Summary
To introduce several advanced topics in quantum physics, including semiclassical approximation, path integral, scattering theory, and relativistic quantum mechanics.

Content
1. Transition from quantum physics to classical mechanics: the coherent states and the Ehrenfest theorem.

2. Semiclassical approximation in quantum mechanics: general form of the semiclassical wave function and matching conditions at turning points.

3. One-dimensional problems in semiclassical approximation: Bohr-Sommerfeld quantisation condition and the Planck formula, tunnelling probability through a potential barrier, lifetime of a metastable state, splitting of the energy levels in a double-well potential.

4. Path integral representation of quantum mechanics: Schrodinger equation from path integral, physical interpretation of the path integral and the principle of minimal action, Euclidean path integral and statistical physics, "instanton" and "bounce".

5. Scattering theory: cross-section, Moller operators and S-matrix, Green's functions and the scattering amplitude, the T-matrix and the Lippmann-Schwinger formula, perturbation theory for amplitudes and the Born approximation, scattering amplitude via stationary scattering states.


Learning Prerequisites
Required courses
Quantum physics I, II

Teaching methods
Ex cathedra and exercises
Assessment methods
oral exam (100%)

Supervision
Office hours Yes

Resources
Bibliography
C. Cohen-Tannoudji, B. Diu, F. Laloe, Quantum Mechanics
L. D. Landau and E. M. Lifshitz, Quantum mechanics: non-relativistic theory
R. P. Feynman, A. R. Hibbs, Quantum Mechanics and Path Integrals
J. R. Taylor, Scattering Theory: The Quantum Theory of Nonrelativistic Collisions
J. D. Bjorken, S. D. Drell, Relativistic Quantum Mechanics
A. Messiah, Quantum Mechanics

Ressources en bibliothèque
• J. D. Bjorken, S. D. Drell, Relativistic Quantum Mechanics
• (Ebook) L. D. Landau and E. M. Lifshitz, Quantum mechanics: non-relativistic theory
• C. Cohen-Tannoudji, B. Diu, F. Laloe, Quantum Mechanics
• R. P. Feynman, A. R. Hibbs, Quantum Mechan
• J. R. Taylor, Scattering Theory: The Quantum Theory of Nonrelativistic Collisions
• A. Messiah, Quantum Mechanics
• L. D. Landau and E. M. Lifshitz, Quantum mechanics: non-relativistic theory

Moodle Link
• http://moodle.epfl.ch/course/view.php?id=14069

Prerequisite for
Quantum Physics IV