UE Open Quantum Systems

Niveau d'étude
Bac +5

ECTS
3 crédits

Composante
UFR Physique, Ingénierie, Terre, Environnement, Mécanique (PhITEM)

Période de l'année
Automne (sept. à dec./janv.)

Diplômes intégrant cet élément

- Master Nanosciences et nanotechnologies

Langue(s) d'enseignement: Anglais

Ouvert aux étudiants en échange: Oui

Code d'export Apogée: PAX9QIAF

Présentation

Description

Teacher : Pr. Alain Joye, Institut Fourier, UGA

Objectives :
Introduce the mathematical formalism and concepts required to address the main physical questions raised in the description of open quantum systems. These lectures and tutorials will provide advanced theoretical tools to understand and model quantum open systems (quantum systems coupled to a dissipative environment), with constant opening on foundational questions of quantum mechanics, e.g. the famous “measurement problem”.

Organisation : Total of 24 hours of Lectures & Exercise classes

Program :

Chapter 1)

Informations non contractuelles.
Dernière mise à jour le 30 juin 2026

* Mathematical framework, Functional Calculus for matrices
* Quantum formalism, Density matrices, Pure states, Gibbs states
* Von Neumann entropy, relative entropy and their properties
* Variational characterisation of Gibbs states
* Quantum trajectories, two-time measurement protocols

Chapter 2)

* By-partite systems, tensor products, partial traces
* Purifications, Schmidt decomposition, Entropy (in-)equalities
* Subadditivity of entropy and Landauer's bound

Chapter 3)

* Markovian approximation of Quantum Dynamics
* CPTP maps and Markovian semi-groups
* Lindblad generators and their properties
* Entropy production

Prerequisites:

Quantum Mechanics M1

Statistical physics M1

References:

Exploring the quantum (Haroche & Raimond, Cambridge University Press)

Quantum measurement and control (Wiseman & Milburn, Cambridge University Press)

Quantum computation (Online lectures by John Preskill)

Heures d'enseignement

CMTD	Cours magistral - Travaux dirigés	24h

Période : Semestre 9

Infos pratiques

Campus

Grenoble - Domaine universitaire

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