

## Summary list of topics addressed in the lecture

### Adiabatic theorem

- What is the physics idea underlying the adiabatic approximation?
- What is the “adiabatic theorem”? Under which condition does it hold?
- What is the Berry phase? Under which conditions on the Hamiltonian of the system can it appear?

### Quantum Mechanics in phase space

- Wigner distribution: how is it defined? What are its main properties?
- How is the Wigner transform of an operator defined?
- How can one express the expectation value of an operator with the Wigner distribution?
- How can one derive an evolution equation for the Wigner distribution?
- Husimi distribution: how is it defined? What are its main properties? How does it compare to the Wigner distribution?

### Open quantum systems

- What is the Pauli master equation?
- What is the main idea of the system–environment model? How is the (reduced) statistical operator of the “small” system of interest defined?
- How can one derive a “perturbative” master equation for the statistical operator of an open quantum system? What is the starting point? Which assumptions are necessary to simplify the evolution equation?
- What is the Kraus operator-sum representation of the superoperator governing the time evolution of a statistical operator? Which properties should the superoperator obey? What are the main features of the Kraus decomposition?
- Lindblad master equation: How does it look like? How can one derive it? What is the physical interpretation of the various terms? Which physical assumptions underlie the description of an open quantum system with the Lindblad equation?
- Monte-Carlo wave function (MCWF): Given a Lindblad master equation, what is the corresponding evolution scheme for a MCWF? What are “quantum trajectories” in this context? How can one recover a master equation from the MCWF evolution scheme?
- How can one apply the path integral formalism to a statistical operator? To a reduced statistical operator? What is the influence functional?