Lectures on Quantum Processes

Quantum Information Summer School, Karachi

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Literature references

General introduction to quantum theory and quantum information

- Quantum information and quantum computation, the most used reference, although not the most updated [1].
- A good resource with more emphasis on mathematical structure. More details about quantum channels (such as state-channel duality) not covered in Nielsen and Chuang [2].

Pictorial formalism

- An introduction to the pictorial formalism within the category theory approach [3].
- A more recent and more mathematical overview of the category-theory approach [4].
- A book extending the approach of the references above to an extensive introduction to quantum theory [5].
- A different approach to the graphical formalism, based on tensors [6].

Quantum-process approach to open quantum systems and non-markovianity

- A short paper containing the essential elements, incuding the definition of markovian and non-markovian processes [7].
- A review with an extensive introduction, including various representations of quantum maps and an historical background [8].
- Quantum processes with classical memory (topic of the problem-solving session) [9].

Indefinite causal order

- A good place to start (introduction of processes with indefinite causal order, causal separability, causal inequalities, and related concepts) [10].
- Paper introducing the "quantum switch" (quantum control of causal order) [11].
- Paper showing that the quantum switch can provide a computational advantage [12].
- Some experiments on indefinite causal order [13, 14, 15, 16, 17, 18, 19].

Indefinite causal order from quantum theory and gravity

- The scenario with superposition of masses discussed in the lecture [20].

References

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