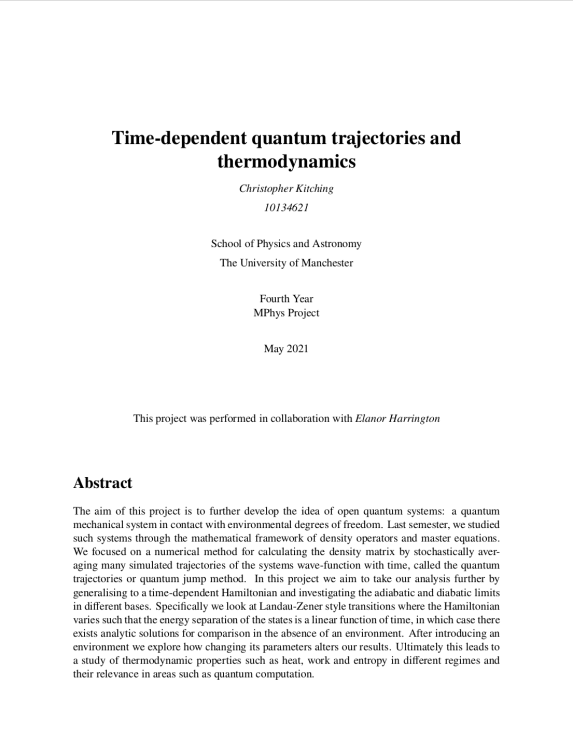
Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	Christopher Kitching
Assignment title:	S8 Final Stage: report pdf submission
Submission title:	MPhys Project Report - Semester 2 - Modelling open quantu...
File name:	MPhys_Report_-_Semester_2_-_10134621.pdf
File size:	482.78K
Page count:	20
Word count:	7,848
Character count:	37,148
Submission date:	23-May-2021 02:30PM (UTC+0100)
Submission ID:	153414162



Time-dependent quantum trajectories and thermodynamics

Christopher Kitching
10134621

School of Physics and Astronomy
The University of Manchester

Fourth Year
MPhys Project

May 2021

This project was performed in collaboration with *Elanor Harrington*

Abstract

The aim of this project is to further develop the idea of open quantum systems: a quantum mechanical system in contact with environmental degrees of freedom. Last semester, we studied such systems through the mathematical framework of density operators and master equations. We focused on a numerical method for calculating the density matrix by stochastically averaging many simulated trajectories of the systems wave-function with time, called the quantum trajectories or quantum jump method. In this project we aim to take our analysis further by generalising to a time-dependent Hamiltonian and investigating the adiabatic and diabatic limits in different bases. Specifically we look at Landau-Zener style transitions where the Hamiltonian varies such that the energy separation of the states is a linear function of time, in which case there exists analytic solutions for comparison in the absence of an environment. After introducing an environment we explore how changing its parameters alters our results. Ultimately this leads to a study of thermodynamic properties such as heat, work and entropy in different regimes and their relevance in areas such as quantum computation.