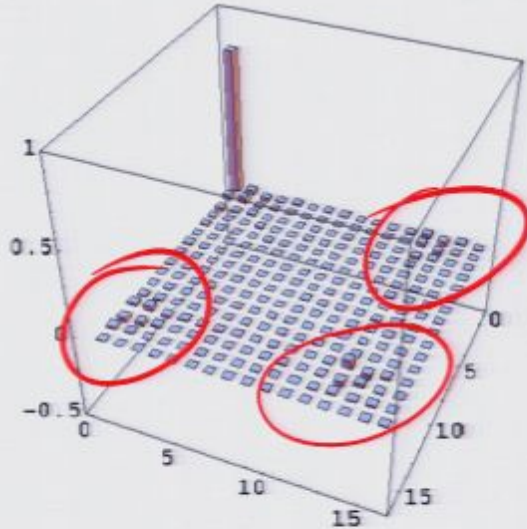


Question for experimentalists: "What is going wrong?"



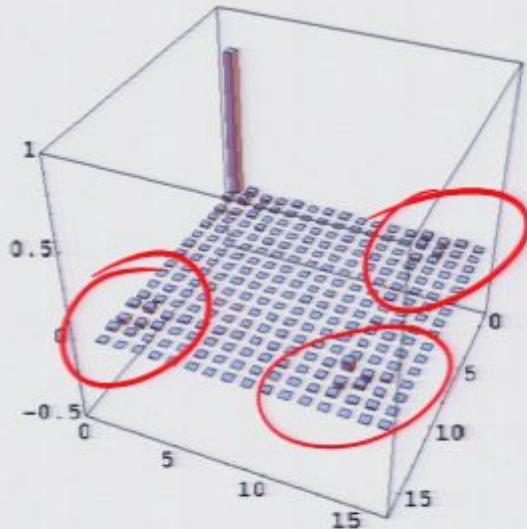
$$CNOT\{I \otimes I, I \otimes X, I \otimes Y, \dots\}$$

Question for experimentalists: "What is going wrong?"



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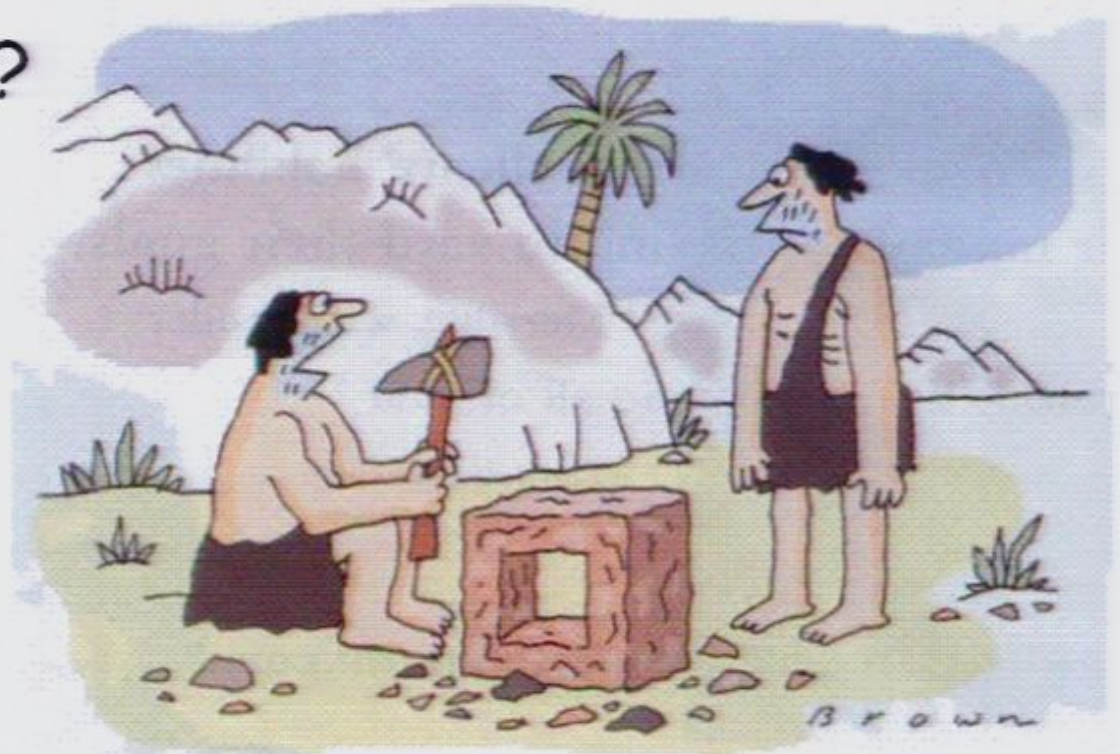
Want diagnostic information ...

e.g. what are the leading noise terms?

-> useful

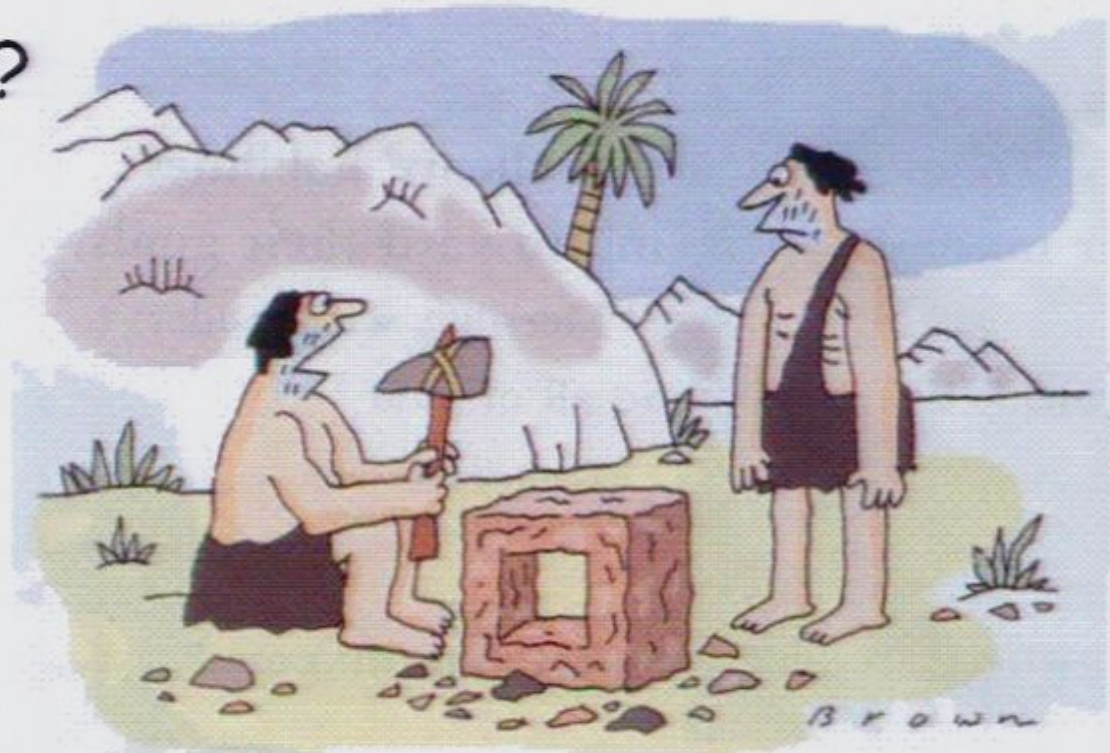
-> efficient

# Bootstrap the process?



***"I call my invention 'The Wheel,' but so far I've been unable to attract any venture capital."***

# Bootstrap the process?

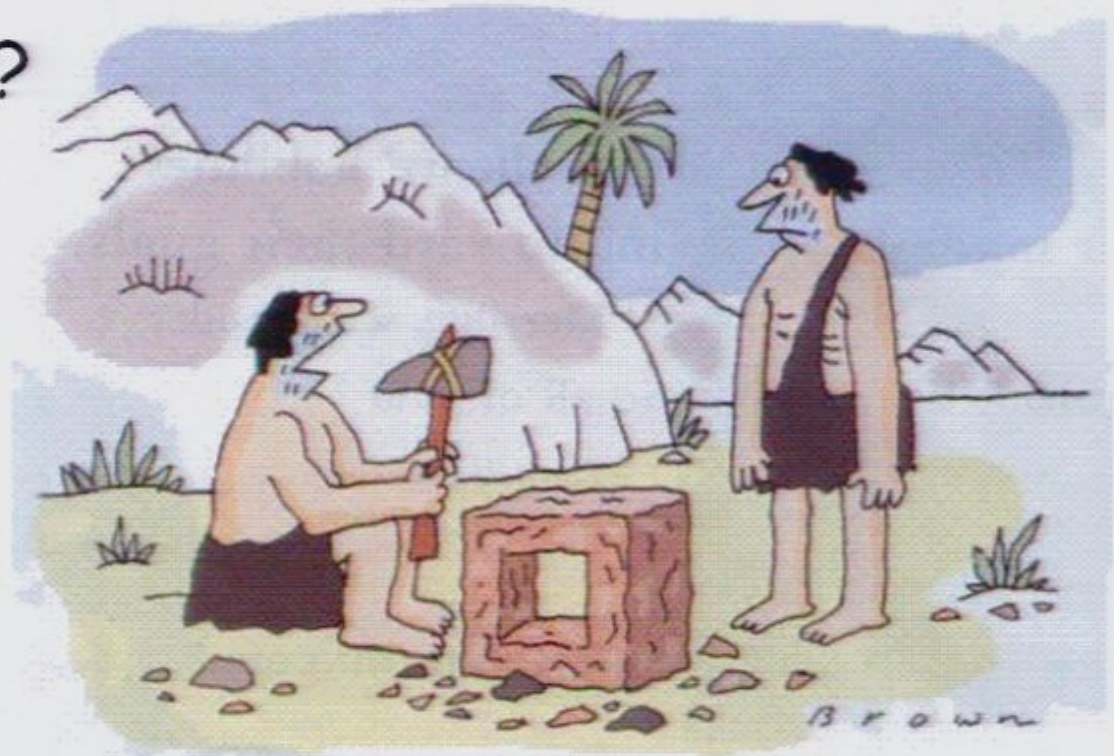


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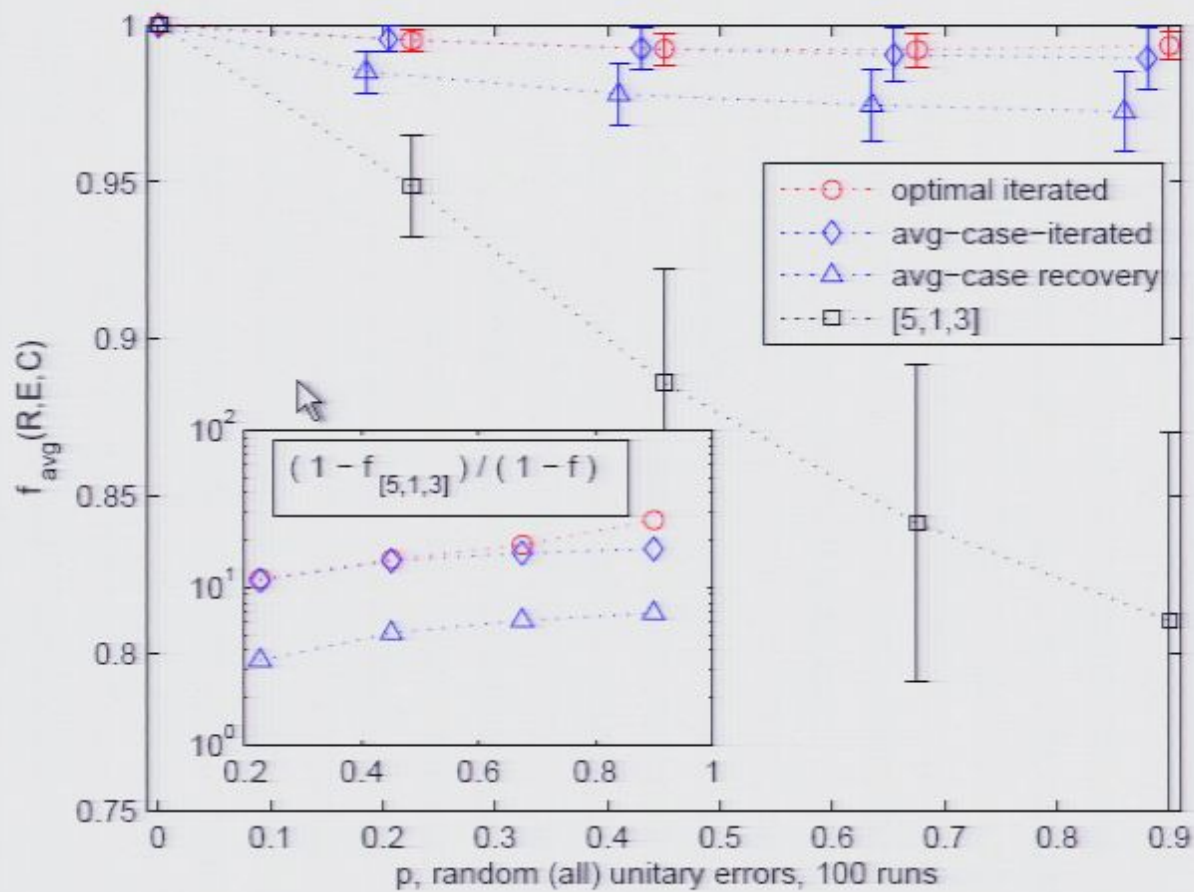
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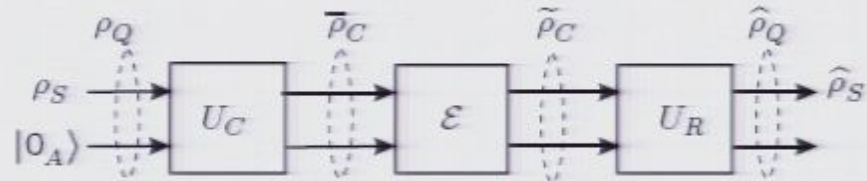
Can we use a small (and easier to characterise) quantum device to characterise a larger one?

# Discussion: How to characterise large systems?

### Weight-2 all-random unitary error for 5-qubit codes.

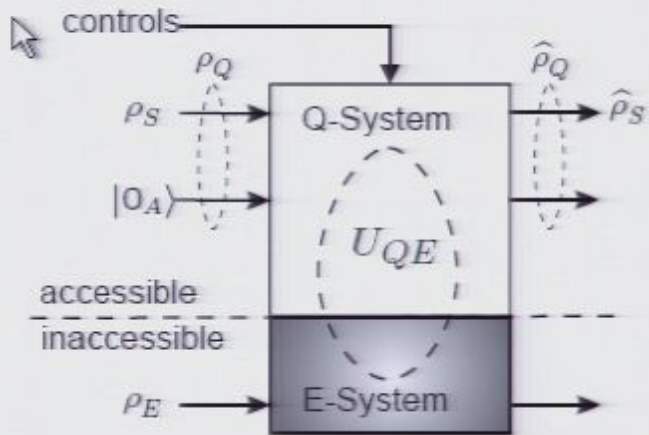


### OSR of error-correcting system



$$\hat{\rho}_Q = \sum_e (U_R E_e U_C) \rho_Q (U_R E_e U_C)^\dagger$$

### Physical representation of error-correcting system



$$\hat{\rho}_Q = \sum_e A_e \rho_Q A_e^\dagger$$