UNIVERSITÀ DI PISA

DEPARTMENT OF PHYSICS

Master Degree in Physics

Dissertation in General Subject

Title

Supervisors

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Candidate
Author

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Abstract

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- Lipsum

Contents

Notation and acronyms

To help the reader navigate the content throughout the thesis we introduce here the most relevant notation. In the whole thesis...

List of acronyms

QM stands for *Quantum Mechanics*
GR stands for *General Relativity*
GLM stands for *Giovannetti, Lloyd and Maccone*

Chapter 1

Introduction

What is the problem?

1.1 State of the art and Open Problems

In the attempt to solve this problem... Look at these approaches and literature. [1]

1.2 The research questions

Following the open problems discussed so far, in the present thesis we consider the following research questions:

(1.) Can it be?

(2.) How can it be?

1.3 What is this thesis about

To answer these questions, we...
A further implication of these results is...

1.4 Plan of the thesis

Here we give an outline of the contents with the structure of the work.

In Chapter 2 we address the problem formally and introduce the tools, while in Chapter 3 we derive our original results.

Useful mathematical tools are introduced in the Appendix. This includes...

Finally, the last chapter is devoted to a summary of the results, concluding remarks and a discussion of relevant perspectives.

Chapter 2

Introducing the tools

In this Chapter, we start introducing the tools...

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2.1 Section

In this section, we introduce the...

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2.1.1 Subsection

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Let us consider

$$\partial_t \left|\psi(t)\right\rangle = \hat{\mathcal{H}}_\Gamma \left|\psi(t)\right\rangle \ . \tag{2.1}$$

Its solution can be written in terms of a time evolution operator $U(t)$ as

$$\left|\psi(t)\right\rangle = U(t) \left|\psi(0)\right\rangle = e^{-\frac{i}{\hbar}\hat{\mathcal{H}}_\Gamma t} \left|\psi(0)\right\rangle \ . \tag{2.2}$$

Finally, a resolution of the Identity of the interest system's Hilbert space in terms of the eigenstates of the Hamiltonian can be expressed as

$$\mathbb{1}_\Gamma = \sum_{k=0}^{d_\Gamma - 1} \left|E_k\right\rangle\!\left\langle E_k\right| \ . \tag{2.3}$$

As we shall see at the end of the chapter...

Chapter 3

Research

In this Chapter, we discuss the research...

3.1 Section

In this section, we introduce the...

Via the resolution of the Identity

$$|\Psi\rangle = \int \mathrm{d}\mu(t)\, \chi(t)\, |t\rangle_C\, |\psi(t)\rangle_\Gamma \,, \tag{3.1}$$

in which, for every $\chi(t) \neq 0$, we have

$$\chi(t) = \sqrt{\sum_{n=0}^{d-1} \lambda_n \left|\langle t|\phi_n\rangle_C\right|^2}\,, \quad |\psi(t)\rangle_\Gamma = \frac{1}{\chi(t)}\, \langle t|_C\, |\Psi\rangle \,. \tag{3.2}$$

In the literature, an entangled state $|\Psi\rangle$ is called a history state.

The states $|\psi_k\rangle_\Gamma$, i.e. $|\psi(t)\rangle_\Gamma$, are normalized, but not necessarily orthogonal.

Conclusions and Perspectives

Addressing the problem of this thesis...
With this in mind, we proceeded...

The answer to the above research questions and the results obtained in this thesis can be summarized as follows:

Question (1.) Result 1.

Question (2.) Result 2.

Our analysis opens new research questions which may be addressed in future developments of the present work and can be summarized as follows:

First, we can ask...

Second, the generalization...

Appendix

The Postulates of Quantum Mechanics

Quantum Mechanics is a mathematical framework for the development of physical theories. Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

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Bibliography

[1] Vittorio Giovannetti, Seth Lloyd, and Lorenzo Maccone. Quantum time. *Phys. Rev. D*, 2015.