

Stefano Chessa

PhD
Nanoscience

Year I

Courses & Exams

- Courses & Exams

- Stages

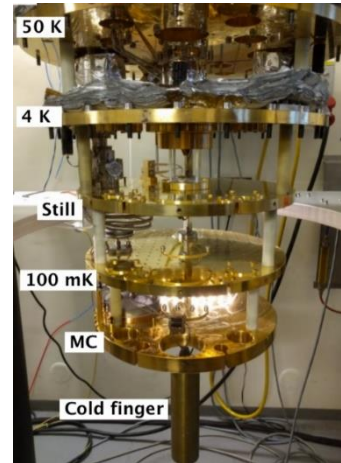
- Research project

Course + Exam	Seminars – Condensed Matter Physics		✓
	Quantum Technologies	Module 1	Module 2
		✓	✓
	Many-Body Physics	Module 1	Module 2
		✓	-
Course (attendance)	Physics of Nanostructures		

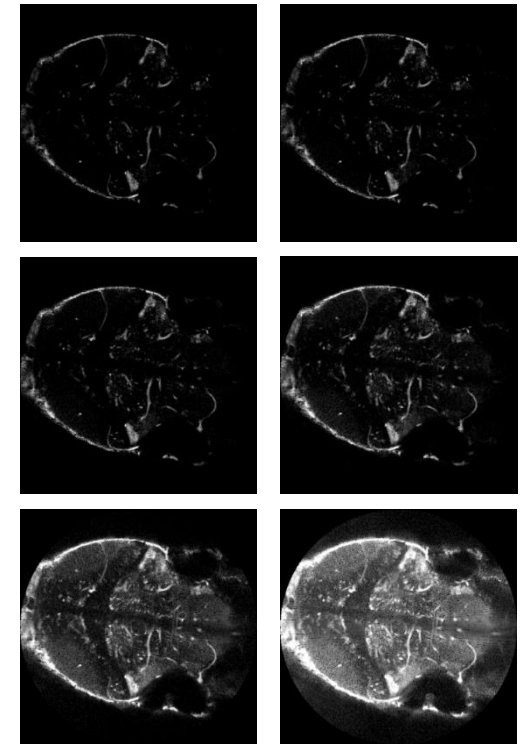
Stages

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- Research project

F. Giazotto group



G. Ratto group



Research Project

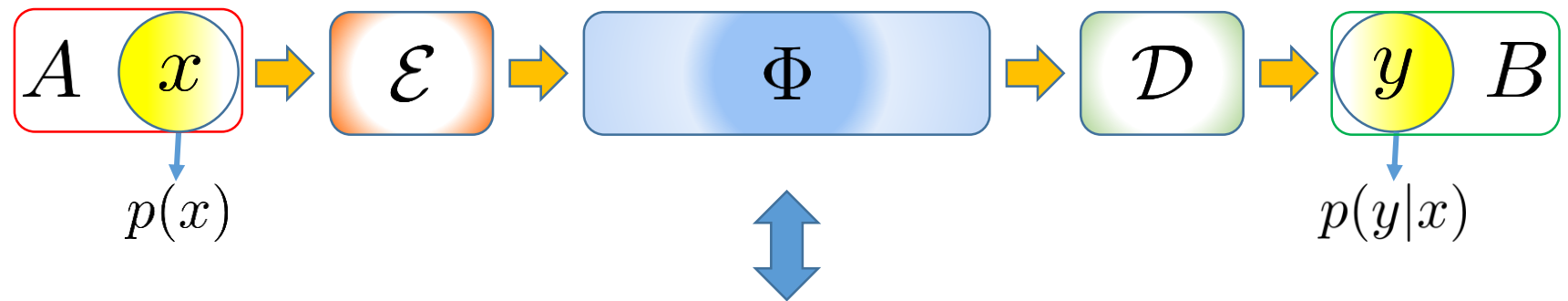
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- Research project

Quantum Information & Communication

- Communication channels:



Characterization

Research Project

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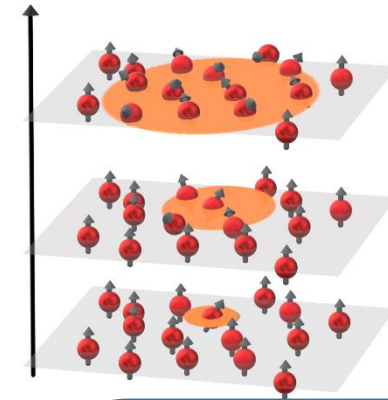
• Research project

• Quantum channel: spin networks

Time-Polynomial Lieb-Robinson bounds for finite-range spin-network models

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(Dated: October 1, 2019)



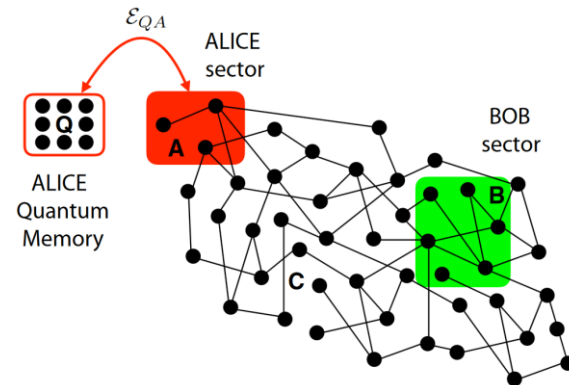
PHYSICAL REVIEW A **100**, 032311 (2019)

Quantum-capacity bounds in spin-network communication channels

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Lieb-Robinson bound constrains information capacities for quantum spin network channels

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ABSTRACT: Lieb-Robinson (LR) bound is a key tool to study the dynamics of quantum spin systems. In this paper, we generalize the LR bound to finite-range spin-network models. We prove that the LR bound is time-polynomial in the system size. This result is crucial to study the quantum capacity of spin-network communication channels. We show that the quantum capacity of such channels is bounded by the LR bound. This result is crucial to study the quantum capacity of spin-network communication channels.

KEYWORDS: Lieb-Robinson (LR) bound, quantum spin networks, information capacities, quantum communication channels.

1. INTRODUCTION: The Lieb-Robinson (LR) bound is a key tool to study the dynamics of quantum spin systems. In this paper, we generalize the LR bound to finite-range spin-network models. We prove that the LR bound is time-polynomial in the system size. This result is crucial to study the quantum capacity of spin-network communication channels. We show that the quantum capacity of such channels is bounded by the LR bound. This result is crucial to study the quantum capacity of spin-network communication channels.

2. PRELIMINARIES: We consider a 3D spin-network Hamiltonian $H = \sum_{i,j} J_{ij} \sigma_i \cdot \sigma_j$. We define the distance $d(i,j)$ between two sites i and j as the number of edges in the shortest path connecting them. We define the LR bound as $\|e^{-iHt}\sigma_i e^{iHt}\sigma_j - \sigma_i \sigma_j\| \leq C e^{-\lambda d(i,j) - \mu |t|}$. We prove that λ and μ are time-polynomial in the system size.

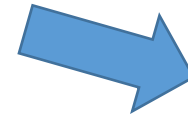
3. QUANTUM CAPACITY: We define the quantum capacity Q of a channel \mathcal{E} as $Q = \lim_{n \rightarrow \infty} \frac{1}{n} \log \mathcal{I}(\mathcal{E}^{\otimes n})$. We show that Q is bounded by the LR bound. This result is crucial to study the quantum capacity of spin-network communication channels.

REFERENCES: [1] E. Lieb and D. Robinson, Commun. Math. Phys. **28**, 249 (1972). [2] M. Fanizza and V. Giovannetti, Phys. Rev. Lett. **118**, 080501 (2017). [3] M. Fanizza, Commun. Math. Phys. **361**, 291 (2018). [4] M. E. Shor, J. Math. Phys. **38**, 4312 (1997).

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**More on spin
channels**



Other channels