The Investigation of Quantum Polarisation Teleportation Protocols

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A thesis submitted for the degree of
Bachelor of Science in Physics
The Australian National University

November, 2002

Declaration

This thesis is an account of research undertaken between February and November 2002, under the supervision of Dr Ping Koy Lam, Dr Ben Buchler and Dr Timothy Ralph. It is a partial fulfilement of the requirements for the degree of Bachelor of Science with Honours in theoretical physics at the Australian National University, Canberra, Australia.

Except where acknowledged in the customary manner, the material presented in this thesis is, to the best of my knowledge, original and has not been submitted in whole or part for a degree in any university.

Aśka Dolińska
November, 2002

StokeSpunk

Acknowledgments

My huge motivation to become a detective of the physics realm had been nurtured by the community at the Australian National University for the last 4 years. Many warm thanks goes to everyone who inspires me so much to learn more about this astounding world. The people at the Physics Department are so happy to share their insights and discoveries, that it is really thanks to them that I can build on and move forward, in this jungle of information.

Special thank you to the fellow quantum optics fans, especially my supervisors: Ping Koy Lam, Ben Buchler and Tim Ralph, for their wise advice and floods of brilliant thoughts. You make me believe that breakthroughs are not freak events but a result of hard work and dedication. Viva to perfectionism!

Thanks for all your backing Hans. (And you have no idea what a life saving raft your laptop has been during the last few weeks!)

The remaining staff at the faculty of physics deserves a big hug, like Joe, who is willing to help me with all those incomprehensible computers, John, for bringing physics to life in a very LARGE way, Thomas and Andrew for the joint time in the lab with the French music and all my previous, undergraduate lecturers. You are all such a pleasure to see everyday, listen to and talk to. I am sure to miss you!

Further, I should mention my office buddies, Prof. Nicolai and Mr Ψ-ko, for being so much fun, even when I was on the brink of madness.

To Rich for insisting I am a nerd.

To Matt B. for sharing my interests when no one else would.

And the rest of the Honours students, for surviving this year with me, and still living it up on Friday nights.

Thanks Stu for all your constructive, unbiased criticism and enthusiasm. (Now's your turn!)

Viellen Danke to Paul Cochrane for his help with atrocious Matlab code.

To dearest Kelly. You're so full of life and affection that you make me look outside my small world to enjoy your universe!

Finally, my flatmates are undoubtedly an integral part of this thesis, reminding me of the day cycles and the concept of sleep, when I was living in a time warp.

Dzięki śliczne maminku i tatinku. Jesteście wspaniałym wsparciem duchowym i moralnym!

I na koniec, całóski dla Ewci we Wrocławiu. Zawsze będziesz mi bliska, nie ważne ile słów zrozumiesz z tej księgi!

Abstract

The continuous variables regime offers much promise for quantum information and computation protocols. In particular, the continuous variable polarisation teleportation is of great interest, both theoretically and experimentally, at the moment.

In this thesis three schemes for continuous variable polarisation teleportation are analysed and their performance is rated. The double teleporter setup, the quantum nondemolition teleporter scheme and the biased entanglement teleporter setup are each discussed and evaluated. Two methods are employed for the evaluation of the teleportation success. The TV diagram which stresses the usefulness of the experimental design and the fidelity, which measures the quantum input to output state preservation. It is later shown that these two independent assessments, which consider physically different attributes, yield contradicting conclusions. Further it is shown that it is important to decide whether the objective of the polarisation teleportation is the transfer of information or the quantum state recreation before meaningful analysis using TV or fidelity can be made.

Finally, a study of a special cloning limit for a particular input state is made, related to the two of the above polarisation teleportation schemes. A new cloning fidelity limit is derived for these cases and TV cloning limits of information transfer and correlations are discussed.

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